Channel Design Report For 60% Design:
Rolling Meadows Channel and Floodplain Modification

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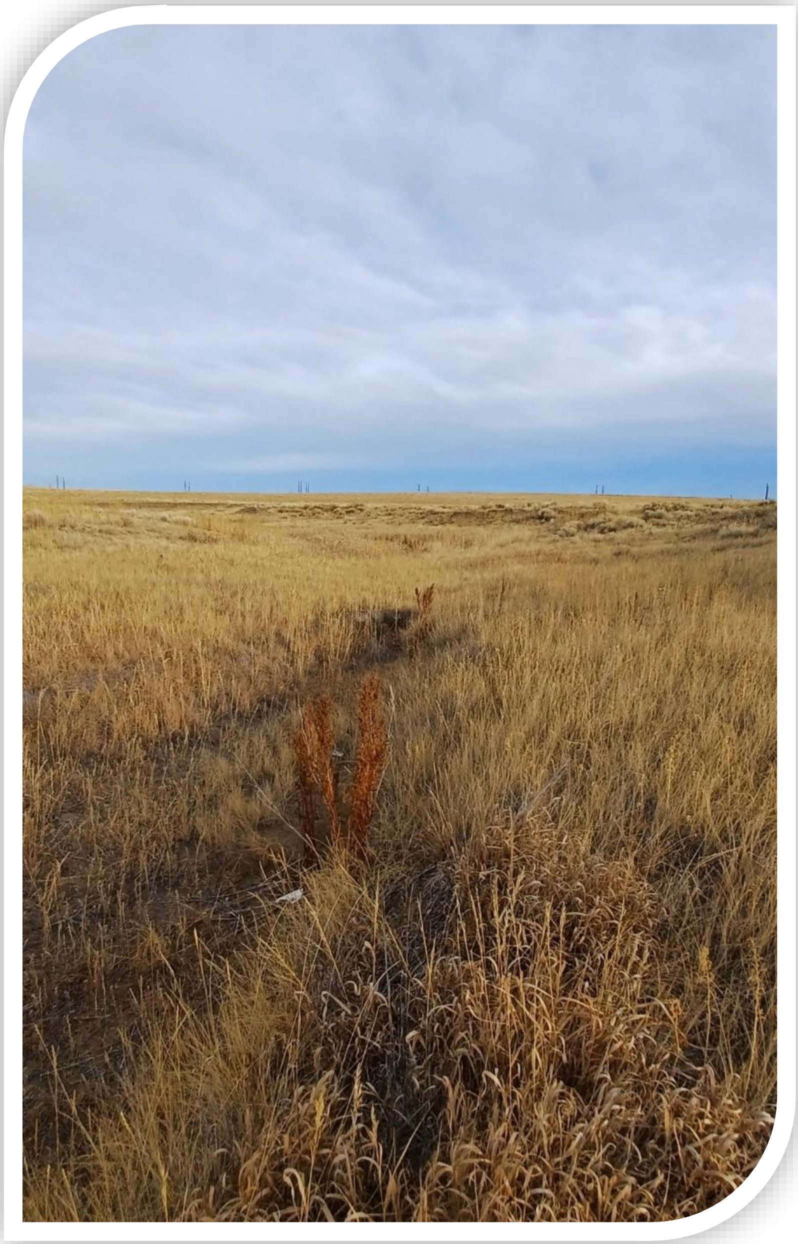

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Introduction

A. Report Description

This report is submitted in support of the 60% Design Plans (Plans) for the proposed East Fork Jimmy Camp Creek channel improvements at the Rolling Meadows development (Project). The proposed channel improvements are being constructed in association with The Landhuis Company (Client). Design elements have been coordinated with the Client, the City of Colorado Springs (City), and El Paso County (County). The Project limits are within the boundaries of both the City and County. Per previous coordination meetings with the City and County, City review will take precedent from Station 0+00 to 40+00, and County review will take precedent from 40+00 to 165+73.

B. Purpose

The purpose of this report is to document the design criteria, present data analysis, and provide supplemental information to support the proposed improvements shown in the Plans. This report recognizes the limits of the current design given the 60% level and identifies further analysis that will be required at the 90% and 100% design levels.

C. Location

The project is located between Drennan Road and the Lorson Ranch Development in El Paso County, Colorado and is in Township 15 South, Section 1, 12, & 13, Range 65 West of the 6th Principal Meridian. The project reach includes over 15,000 linear feet of East Fork Jimmy Camp Creek with approximately 3,000 feet of the downstream section located within City limits.

The location of the project is shown in Figure 1. Detailed location information is also included in the Plans. Design and construction phasing are discussed in more detail in the Phasing section of the report to follow.

Figure 1. Project Location

Previous Reports and Jurisdictional Requirements

A. DBPS Reference

The Project reach was previously included in the Jimmy Camp Creek Drainage Basin Planning Study, herein referred to as "2015 DBPS". The findings of the DBPS study identify the project reach as a dry wash with ephemeral flow. It notes no significant habitat presence and a lack of bed and bank configurations in the project reach, downstream of Meridan Rd. The DBPS identifies the existing culvert crossing at Bradley Rd as undersized and that additional capacity will need to be added.

B. FEMA Regulations & Floodplain Development

The project reach is within a Zone AE regulatory 100-year floodplain shown on Flood Insurance Rate Map (FIRM) Panels 08041C0769G, 08041C0790G and 08041C0976G, dated December 7, 2018. The reach is approximately between cross sections R and I and has 100-year Base Flood Elevations and a regulatory floodway. The floodplain datum is North American Vertical Datum 1988 (NAVD88). The Project will impact the regulatory floodplain, therefore it will require a floodplain development permit (CLOMR/LOMR). The proposed channel design introduces a defined channel throughout the project area. It is not anticipated that changes to floodplain mapping will have negative impacts on the existing infrastructure. The current effective floodplain limits do not include the impact of Bradley Rd. The effective floodplain limits are shown on the FIRM panels included in the Appendix C.

C. U.S. Fish and Wildlife Service Requirements

This site is not suitable habitat for any threatened or endangered species that may be found in the area. We assume that, during the Clean Water Act Section 404 process, the US Army Corps of Engineers will assume the role as lead federal agency in addressing the National Environmental Policy Act (NEPA).

D. U.S. Army Corps of Engineers (USACE) Requirements

Matrix has requested a jurisdictional determination with the USACE as the project area may not be considered "Waters of the United States," exempting the project from the 404 permitting process. In support of this, an assessment of the existing vegetation, soils and habitat has been completed and submitted to the USACE for review. If the area is determined to be jurisdictional an Individual Permit will likely be required to satisfy the 404 process.

To meet the requirements of an Individual Permit the USACE requires the completion of the Colorado Stream Quantification Tool (CSQT). This allows for numerical validation of the environmental benefit of this Project. The CSQT has been taken into consideration during project design and is expected to show no loss in ecological function along East Fork Jimmy Camp Creek.

Approval from the USACE must be obtained before construction can begin on the Project.

Site Description

A. Channel Description and Features

The subsections below provide a summary of the existing conditions of the project reach.

Existing Conditions Map

The existing conditions map is shown on Sheets 3 and 4 of the Plans (Appendix A). The map shows the existing terrain, utility locations, and parcel boundaries. The existing terrain was obtained from a 2022 LiDAR flight of the project site (one-foot contour intervals) by M&S Civil Consultants, Inc. All elevations are referenced to the North Geodetic Vertical Datum of 1929. Horizontal control information is provided on the Title Sheet (TS01) of the Design Plans.

Channel and Adjacent Land Use

The existing channel area has no defined bank or bed features and conveys no baseflow. During flooding, the water spreads extensively across the undeveloped plains, as modeled in the FEMA floodplain mapping. Example photos of the floodplain are in Figure 2 though Figure 5 below. The Project reach is bounded to the north by Drennan Rd, Bradley Rd bisects the project, and the Lorson Ranch development borders the project to the south.

Figure 2. Typical floodplain on East Fork Jimmy Camp Creek.

Figure 3. Bradley Rd Culvert

Figure 4. View from Bradley Rd looking South.

Figure 5. View from southern end of project extents.

Existing Vegetation

The Project area supports upland plains vegetation throughout most of the reach. Many sections of the Project reach appear to be grazed by livestock. Due to the lack of baseflow in the creek, there are few riparian species present in the project reach. Upland areas consist mostly of native grasses. Few mature trees are present in the reach.

Matrix conducted a wetland delineation and will conduct a riparian vegetation assessment for the CSQT, if required by the USACE. Memoranda for these assessments are provided in Appendix D.

Wildlife Habitat

This site does not provide suitable habitat for endangered or threatened species and their presence was not considered in the design. Wildlife habitat was evaluated by Matrix as part of the US Army Corps of Engineers 404 permitting effort. Documentation is provided in Appendix D.

Notable Features

There are significant utility crossings located on the upper reach of the project site, north of Bradley Rd. These crossings are noted in the Design Plans. South of Bradley Rd, a waterline is present along the proposed channel location near Sta. 70+00. This water line and the associated hydrants will be relocated by others as part of the channel construction and site development.

Additional features include the Drennan Rd and Bradley Rd crossings and the channel tie-in at Lorson Ranch.

Erosion and Degradation Issues

This channel is not presently experiencing erosion or degradation issues. Work is being completed in anticipation of suburban development and anticipated hydrology changes therein.

Channel Bottom and Bank Characteristics

The majority of the Project site does not have a defined channel or banks. Wetland areas are noted, primarily to the south of Bradley Rd in extremely small pockets of the existing drainage. As previously described, flood events inundate the existing undeveloped plains and flow over the site.

Overbank Limitations

The existing crossing at Bradley Rd is undersized, causing water to pond behind Bradley Rd and overtop at the low point on the east side of the road. Additional limitations include proposed development throughout the adjacent property.

Geomorphology

The Project reach currently exists as an ephemeral swale with an undefined low flow channel within an unconfined valley.

Prior Studies

The 2015 Jimmy Camp Creek DBPS provides background information on the Jimmy Camp Creek basin; a summary of basin characteristics and environmental resources; updated hydrology for existing and future flows; and an updated hydraulic analysis (Kiowa, 2015).

The City and Matrix completed a study of the Jimmy Camp Creek watershed in 2013 to provide guidance for low flow estimation of the design. This study, along with the accompanying data, provides guidance for the establishment of low flow hydrology within the Jimmy Camp Creek watershed (Matrix, 2013).

B. Tributary Watershed

The contributing watershed to the project reach is 7.2 square miles at the downstream end of the project at Lorson Ranch and is predominantly undeveloped. Existing and future land use conditions in the East Fork Jimmy Camp Creek watershed can be seen in Table II-2 and II-3 of the DBPS (Kiowa, 2015). Runoff from proposed development will be attenuated through full spectrum detention storage, as specified in the DBPS. Detention facilities on East Fork Jimmy Camp Creek will be designed by others as part of the Rolling Meadows-Bull Hills development.

The drainage area contributing to the project reach is 1.4 square miles at Drennan Rd, 4.2 square miles at Bradley Rd, and 7.2 square miles at Lorson Ranch (StreamStats, 2022). The existing land use of the contributing watershed is rural and undeveloped. The DBPS estimates that future watershed land use will include low to medium density residential lots with some commercial use increasing the impervious cover to 42%.

C. Adjacent Developments Bounding the Improvement

The adjacent property is currently being platted for development as part of the Rolling Meadows-Bull Hill development.

D. Major Crossings

The project reach is bounded to the north by Drennan Rd where a 58’ bridge provides adequate flow capacity for the existing 100-year flood flows, 1,720 CFS (DBPS, 2015). Bradley Rd bisects the project reach and flows pass through two 8’x12[EL1][TM2]‘ concrete box culverts (DBPS, 2015). The DBPS notes that the Bradley Rd culverts do not contain adequate capacity to pass the existing 100-year flows, 2,860 CFS, and recommends the installation of an additional culvert to pass the existing 100-year flows.

To the north of Bradley Rd, overhead electric and underground gas lines cross the channel. A map of major crossings is found on the Existing Conditions sheets (EX01-02) in the 60% Design Plans.

E. Parcel Ownership and Conveyance

The Project crosses parcels owned by Murray Foundation LLC, Eagle Development Company Heidi LLC, and BLH NO2 LLC. Parcel numbers and owners are noted on the Existing Conditions sheets in the 60% Design Plans. Coordination between the Landhuis Company and Banning Lewis Ranch in ongoing. This channel is currently within a tract.

Verify how the channel property will be set apart. (Discuss with staff)

F. Soil Conditions

Soils data is described in the NRCS Web Soil Survey, available in Appendix E. The channel bottom was predominantly classified as Sampson loam and Ascalon sandy loam. Areas adjacent to the channel are composed of fine sandy loam, sandy loam, and clay loam.

Geotechnical investigations, describe the area as composed of clay to sandy clay, silty to clayey sand, sandstone, and claystone bedrock. The report, completed by RMG and included in Appendix F, identifies possible foundation concerns on the site. Additional geotechnical investigation of the channel, including soil borings at drop structure locations, will be conducted prior to the submittal of the final design plans.

Proposed Conditions

A. Reference to Proposed Conditions Map

The proposed improvements are shown in the Design Plans in Appendix A. The Overall Drainage Plan (DR01-02) shows an overview of proposed conditions and proposed site grading. The Plan and Profile sheets (PP01-PP15) provide greater detail on the proposed improvements.

Drop structures, grading, and revegetation are proposed throughout the reach. Due to wide, shallow characteristics of the existing floodplain, channel realignment and establishment of a stable channel cross section is proposed throughout the reach to establish a single channel.

B. Channel and Adjacent Land Use

The proposed channel improvements are designed to mimic natural, stable conditions of a moderately entrenched, moderate gradient channel. The proposed multi-staged cross section will help maintain geomorphic equilibrium, reducing tendencies for excessive degradation and aggradation. This corridor will engage floodplain benches at different flood frequency events, creating a diverse riparian habitat and slowing the overbank flows to non-erosive levels.

Due to the low resistivity of the local soils, the proposed stable slope is shallow, resulting in the need for constructed drop structures throughout the project reach. This is consistent with the findings of the 2015 DBPS Report. The grade control structures will provide vertical grade control to prevent the propagation of a headcut through the project reach as well as energy dissipation within the channel.

El Paso County requires maintenance access to the proposed drop structures. An access road will be constructed and will double as a community walking trail (see DT04).

C. Project Need

The goals of the Project are to stabilize and protect the channel against excessive erosion and/or depositon and to limit the regulatory floodplain extents through the Project area.

(Freeboard calculations will be needed with final report.)

D. General Description of Proposed Channel Modifications

The proposed modifications aim to establish a single-thread, stable channel along East Fork Jimmy Camp Creek which can convey the 100-year storm event with a minimum of one foot of freeboard, with no additional superelevation height required. The design will generally maintain a naturally lined channel with appropriately placed grade control.

Stabilization elements include hydraulic grade control structures and riprap revetments within the channel. The proposed grade control structures are sculpted concrete with a 4H:1V sloping face. These structures are installed to achieve a flatter bed slope based on the expected long-term stable slope.

The channel improvement effort focuses on establishing multi-stage channel geometry to create a riparian corridor with a functional floodplain. The channel staging is based on an estimated bankfull flow that informs the channel geometry and meander planform. The revegetation plan matches the staged geometry, where hydrologic zones and groundwater availability determine the locations of riparian, and upland plant species.

E. Variances/Deviations

Partial-Width Drop Structures

Partial-width drop structures are proposed throughout the reach. The lateral extents of concrete extend to the low flow width with sheet pile and soil riprap providing protection across the 100-year floodplain. Additional discussion of this is provided in this report and in the submitted variance/deviation requests.

Channel Hydraulics

Due to the use of partial width drop structures, velocity and shear stresses in excess of the City and County criteria may be found within the channel. These areas will be stabilized to prevent any erosion within the channel and validated with hydraulic modeling. Additional discussion of this is provided in this report and in the submitted variance/deviation requests.

Deviations need to be provided for review and approval.

F. Maintenance and Access

El Paso County requires maintenance access to the drop structures. A multi-purpose trail shall be constructed to provide access for both maintenance and recreational purposes. Coordination with the County may be required in later design stages.

The project site can be accessed off Drennan Rd or Bradley Rd. It is not anticipated that construction access will be an issue since the project site is relatively flat and should be able to accommodate construction traffic. As the adjacent site is developed, access from the residential roads will be provided.

At the 60% design phase the proposed grading plan has 4:1 slopes or flatter, improving the possibility of access. Permanent access will be provided by the multi-purpose trail proposed along the channel.

Post-construction channel maintenance is anticipated to be transferred to the County and City for maintenance.

G. Tributary Stormwater Facilities

The project site is undeveloped and there are no existing stormwater outfalls or detention facilities present within the project reach. There are two road crossings within the reach, Drennan Rd and Bradley

Rd, that are discussed above. Stormwater outfalls are being designed by others and will be shown in the design plans at later stages.

Channel, Structure and Utility Crossing Design

A. Variances to DBPS

The design of East Fork Jimmy Camp Creek varies from the design in the 2015 DBPS in the channel cross section design and drop structure design. Due to the use of full spectrum detention in the adjacent development, it is not appropriate to use the future flows, as shown in the 2015 DBPS. The proposed improvements utilize modifications to the 2015 DBPS recommendations of a floodplain bench, grade control, and planform modifications for stabilizing East Fork Jimmy Camp Creek. See Section D for discussion of the typical cross section and floodplain staging.

B. Hydrologic and Hydraulic Criteria

The design hydrology for the project includes an estimated bankfull flow, flood flows based on City DCM criteria and the 2015 DBPS, and 100-year flows based on FEMA hydrology from the Flood Insurance Study. Due to an increase in the drainage basin area, two design points were selected for flow calculations, Bradley Rd and the project endpoint at Lorson Ranch.

Baseflow

The baseflow hydrology is based on the minimum constructable channel. As the project reach becomes developed and impervious area increases, this base flow channel will accommodate the minimum flows in the reach.

Bankfull Flow

The bankfull flow was estimated using regional regression equations developed by Matrix.

Low Flow

Low flow data, compiled as part of the City's assessment of Jimmy Camp Creek, was used to develop regression equations for the watershed (Matrix, 2013). These regression equations calculate a low flow significantly higher than the Matrix regional equations for the East Fork Jimmy Camp Creek Basin. This larger flow was incorporated into the cross-section design.

10- and 100-year Flows

Matrix used the hydrology from the 2015 DBPS and FEMA FIS for the design flood flows. The DBPS provides the most recent hydrologic study of the basin, and the flows have been approved by the City and County for use. The 10-year design flow is approximately equal to the existing condition, 100-year flows in the 2015 DBPS. Additional vertical depth is added to this channel stage to accommodate the 100-year FEMA flood flow. This FEMA flow is greater than the 100-year future flows in the 2105 DBPS. In discussions with stakeholders, it was determined that a reduction to the FEMA 100-year flows would not be acceptable.

The project design flows are summarized in Table 1 below with the source of each value noted.

Table 1. Design Flows

	Upper Reach	Lower Reach	
Return Period	**Drennan Rd to Bradley Rd (CFS)**	**Bradley Rd to Lorson Ranch (CFS)**	**Source**
Baseflow	2	4	Min. constructable channel
Bankfull	25	40	Matrix Regression
Low Flow	183	227	County Jimmy Camp Creek low flow equation
10-year	2,320	3,729	Approximately DBPS – 100-year Existing
100-year	3,600	4,400	FEMA FIS

Hydraulic Criteria

The hydraulic criteria used for the 60% Design includes criteria from The City of Colorado Springs, El Paso County, and the Mile High Flood District. Design criteria for each calculation is noted within that calculation.

C. Site Constraints

Several constraints were identified for the project, including but not limited to:

- *Drennan Rd and Bradley Rd culverts* – the proposed flow must tie into existing culverts.
  - The design does not include any improvements to the crossing at Drennan Rd. It is not anticipated that the proposed improvements will have any adverse effects on the crossing hydraulics. Due to changes to the channel downstream of Drennan Rd, a drop structure has been placed downstream of the crossing, outside of the Drennan Rd easement.
  - The culverts at Bradley Rd are undersized and will need to be improved. The 60% Design Plans contain Matrix's recommendations for the selection and placement of an additional culvert to increase capacity to future 100-year flows, 4,400 cfs.
  - The existing culverts crossing Bradley Rd will be extended to accommodate the future widening of Bradley Rd. The future width of Bradley Rd is shown in the 60% Design Plans and will be completed by others.
- *Lorson Ranch channel* – the proposed channel improvements must tie into the existing geometry of the Lorson Ranch reach of East Fork Jimmy Camp Creek.
  - The proposed channel through Rolling Meadows is a multi-staged channel while the Lorson Ranch section is a single staged, trapezoidal channel. The downstream channel tie-in will require adjustment of the typical channel section to maintain capacity while smoothly transitioning to the Lorson Ranch channel geometry.
- *Utility crossings* – shown in the Existing Conditions map of the Design Plans.
  - The underground gas crossing upstream of Bradley Rd constrains channel invert elevation. A minimum three feet of cover will be maintained over the gas line.
    - Coordination with the utility owner will be competed following the 60% Design submittal.
  - Overhead electric lines cross the channel upstream of Bradley Rd. Additional safety considerations will be needed during construction.

        - Minimal earthwork is proposed at the base of the existing electrical poles located within the 100-year floodplain.
- *Water main relocation* – the watermain and hydrants between Stations 40+00 and 67+00 will be relocated to avoid conflict with the proposed channel.
    - The water main relocation is being coordinated by others.

D. Major Channel Components/Attributes

The major channel components are broken out based on Section, Planform, and Profile.

Section

The typical cross section is shown in Figure 6 on the following page, as well as sheet DT01 of the Design Plans. The geometry consists of four stages: base flow, bankfull, low flow, and 100-year floodplain. The contributing watershed area changes significantly between the start of the project reach at Drennan Rd and the end tie-in at Lorson Ranch. Two channel cross sections are proposed to accommodate the change in flow throughout the project reach. The upper section applies from the start of the project at Drennan Rd to the Bradley Rd crossing. The lower section applies through the Bradley Rd crossing to the end of the project reach at Lorson Ranch.

Baseflow

The dimensions of the base flow stage are based on the minimum constructable channel dimensions. There is currently no base flow within the channel. Erosion control fabric and seed will be placed to prevent erosion during site development. As the upland areas are developed, it is anticipated that base flow will be established within the channel, and this base flow channel will maintain sediment transport at low flows.

Bankfull

The bankfull stages were designed to maintain an average width-to-depth ratio (W/D) of approximately 21, based on appropriate Rosgen B stream type channel criteria and design success in similar systems. This W/D will help convey sediment in a manner that minimizes the potential for excessive erosion and deposition.

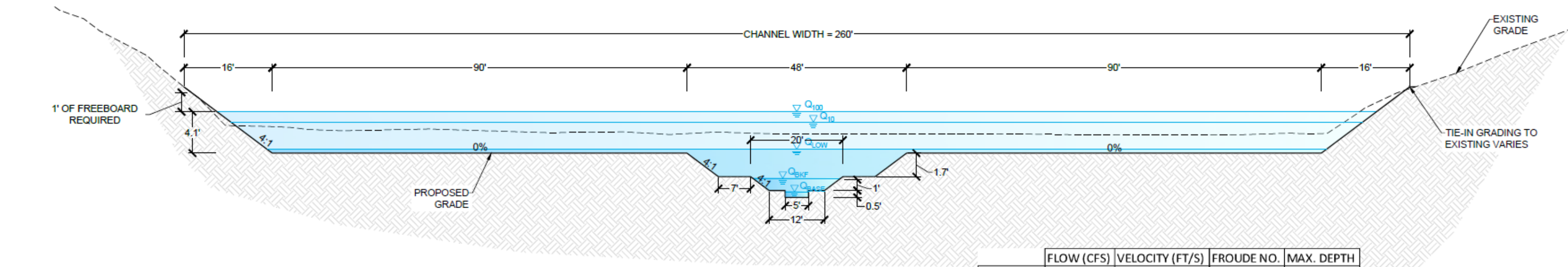
Low Flow

The dimensions of the low flow channel targeted a depth of 2 times max bankfull depth, for an entrenchment ratio of 2.33, appropriate for a moderately entrenched channel in this region.

100-year Flow

The typical floodplain width of 266-267 feet was sized to meet City velocity and shear stress criteria in the 100-year event. The floodplain is wider in areas where the existing valley has little topographic relief. The DCM criteria for threshold design was used to identify areas where additional floodplain stabilization is required. The 10-year flows shown in Table 1 fit within the 100-year floodplain

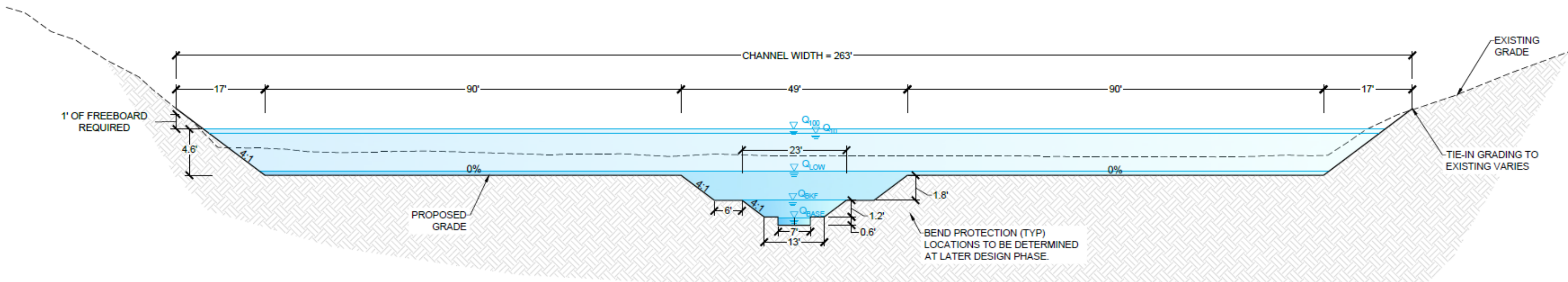
Figure 6. Typical Channel Cross Sections



NOTE:
FLOODPLAIN DEPTH VARIES BASED ON CHANNEL HYDRAULICS.

UPPER CHANNEL TYPICAL SECTION
STA 92+06 TO 165+37; SLOPE = 0.25%
NOT TO SCALE
NOTE 3:1 VERTICAL EXAGGERATION

	FLOW (CFS)	VELOCITY (FT/S)	FROUDE NO.	MAX. DEPTH
Q_{BASE}	2	1.03	0.29	0.39
Q_{BKF}	25	1.14	0.25	1.60
Q_{LOW}	183	1.05	0.21	3.58
Q_{10}	2320	2.80	0.27	6.29
Q_{100}	3600	3.29	0.28	7.32



LOWER CHANNEL TYPICAL SECTION
STA 00+00 TO 90+98; SLOPE = 0.25%
NOT TO SCALE
NOTE 3:1 VERTICAL EXAGGERATION

	FLOW (CFS)	VELOCITY (FT/S)	FROUDE NO.	MAX. DEPTH
Q_{BASE}	4	1.19	0.30	0.48
Q_{BKF}	40	1.39	0.27	1.89
Q_{LOW}	227	1.15	0.22	4.02
Q_{10}	3729	3.33	0.29	7.74
Q_{100}	4400	3.54	0.29	8.21

FLOW DATA SOURCES:
Q_{100} - FEMA FIS
Q_{10} - 2015 DBPS
Q_{LOW} - CITY/COUNTY EQUATIONS
Q_{BKF} - MATRIX REGRESSION EQUATIONS
Q_{BASE} - MIN. CONSTRUCTIBLE CHANNEL

SEE CHANNEL DESIGN REPORT FOR ADDITIONAL DETAIL.

Planform

The proposed planform is shown in the Overall Drainage Sheets (DR01-02) of the 60% Design Plans. The overall floodplain alignment follows the low point in the valley and the low flow channel meanders within the floodplain alignment. The proposed meander planform creates facet lengths and bend radii based on dimensionless ratios, normalized by bankfull width, and consistent with reference reach data. The meander planform aides in maintaining stream length and provides energy distribution consistent with natural and healthy stream systems.

Profile

The profile design is based on relevant DCM criteria and informed by local experience within the Fountain Creek watershed. The existing average bed slope through the reach is 1.0%. Planned future development is expected to impact flows in East Fork Jimmy Camp Creek which could destabilize the creek and can be preempted by implementing the proposed channel improvements within the Project reach. To achieve a stable longitudinal profile, hardened drop structures are proposed that provide shear resistance over a steep drop, with flatter bed slopes between each drop. The proposed drop structures are discussed in the Section E below.

The longitudinal slope of the naturally lined portion of channel was determined using guidance provided in Chapter 12, Section 3.1.2 of the City of Colorado Springs DCM and hydraulic modeling. The stable slope based on Figure 12-4 of the DCM for Q_{100} = 3,600 cfs and Q_{100} = 4,400 cfs is S=0.12% and S=0.09% respectively. Figure 12-4 is specific to sand bed channels and per the NRCS Web Soil Survey report and the Geotechnical report, the soils present in the project area are mostly a mix of loam and clay loam. FlowMaster was used to create a hydraulic model to determine what slope and cross section configuration would meet capacity requirements while adhering to DCM criteria. A design slope of 0.25% was selected for the project based on the model results. FlowMaster results are included in the Appendix G

It should be noted that in the proposed profile the slope S=0.25% represents an average bed slope for the naturally lined portion of the design reach. Based on natural riffle-pool systems, the slope in straight sections is steeper, while the slope in bend sections is flatter. These facet slopes will be incorporated in future design iterations. See the Plan and Profile Sheets (PP01 to PP15) of the Plans for details on the proposed longitudinal profile.

E. Major Drop Structure Components/Attributes

The 60% Design Plans propose sculpted concrete drop structures for grade control. These structures will have a drop height of 2.5’, 3.5’, or 4.5’. The Plan and Profile sheets (PP01 to PP15) show the location and height of the proposed grade control structures.

Large Drop Structures

The details for typical large drop structures are shown in DT02 and DT03 of the Design Plans. The design is based on guidance from Urban Storm Drainage Criteria Manual (USDCM). The typical structure consists of a sloping 4:1 longitudinal face, with a stilling basin for dissipating energy.

Minor flood events up to the low flow event will be contained within the sculpted concrete structure. This approach reduces the footprint of the structure and provides increased vegetation potential, improved stream function, reduced cost, and improved aesthetics. The partial width drop structure approach requires a variance.

The Q_{low} event (183 cfs and 227 cfs) was selected as the threshold for the flood event completely contained within the structure and the crest geometry was sized accordingly. The typical section is shown in Figure 7 on the following page, with additional detail in DT03 of the Design Plans. The concrete structure is extended to the top of the low flow channel with buried soil riprap placed along the sides of the structure.

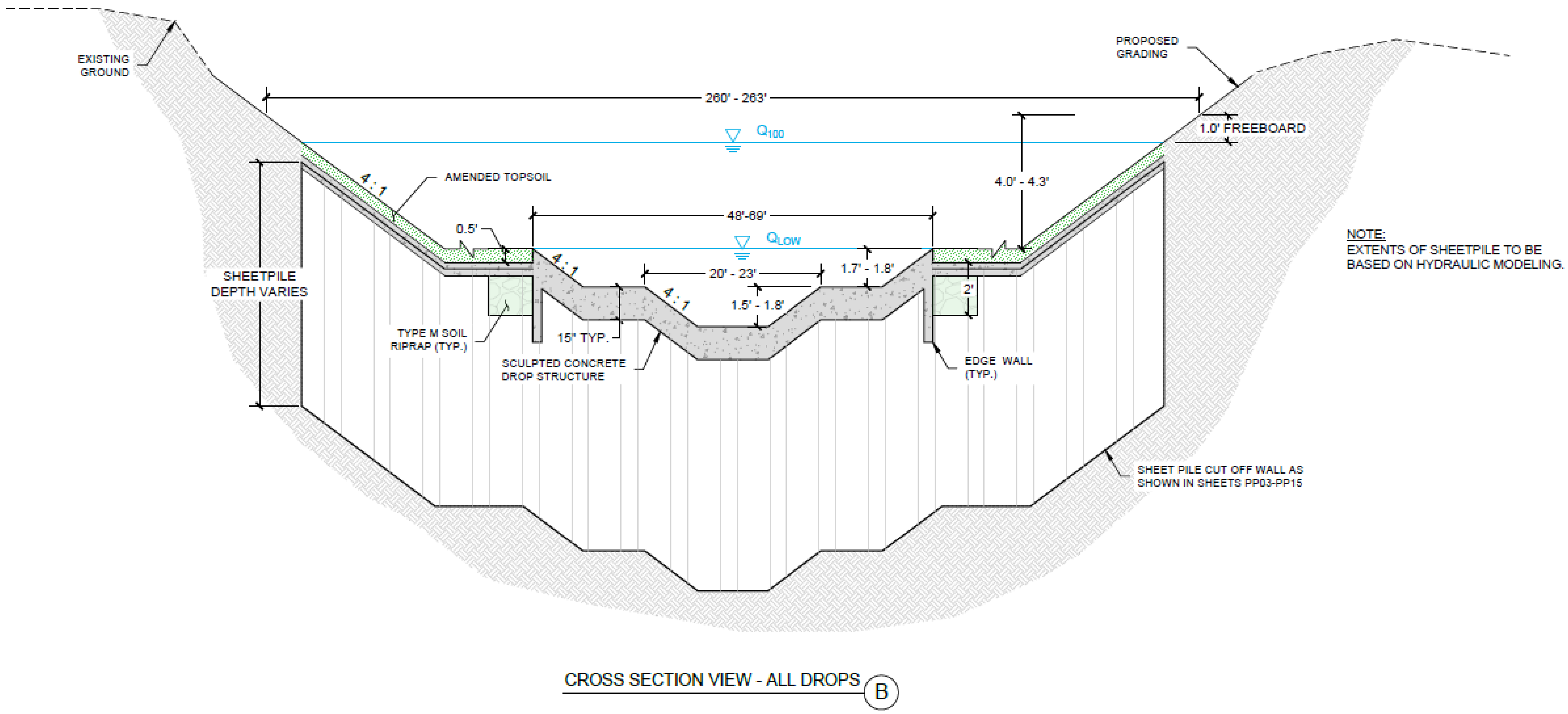
Each structure will include additional elements to ensure long-term vertical and horizontal stability in the floodplain. A sheet pile cut off wall will be placed at the crest of each drop and will be keyed down to a depth sufficient to protect against downstream degradation. This depth is determined by Lane’s weighted creep analysis included in Appendix H. As a result of this analysis, an end sill is placed at the downstream end of each drop to protect the drop from hydraulic uplift.

Adjacent Riprap

A riprap apron is placed upstream and downstream of each drop structure to provide a transition to the natural channel and protection against accelerating and turbulent flows. Sizing for this riprap was completed using USDCM criteria. Calculations are in Appendix H. Type M riprap is to be placed on all drop structures.

Buried soil riprap is to be placed adjacent to the sculpted concrete drops per USDCM criteria. The buried soil riprap is a secondary measure of protection should the vegetated overbanks begin to erode. The downstream riprap extents were calculated as part of the stilling basin design and fall below the USDCM minimum length requirements. Both the upstream and downstream riprap was placed at the USDCM minimum extents. Steep slope sizing equations were used, per criteria in the City of Colorado Springs Drainage Criteria Manual (COS DCM). Riprap sizing calculations provided unreasonably small riprap D_{50} values, and a minimum size of Type M riprap will be used. Calculations for all riprap sizing are located in Appendix H.

Figure 7. Crest Section of Large Drop Structure



F. Major Components/Attributes

The major components of the project include channel realignment, earthwork, drop structures, and revegetation. Channel realignment and drop structures are discussed above in Section C and Section D respectively.

Earthwork

A proposed grading plan was created at the 60% design level for the purposes of detailed hydraulic modeling, drop structure placement and tie in, and estimating construction cost. Refinement of the grading plan will be ongoing throughout later design stages.

The 60% earthwork estimates indicate that there will be 70,096 CY of onsite cut and fill work with 819,135 CY of excess material for the entire reach. This estimate is not adjusted for material displaced by large drop structures or riprap protection or for compaction, shrinkage, and swell of materials. Additional items such as soil amendment were not considered in the earthwork estimates.

The geotechnical report (Rocky Mountain Group, 2022) indicates that expansive soils are present onsite and structure subgrade may need to be moisture conditioned or replaced with granular subgrade. The technical specifications address criteria and testing requirements for structural fill. The availability of suitable structural fill onsite is to be determined, with the possibility that material may need to be imported to establish structure subgrade.

Revegetation

As part of the 60% Design, Matrix conducted a wetland assessment and delineation. The Memorandum summarizing the results can be found in the Appendix D.

A revegetation plan was created for the 60% Design and can be found on sheets RV01 to RV05 of the Design Plans. Sheets RV01-RV06 show the planting and fabric placement throughout the project reach. Seed mixes and soil amendments are outlined on RV07. Due to the anticipated changes to the site as the surrounding area is developed, the seed mixes have been developed to create a seed bank for future site conditions. It is Matrix's recommendation that site monitoring be completed as vegetation emerges to prevent the establishment of noxious or undesirable weed species.

Soil testing will be required, and topsoil may require amendment to provide suitable soil conditions for revegetation.

An example stormwater outfall is shown in RV05. Future floodplain grading around the proposed stormwater outfalls may provide an opportunity for cultivation of beneficial riparian or wetland vegetation, adding ecological value to the site.

Erosion control fabric will be required to stabilize soils until the vegetation can establish. Within the bankfull channel but excluding the bottom, Nedia KoirWrap 900 is specified for erosion control. Outside of the bankfull channel, Nedia C400B (coconut blanket) is specified for erosion control. Crimped straw is to be placed outside of the 100-year floodplain.

Overbank Shear Protection

In the overbanks, adjacent to each drop, lateral scour protection is provided by a combination of sheet pile and riprap sills. Sheet pile placement and extents are shown in the plan and profile sheets and sheet pile depths are outlined in DT02-DT03. Sheet pile is placed in the overbanks where 2D hydraulic modeling shows excessive shear stress due to the increased overbank slope. Riprap will be placed on the downstream side of the sheet pile to provide protection from rill erosion in the floodplain. As an alternative to sheet pile, a buried soil riprap apron can be placed in the overbanks adjacent to the drop structures to provide a lager area with high shear resistance.

At the drop at Sta. 102+69, a riprap floodplain sill extends to the Bradley Rd embankment to protect rill propagation in the widest sections of the floodplain.

G. Major Drainage Structure Components/Attributes

Stormwater Outfalls

There are no existing stormwater outfalls to the channel. Proposed stormwater outfalls and detention pond outlets for the Rolling Meadows development will be designed by others and shown on future plan submittals.

Unresolved:
build in one outfall per plans
to simplify LOMR process?

Overbank Protection

Hydraulic modeling, discussed in the next section, indicates the possibility of high shear stresses in the overbanks adjacent to the drop structures. To account of the possibility of erosive forces in the overbanks, sheet pile will be extended across the 100-year floodplain. The depth of overbank sheet pile is noted in DT03-DT04 for each drop height. Additional discussion of overbank protection is provided in the previous section.

Soils

Soils have been discussed in previous sections. It will be the construction contractor's responsibility to ensure all compaction requirements in the technical specifications are met.

H. Hydraulic Analysis

Hydraulic analysis on the typical cross sections was completed in FlowMaster and represents general values for each cross section. Manning's n values outlined previously were used. Table 2 shows the velocity, shear stress, and Froude number for the upper and lower typical cross sections.

Table 2. Forces in the Typical Cross Sections

Upper Reach				
Flow (CFS)		Max Flow Depth (ft)	Velocity (fps)	Fr
Baseflow	2	0.39	1.02	0.29
Bankfull	25	1.6	1.14	0.25
Low	183	3.6	1.05	0.21
10-year	2320	6.29	2.8	0.27
100-year	3600	7.32	3.29	0.28

Lower Reach					
Flow (CFS)		Max Flow Depth (ft)	Velocity (fps)	Fr
Baseflow	4	0.48	1.19	0.30
Bankfull	40	1.89	1.39	0.27
Low	227	4.02	1.15	0.22
10-year	2802	7.03	3.00	0.28
100-year	4400	8.21	3.54	0.30

A detailed proposed conditions 1D hydraulic analysis for the upstream and downstream sections of the project was performed and an additional 1D hydraulic analysis was completed for the drop structures. Water surface elevations and velocities were computed using the USACE HEC-RAS computer modeling program, Version 5.0.5. The HEC-RAS model was used to inform drop structure design, grading efforts, and general project design calculations. The 1D hydraulic model provides channel and overbank velocities and shear stresses. The flows inside the drop structures and stilling basins are modeled at supercritical flow and outside of the drop structures at subcritical flow.

Manning's "n" coefficients used in the hydraulic computations were chosen by engineering judgment based on field observations of the channel bottom and floodplain areas and are consistent with design guidance in criteria manuals. The Manning's n value for the proposed overbanks was increased to represent the fully developed vegetation in the site. Manning's n values are summarized in Table 3 below.

Table 3. Manning's n Values for Hydraulic Modeling

Terrain		Manning's n
Existing	Channel Bottom and Overbanks	0.04
Proposed	Channel	0.04
	Overbanks	0.06
	Drop Structures	0.025

The 1D hydraulic model was developed per USDCM criterial for detailed drop structure design. This model was used to determine the length of each stilling basin, perform a creep analysis, and size riprap. These calculations and the 1D hydraulic model are provided in Appendix G.

The crossing at Bradley Rd was modeled in both the Federal Highway Administration's HY-8 culvert modeling program and in a 2D hydraulic model. For the 2D model, the computational mesh was developed with breaklines inserted into the mesh to align computational cell faces with the direction of flow within the channel. The 2D model computations were solved with the Full Momentum equations. Additionally, the upstream and downstream reaches were connected with the proposed culvert configuration including, two existing 8'x12' concrete box culverts and one 42'x11.6' ConSpan arch culvert.

The unsteady hydrograph modeled both the upper and lower values of the 100-year flood event, with Results of the 2D HEC-RAS analysis are presented in Appendix G.

I. Riprap Design

Drop Structures

Riprap will be placed around the sculpted concrete drop structures. The placement and sizing of this material was discussed in Section F.

Overbanks

Riprap sills are proposed in the overbanks adjacent to each drop structure and on the downstream side of the sheet pile for shear protection. Steep slope riprap sizing equations were used to size this riprap.

Culvert Rundowns

The riprap apron proposed downstream of the Bradley Rd crossing was sized according to USDCM criteria. This calculation is available in Appendix H.

J. Stability Analysis

Stability analysis was conducted using the hydraulic modeling previously described. Areas indicating excessive shear stress or velocities are to be reinforced to provide additional protection to the reach.

At the 60% design level, hydraulic modeling does not indicate the presence of erosive forces at channel bends either within the low flow channel or at the 100-year floodplain. Evaluation of these forces will continue throughout later design stages.

K. Improvement Design Description

The proposed improvements will discourage future degradation of East Fork Jimmy Camp Creek caused by increased flow from development. Proposed channel improvements will also enhance the ecological integrity of the project area, increase stream function, and establish the creek as a community asset.

Design of the proposed improvements follow guidance provided in the COS DCM, El Paso County, and the USDCM. Design elements outside of the specifications of the COS DCM and El Paso County DCM's will be submitted as a variance.

Drainage and Bridge Fees

A. Major Watershed

The project reach is within the Jimmy Camp Creek watershed which is a part of the Fountain Creek watershed.

B. Current Year and Fees

The 2023 City of Colorado Springs Jimmy Camp basin fees include:

Drainage fee – $10,030 per platted acre

Pond facility fee – $3,269 per platted acre

Coordination on the drainage fees is being completed by others and will be updated in later submittals.

Construction Cost Opinion

The projected cost of the project is as follows:

Table 4. 60% Design – Opinion of Probable Construction Cost (OPCC)

	OPCC	-15%	+20%
60% Project Cost Estimate (full project)	$23,079,442	$19,617,525	$27,695,330
BLR Portion Cost Estimate (Sta. 07+41 to 39+98)	$3,734,860	$3,174,631	$4,481,831
50/50 Split Cost Estimate (Sta. 39+98 to 68+33)	$3,504,137	$2,978,669	$4,205,180

The cost estimate is a AACE International Class 2 Cost Estimate, which includes a lower estimate of 15% less and an upper estimate of 20% more. A more detailed breakdown is provided in the Appendix.

Phasing

The Project construction will be phased, with the areas south of Bradley Rd being developed first and the channel work being completed first. Future design stages will establish a timeline for the completion of the design and construction phasing.

Summary

A. Scope of Work and Need

East Fork Jimmy Camp Creek between Drennan Rd and Lorson Ranch is anticipated to see elevated flows due to increased impervious cover caused by a change in land use. The prescribed DBPS channel improvements intend to mitigate these effects through channel stabilization efforts.

Existing conditions in the project area include a wide, shallow floodplain that is approximately 2,000’ wide. Additionally, the double 8’x12’ box culverts at Bradley Rd are undersized for the 100-year event. Development of the contributing watershed is expected to increase runoff and decrease the available sediment supply leading to channel instability.

The proposed project aims to mitigate the risk of channel degradation by establishing a long-term stable slope between proposed grade control structures. Project goals include channel stabilization, flood conveyance, establishment of native flora, and the creation of a riparian corridor that is an asset to the community.

B. Design Refinements

The proposed design is a 60% design and will require refinements before construction. Necessary refinements are detailed in this design report and include refinement of the proposed drop structures, refinement of the channel tie in at Lorson Ranch, coordination of utility and road crossings, and refinement of the proposed channel.

C. Design Conformance with 2015 DBPS

The design uses the hydrology provided by the DBPS. No significant variances from the DBPS are required. The proposed improvements utilize a floodplain bench, grade control, and planform as methods for stabilizing East Fork Jimmy Camp Creek in accordance with the 2015 DBPS recommendations.

2015

D. Environmental Habitat

Due to the wide, shallow nature of the existing floodplain, channel realignment is necessary. Thus, the channel corridor will undergo significant temporary disturbance creating significant challenges to preserve existing vegetation near the channel. However, one of the project goals is to establish a healthy, native plant community. To achieve this community, a revegetation plan has been developed to ensure there is not a net loss of riparian and wetland areas within the project. The revegetation plan will continue to be refined in later design stages.

E. Safety

The proposed grading plan maintains slopes at 4:1 or flatter for nearly all the grading to provide appropriate ingress and egress. The drop structure elements are considered low-risk and meet criteria consistent with structures used throughout the City.

References

COS. 2014. City of Colorado Springs, *Drainage Criteria Manual*, Volume 1, May 2014.

Kiowa. 2015. Jimmy Camp Creek Drainage Basin Planning Study Development of Alternatives & Design of Selected Plan Report, March 2015.

Matrix Design Group. 2013. *Low Flow Estimation for Natural Channel Design*, Technical memorandum, April 9, 2013.

StreamStats. 2021. US Geological Survey, https://streamstats.usgs.gov/ss/

USDCM. 2016. Mile High Flood Control District, *Urban Storm Drainage Criteria Manual*, Volumes 1 and 2, 2016.

Appendix

Appendix A

60% Design Plans

(Attached)

Appendix B

Opinion of Probable Construction Cost

THE LANDHUIS COMPANY

60% Design Opinion of Probable Construction Cost
AACE International Class 2 Cost Estimate

ROLLING MEADOWS CHANNEL DESIGN
MATRIX PROJECT NO. 21.1129.009

BID ITEM NO.	DESCRIPTION OF BID ITEM	QUANTITY	PAY UNIT	UNIT PRICE	TOTAL COST OF BID ITEM
1	Mobilization	1	LS	$633,000	$633,000
2	Traffic Control	1	LS	$30,000	$30,000
3	Clearing and Grubbing	1	LS	$272,000	$272,000
4	Dewatering, Erosion, and Sediment Control	1	LS	$1,055,000	$1,055,000
5	Earthwork - Cut/Fill Onsite	70,097	CY	$12	$841,164
6	Earthwork - Stockpile Onsite	819,135	CY	$5.50	$4,505,243
7	Drop Structure - Sculpted Concrete	3,047	CY	$987	$3,007,389
8	Drop Structure - Sheet Pile	18,188	SF	$50	$909,400
9	Drop Structure - Type M Riprap	3,067	CY	$100	$306,700
10	Floodplain Sill - Sheet Pile	39,928	SF	$50	$1,996,400
11	Floodplain Sill - Type M Riprap	18,214	CY	$100	$1,821,400
12	Floodplain Sill - Type L Riprap	63	CY	$154	$9,702
13	Bradley Rd. Crossing - Type M Riprap	632	CY	$100	$63,200
14	Bradley Rd. Crossing - ConSpan O742	1	LS	$784,015	$784,015
15	Bradley Rd. Crossing - 12'x8' Box Culvert Extension	164	LF	$2,062	$338,168
16	Bradley Rd. Crossing - Wingwall	31	LF	$564	$17,484
17	Bradley Rd. Crossing - Headwall	171	LF	$230	$39,330
18	County Access Road - CDOT Class 2 Road Base	2,267	CY	$90	$204,030
19	Riparian Transition Seed	7.1	AC	$3,500	$24,850
20	Upland Seed & Overseed	101.5	AC	$3,500	$355,250
21	Temporary Seeding	51.1	AC	$2,500	$127,750
22	Compost Amendment	20,092	CY	$55	$1,105,060
23	Humate	39,869	LBS	$3	$119,607
24	Landscape Maintenance	24	MONTH	$3,800	$91,200
25	Koir Fabric (Koir Wrap 900)	66,832	SY	$20	$1,336,640
26	100% Coconut Fabric (Nedia C400B)	500,810	SY	$6	$3,004,860
27	Crimped Straw	40.3	AC	$2,000	$80,600
				Total	**$23,079,442**

AACE Class 2 Low Estimate (-15%)	$	19,617,525
AACE Class 2 Upper Estimate (+20%)	$	27,695,330

AACE International Class 2 Cost Estimate Definition – Class 2 estimates are generally prepared to form a detailed control baseline against which all project work is monitored in terms of cost and progress control. For contractors, this class of estimate is often used as the "bid" estimate to establish contract value. Typically, engineering is from 30% to 70% complete, and would comprise at a minimum the following: process flow diagrams, utility flow diagrams, piping and instrument diagrams, heat and material balances, final plot plan, final layout drawings, complete engineered process and utility equipment lists, single line diagrams for electrical, electrical equipment and motor schedules, vendor quotations, detailed project execution Expected accuracy ranges are from –5% to –15% on the low side and +5% to 20% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.

Matrix

THE LANDHUIS COMPANY

60% Design Opinion of Probable Construction Cost - Cost for Each Property
AACE International Class 2 Cost Estimate

ROLLING MEADOWS CHANNEL DESIGN
MATRIX PROJECT NO. 21.1129.009

BID ITEM NO.	DESCRIPTION OF BID ITEM	QUANTITY	PAY UNIT	UNIT PRICE	TOTAL COST OF BID ITEM
BLR	**Banning Lewis Ranch (Sta. 7+41 to Sta. 39+98, 21% of total project)**				
1	Mobilization (21% of total)	0.21	LS	$633,000	$132,930
2	Traffic Control (21% of total)	0.21	LS	$30,000	$6,300
3	Clearing and Grubbing	0.21	LS	$272,000	$57,120
4	Dewatering, Erosion, and Sediment Control	0.21	LS	$1,055,000	$221,550
5	Earthwork - Cut/Fill Onsite	6,190	CY	$12	$74,280
6	Earthwork - Stockpile Onsite	228,109	CY	$5.50	$1,254,600
7	Drop Structure - Sculpted Concrete	358	CY	$987	$353,346
8	Drop Structure - Sheet Pile	2,334	SF	$50	$116,700
9	Drop Structure - Type M Riprap	405	CY	$100	$40,500
10	Floodplain Sill - Sheet Pile	4,259	SF	$50	$212,950
11	Floodplain Sill - Type M Riprap	206	CY	$100	$20,600
12	County Access Road - CDOT Class 2 Road Base	488	CY	$90	$43,920
13	Riparian Transition Seed	1.6	AC	$3,500	$5,600
14	Upland Seed & Overseed	16.4	AC	$3,500	$57,400
15	Temporary Seeding	14.8	AC	$2,500	$37,000
16	Compost Amendment	4,039	CY	$55	$222,145
17	Humate	8,085	LBS	$3	$24,255
18	Landscape Maintenance (21% of total)	0.21	Total	$91,200	$19,152
19	Koir Fabric (Koir Wrap 900)	14,137	SY	$20	$282,740
20	100% Coconut Fabric (Nedia C400B)	88,262	SY	$6	$529,572
21	Crimped Straw	11.1	AC	$2,000	$22,200
				Total	**$3,734,860**

AACE Class 2 Low Estimate (-15%)	$	3,174,631
AACE Class 2 Upper Estimate (+20%)	$	4,481,831

BID ITEM NO.	DESCRIPTION OF BID ITEM	QUANTITY	PAY UNIT	UNIT PRICE	TOTAL COST OF BID ITEM
50/50	**50/50 Split - Banning Lewis/Landhuis (Sta. 39+98 to Sta. 68+33, 18% of total project)**				
1	Mobilization (18% of total)	0.18	LS	$633,000	$113,940
2	Traffic Control (18% of total)	0.18	LS	$30,000	$5,400
3	Clearing and Grubbing	0.18	LS	$272,000	$48,960
4	Dewatering, Erosion, and Sediment Control	0.18	LS	$1,055,000	$189,900
5	Earthwork - Cut/Fill Onsite	1	CY	$12	$12
6	Earthwork - Stockpile Onsite	207,139	CY	$5.50	$1,139,265
7	Drop Structure - Sculpted Concrete	371	CY	$987	$366,177
8	Drop Structure - Sheet Pile	2,369	SF	$50	$118,450
9	Drop Structure - Type M Riprap	410	CY	$100	$41,000
10	Floodplain Sill - Sheet Pile	8,388	SF	$50	$419,400
11	Floodplain Sill - Type M Riprap	306	CY	$100	$30,600
12	County Access Road - CDOT Class 2 Road Base	446	CY	$90	$40,140
13	Riparian Transition Seed	1.4	AC	$3,500	$4,900
14	Upland Seed & Overseed	14.4	AC	$3,500	$50,400
15	Temporary Seeding	9.0	AC	$2,500	$22,500
16	Compost Amendment	3,073	CY	$55	$169,015
17	Humate	6,176	LBS	$3	$18,528
18	Landscape Maintenance (18% of total)	0.18	Total	$91,200	$16,416
19	Koir Fabric (Koir Wrap 900)	12,127	SY	$20	$242,540
20	100% Coconut Fabric (Nedia C400B)	75,729	SY	$6	$454,374
21	Crimped Straw	6.2	AC	$2,000	$12,400
				Total	**$3,504,317**

AACE Class 2 Low Estimate (-15%)	$	2,978,669
AACE Class 2 Upper Estimate (+20%)	$	4,205,180

AACE International Class 2 Cost Estimate Definition – Class 2 estimates are generally prepared to form a detailed control baseline against which all project work is monitored in terms of cost and progress control. For contractors, this class of estimate is often used as the “bid” estimate to establish contract value. Typically, engineering is from 30% to 70% complete, and would comprise at a minimum the following: process flow diagrams, utility flow diagrams, piping and instrument diagrams, heat and material balances, final plot plan, final layout drawings, complete engineered process and utility equipment lists, single line diagrams for electrical, electrical equipment and motor schedules, vendor quotations, detailed project execution Expected accuracy ranges are from –5% to –15% on the low side and +5% to 20% on the high side, depending on the technological complexity of the project, appropriate reference information, and the inclusion of an appropriate contingency determination. Ranges could exceed those shown in unusual circumstances.

Matrix

Appendix C

FEMA Floodplain Maps

NOTES TO USERS

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

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

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

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

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

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

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

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

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

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

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

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

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

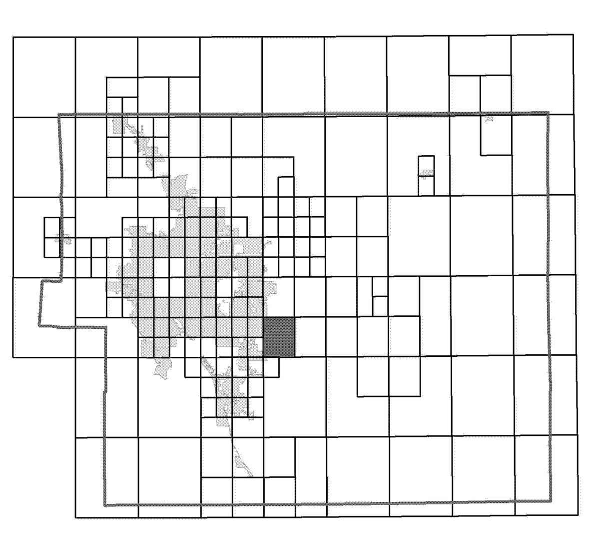
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

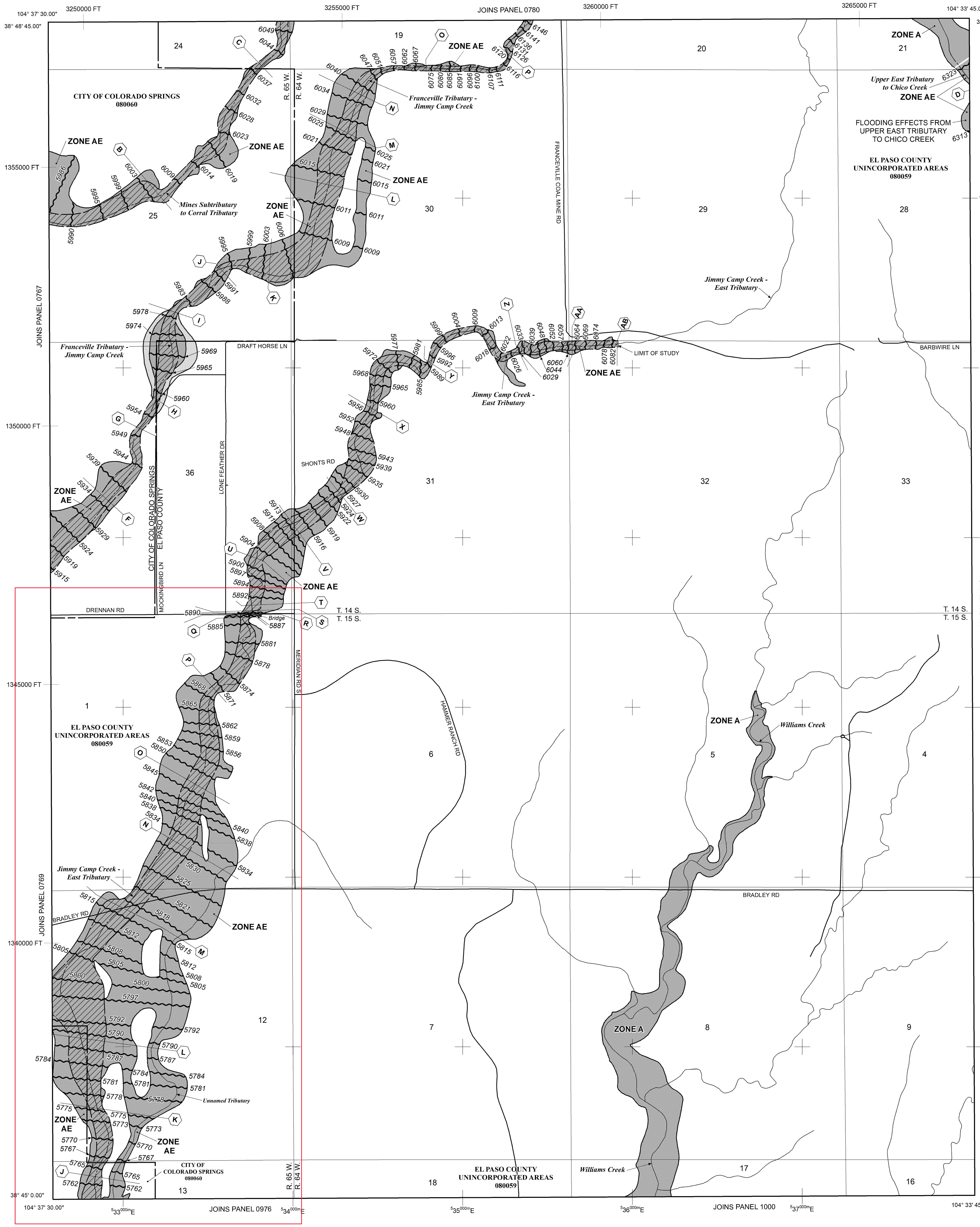
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



LEGEND

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

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

~~ 513 ~~ Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

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

(A)——(A) Cross section line

(23)--------(23) Transect line

97° 07' 30.00" 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

4275000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13

6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection

DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)

● M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0790G

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 790 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0790	G
EL PASO COUNTY	080059	0790	G

Notice: This map was reissued on 05/15/2020 to make a correction.This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

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

MAP NUMBER
08041C0790G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

NOTES TO USERS

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

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

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

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

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

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

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

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

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

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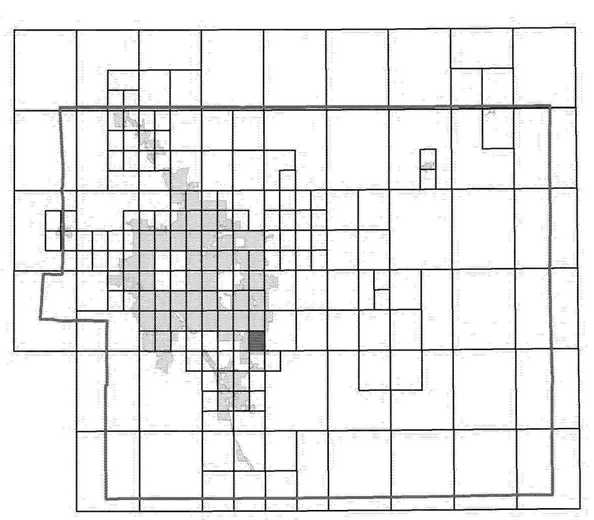
El Paso County Vertical Datum Offset Table

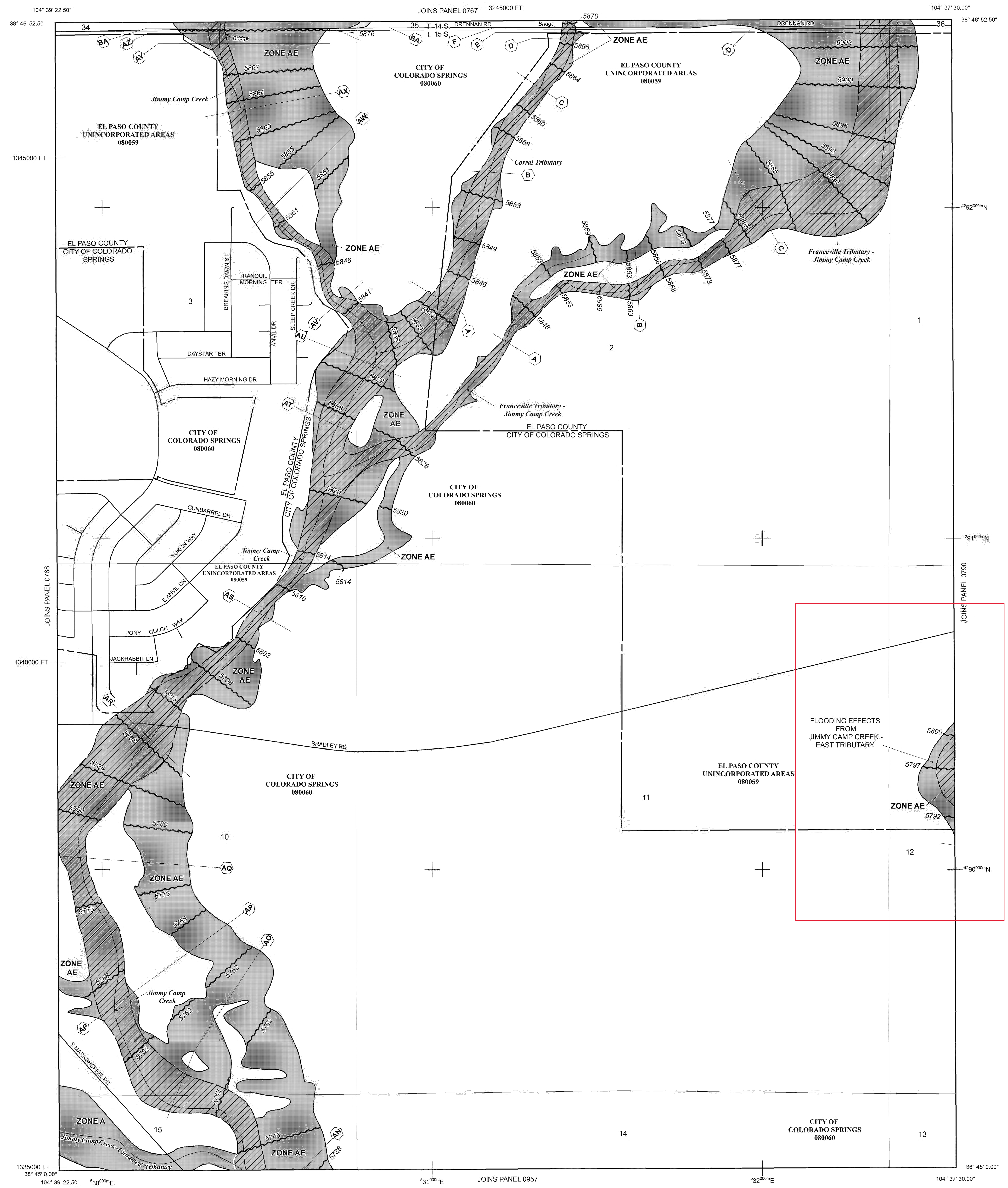
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 SOUTH, RANGE 65 WEST, AND TOWNSHIP 15 SOUTH, RANGE 65 WEST.

LEGEND

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

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

	Floodplain boundary
	Floodway boundary
	Zone D Boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

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

A —— A	Cross section line
23 -------- 23	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0769G

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

PANEL 769 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0769	G
EL PASO COUNTY	080059	0769	G

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MAP NUMBER 08041C0769G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

NOTES TO USERS

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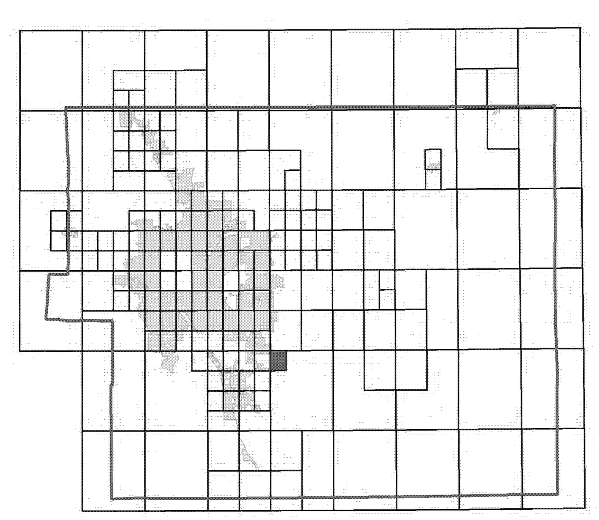

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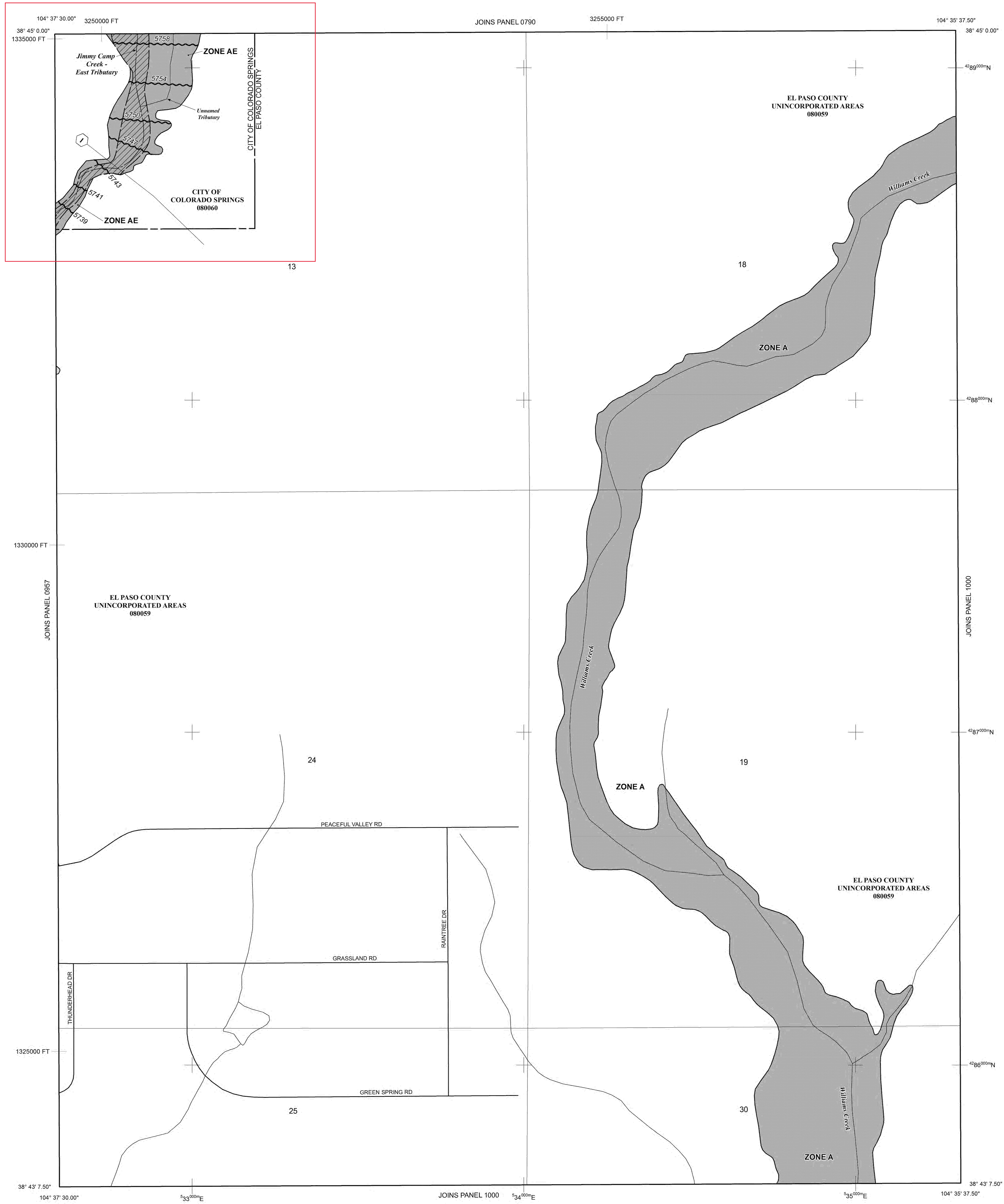

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 15 SOUTH, RANGE 64 WEST, AND TOWNSHIP 15 SOUTH, RANGE 65 WEST.

LEGEND

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FLOODWAY AREAS IN ZONE AE

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OTHER FLOOD AREAS

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OTHERWISE PROTECTED AREAS (OPAs)

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Floodplain boundary

Floodway boundary

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CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet*
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A ——— A	Cross section line
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EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
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250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0976G

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

PANEL 976 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0976	G
EL PASO COUNTY	080059	0976	G

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MAP NUMBER
08041C0976G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

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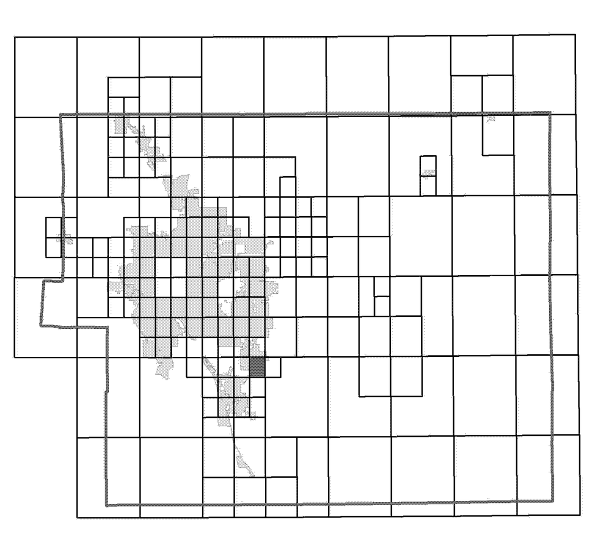

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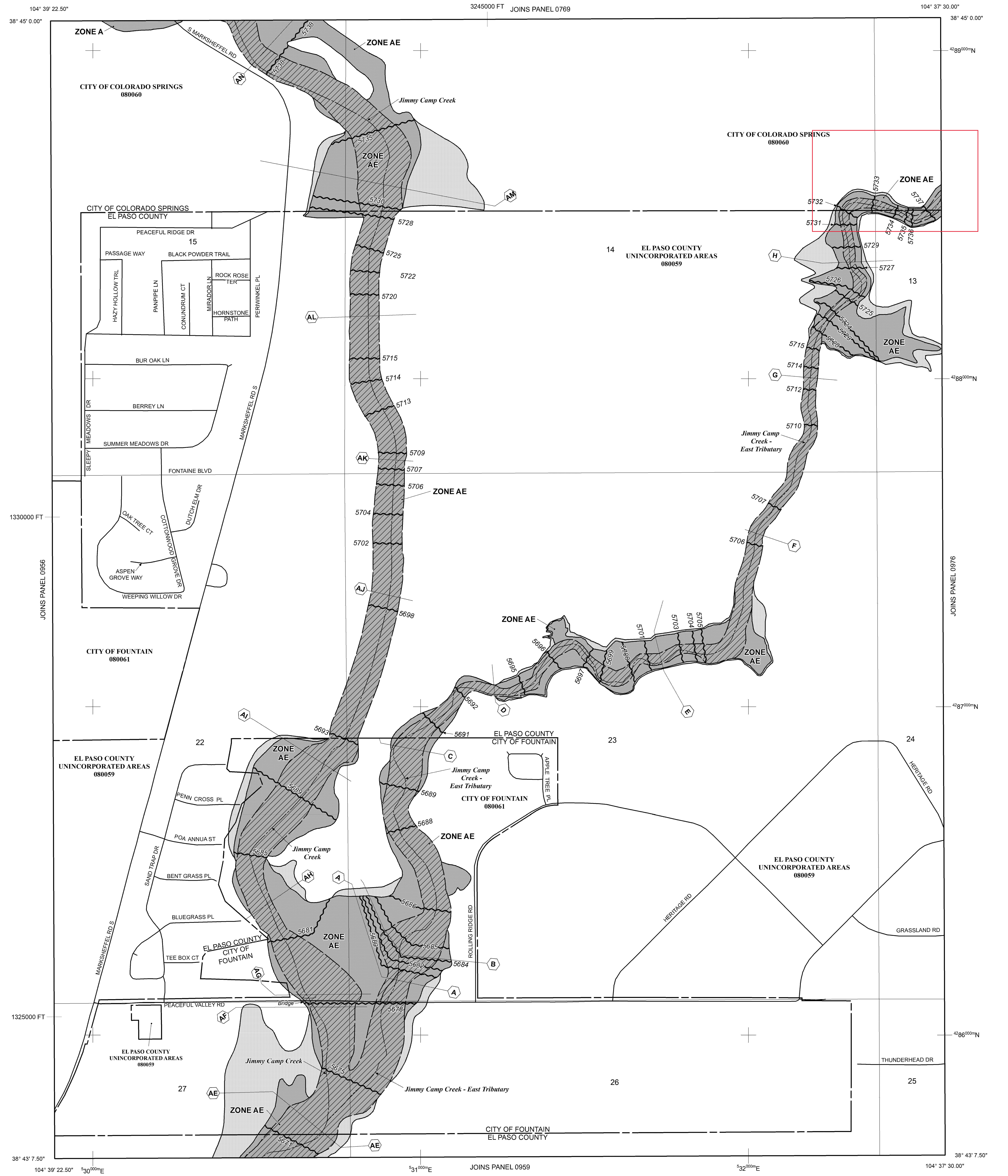

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 15 SOUTH, RANGE 65 WEST.

LEGEND

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ZONE AR Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

Floodplain boundary

Floodway boundary

Zone D Boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

~~ 513 ~~ Base Flood Elevation line and value; elevation in feet*

(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

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

A — A Cross section line

23 - - - - 23 Transect line

97° 07' 30.00" 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

4275000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13

6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection

DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)

● M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0957G

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

PANEL 957 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0957	G
EL PASO COUNTY	080059	0957	G
FOUNTAIN, CITY OF	080061	0957	G

Notice: This map was reissued on 05/15/2020 to make a correction.This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

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

MAP NUMBER
08041C0957G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

Appendix D

Wetland Delineation Reports

Note:

Wetland Delineation Report: contains partial property data

Request for Jurisdictional Determination: contains remainder of the property

2435 Research Pkwy, Suite 300
Colorado Springs, Colorado 80920
Phone: 719.575.0100
Fax: 719.575.0208
matrixdesigngroup.com

Date: 22 September 2021

To: Tony Martinez, U.S. Army Corps of Engineers

From: Tierney Walsh, Matrix Environmental Services

Subject: Wetland Assessment and Delineation Report – Rolling Hills Development at Jimmy Camp Creek East Tributary, West of S Meridian Road and South of Drennan Road, El Paso County, Colorado

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Mr. Martinez,

On behalf of the Landhuis Company, Matrix Environmental Services, LLC (MES) is pleased to submit this report summarizing the assessment and delineation of wetlands within the Rolling Hills development area (the Site), which is located west of S. Meridian Road and south of Drennan Road in El Paso County, Colorado.

The scope of work for the wetland assessment and delineation included the entire Site, which totals approximately 1,025 acres. Similar plant communities were identified throughout the Site; therefore, the observed plant communities were divided into eight distinct communities with one data sample point collected in each community.

The assessment and delineation field work were conducted May 13-14, 2021 (Communities 1-5) and August 7-8, 2021 (Communities 6-8). Climatic and hydrologic conditions at the Site were drier than average for the time of year during the May assessment due to below-normal rainfall; however, conditions were normal during the August assessment. The wet season in Colorado Springs is between April and September, peaking in July and August.

Community 1 includes the relatively flat area identified as a seasonally flooded, intermittent riverine system by the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), which is unnamed and shown by the USFWS NWI to converge with the Jimmy Camp Creek East Tributary at a point approximately 1.75-miles southwest. Community 1 is dominated by common kochia (*Bassia scoparia*) and a grass that was not identifiable at the time of assessment due to the lack of inflorescence. Community 1 vegetation also includes minor amounts of groundplum milkvetch (*Astragalus crassicarpus*), lamb's quarters (*Chenopodium album*) and musk thistle (*Carduus nutans*). No hydric soil indicators were observed within the area's sandy clay soils. Additionally, saturation and a water table were not observed within Community 1: soil was dry to a depth of 28 inches. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of hydric soils and a lack of wetland hydrology.

Community 2 includes a small depression near the eastern boundary of the Site, which is dominated by Russian olive (*Elaeagnus angustifolia*), common kochia (*Bassia scoparia*) and a grass that was not identifiable at the time of assessment due to the lack of inflorescence. Community 2 vegetation also includes minor amounts of field bindweed (*Convolvulus arvensis*) and Russian thistle (*Salsola tragus*). No hydric soil indicators were observed within the area's sandy clay loam and clay soils. Additionally, saturation and a water table were not observed within Community 2 despite the soil pit being advanced to 42 inches below the ground surface. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of hydric soils and a lack of wetland hydrology.

Community 3 includes the drainage swale identified as Jimmy Camp Creek East Tributary, which is dominated by common kochia (*Bassia scoparia*), a grass that was not identifiable at the time of assessment due to the lack of inflorescence and Woods' rose (*Rosa woodsii*). Community 3 vegetation also includes minor amounts of curly dock (*Rumex crispus*) and Russian thistle (*Salsola tragus*). No hydric soil indicators were observed within the area's sandy loam, loamy sand and sand soils. Additionally, saturation and a water table were not observed within Community 3 despite the soil pit being advanced to 52 inches below the ground surface. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of hydric soils and a lack of wetland hydrology.

Community 4 includes the relatively flat area identified as a seasonally flooded, intermittent riverine system by the USFWS NWI, which the NWI shows to converge onsite with Jimmy Camp Creek East Tributary. Community 4 is dominated by common kochia (*Bassia scoparia*) and field bindweed (*Convolvulus arvensis*) with minor amounts of lamb's quarters (*Chenopodium album*) and a grass that was not identifiable at the time of assessment due to the lack of inflorescence. No hydric soil indicators were observed within the area's sandy loam and sandy clay loam soils. Additionally, saturation and a water table were not observed within Community 4 despite the soil pit being advanced to 38 inches below the ground surface. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of dominance of hydrophytic vegetation, a negative prevalence index, the lack of hydric soils and a lack of wetland hydrology.

Community 5 includes a depression near the eastern boundary of the Site within the area identified as a seasonally flooded, intermittent riverine system by the USFWS NWI. Community 5 is dominated by field bindweed (*Convolvulus arvensis*) and a grass that was not identifiable at the time of assessment due to the lack of inflorescence. Vegetation in Community 5 also includes minor amounts of lamb's quarters (*Chenopodium album*) and common kochia (*Bassia scoparia*). No hydric soil indicators were observed within the area's sandy clay and sandy loam soils. Additionally, saturation and a water table were not observed within Community 5: soil was dry to a depth of 38 inches. However, oxidized rhizospheres along living roots were detectable within 12 inches of the soil surface. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of hydric soils.

Community 6 is approximately 0.18 acres and includes a drainage channel associated with a windmill-powered well south of Bradley Road. Community 6 is dominated by foxtail barley (*Hordeum jubatum*) and common kochia (*Bassia scoparia*) with minor amounts of lamb's quarters (*Chenopodium album*), Canada thistle (*Cirsium arvense*), field bindweed (*Convolvulus arvensis*) and alfalfa dodder (*Cuscuta approximata*). The community had visible surface water in approximately 30% of the area, surface soil cracks, algal mats and oxidized rhizospheres along living roots from 4-12 inches. Additionally, 5% prominent redox concentrations from 4-12 inches satisfy the criteria for redox dark surface. In my professional opinion, this community meets the criteria to be identified as a wetland based on the predominance of hydrophytic vegetation and the observation of hydric soil and wetland hydrology indicators.

Community 7 is located immediately south of Community 6 and includes the southern edge of the drainage channel that forms Community 6. Community 7 is dominated by blue grama (*Bouteloua gracilis*) and common kochia (*Bassia scoparia*) with minor amounts of lamb's quarters (*Chenopodium album*), alfalfa dodder (*Cuscuta approximata*), annual meadow grass (*Poa annua*), proso millet (*Panicum miliaceum*), common sunflower (*Helianthus annuus*) and golden crownbeard (*Verbesina encelioides*). No hydric soil indicators were observed within the area's silty clay loam and sandy loam soils. Additionally, saturation and a water table were not observed within Community 7: soil was dry to a depth of 30 inches. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of dominance of hydrophytic vegetation, a negative prevalence index, lack of hydric soils, and a lack of wetland hydrology indicators.

Community 8 includes the relatively flat area identified as Jimmy Camp Creek East Tributary south of Bradley Road, which the USFWS NWI describes as a seasonally flooded, intermittent riverine system. Community 8 is dominated by blue grama (*Bouteloua gracilis*), lamb's quarters (*Chenopodium album*) and red-root amaranth (*Amaranthus retroflexus*) with minor amounts of pineapple-weed (*Matricaria discoidea*), common kochia (*Bassia scoparia*), golden crownbeard (*Verbesina encelioides*) and curly dock (*Rumex crispus*). No hydric soil indicators were observed within the area's clay loam and silty loam soils. Additionally, saturation and a water table were not observed within Community 8: soil was dry to a depth of 48 inches. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of dominance of hydrophytic vegetation, a negative prevalence index, the lack of hydric soils and a lack of wetland hydrology.

According to the National Resources Conservation Service's Web Soil Survey, most soils within the Site are classified as Sampson loam, except soils within Community 3 which are classified as Ellicott loamy coarse sand. Additionally, portions of the Site are classified as wetlands according to the USFWS NWI map, including communities 1, 3, 4, 5 and 8 which the NWI describes as temporarily or seasonally flooded riverine habitats.

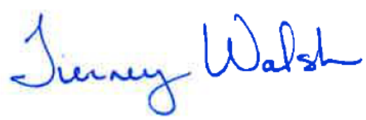
Flags were placed along the boundaries of areas identified as wetlands within the Site, which was limited to Community 6 as indicated in the attached figure.

The professional opinions made in this report regarding the location and extent of areas that do or do not satisfy the criteria of a wetland were determined pursuant to the Army Corps of Engineer's Regional Supplement and appropriate guidance and pursuant to confirmation by appropriate regulatory staff including but not limited to the Army Corps of Engineers.

Please contact Ms. Tierney Walsh at 719-457-5613 or Tierney.Walsh@matrixdesigngroup.com should you have any questions or comments.

Sincerely,

Matrix Environmental Services, LLC



Tierney Walsh

Environmental Scientist

Enclosures:

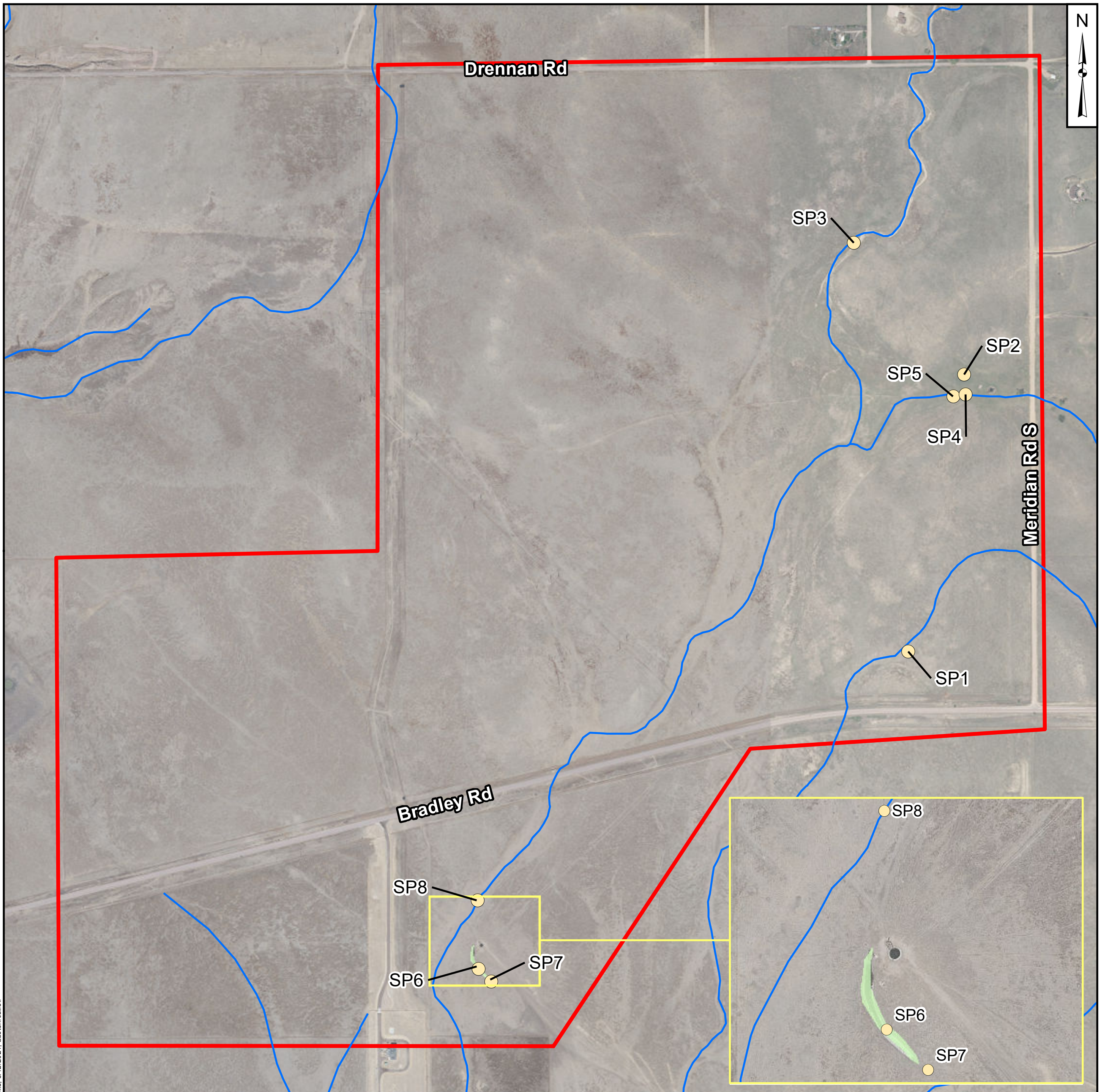
Site Figure

Photolog

Field Data Forms

cc: Mr. Jeff Mark, The Landhuis Company

Figures



Legend

- Sampling Point
- Ephemeral Stream
- Wetland
- Site Boundary

0 1,200 2,400 Feet

Rolling Hills Wetland Delineation

Matrix ENVIRONMENTAL

Figure 1

FILE: G:\gis_projects\MES_RollingHills\active\apps\FigureX_RollingHills_WetlandDelineation_2021_08_12_AKC.mxd, 8/12/2021, austen.cutrell

Photolog

Photo Log
Wetland Delineation for Rolling Hills Development
Colorado Springs, Colorado

Photo 1 – Community 1 includes a relatively flat area identified as a seasonally flooded riverine system by the USFWS NWI. Test pit shown in center of foreground.

Photo 2 – Community 1's sandy clay soils didn't exhibit hydric soil indicators. Additionally, saturation and a water table were not encountered despite the soil pit extending to a depth of 28 inches.

Photo 3 – Community 2 includes a small depression near the eastern boundary of the Site. Test pit is in the center of the middle ground.

Photo 4 – Community 2's sandy clay loam and clay soils didn't exhibit hydric soil indicators. Additionally, saturation and a water table were not encountered despite the soil pit extending to a depth of 42 inches.

Photo Log
Wetland Delineation for Rolling Hills Development
Colorado Springs, Colorado

Photo 5 – Community 3 includes the drainage swale identified as Jimmy Camp Creek East Tributary. Test pit is in the center of the foreground.

Photo 6 – Community 3's sandy loam, loamy sand and sand soils didn't exhibit hydric soil indicators, and saturation and a water table were not encountered despite the soil pit extending to a depth of 52 inches.

Photo 7 – Community 4 includes a relatively flat area identified as a seasonally flooded riverine system by the USFWS NWI. Test pit is in the center of the middle ground.

Photo 8 – Community 4's sandy loam and sandy clay loam soils didn't exhibit hydric soil indicators, and saturation and a water table were not encountered despite the soil pit extending to a depth of 38 inches.

Photo Log
Wetland Delineation for Rolling Hills Development
Colorado Springs, Colorado

Photo 9 – Community 5 includes a depression near the eastern boundary of the Site within the area identified as a seasonally flooded riverine system by the USFWS NWI. Test pit is on the left in the middle ground.

Photo 10 – Community 5's sandy clay and sandy loam soils didn't exhibit hydric soil indicators; however, oxidized rhizospheres along living roots were detectable within 12 inches of the soil surface.

Photo 11 – Community 6 is approximately 0.18 acres and includes a drainage channel associated with a windmill-powered well south of Bradley Road. Test pit is partially shown in the center of the foreground.

Photo 12 – Community 6's sandy loam soils contained 5% prominent redox concentrations from 4-12 inches, which satisfied the criteria for redox dark surface.

Photo Log
Wetland Delineation for Rolling Hills Development
Colorado Springs, Colorado

Photo 13 – Community 7 includes the southern edge of the drainage channel that forms Community 6. Test pit is in the center of the middle ground.

Photo 14 – Community 7's silty clay loam and sandy loam soils didn't exhibit hydric soil indicators, and saturation and a water table were not encountered despite the soil pit extending to a depth of 30 inches.

Photo 15 – Community 8 includes a relatively flat area identified as a seasonally flooded riverine system by the USFWS NWI. Test pit is in the center of the foreground.

Photo 16 – Community 8's clay loam and silty loam soils didn't exhibit hydric soil indicators, and saturation and a water table were not encountered despite the soil pit extending to a depth of 48 inches.

Field Forms

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 5/13/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 1

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): flat NWI trib. boundary Local relief (concave, convex, none): none Slope (%): 0-3%

Subregion (LRR): D Lat: N38.767754 Long: W104.612189 Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓	Is the Sampled Area within a Wetland?	Yes ____ No ✓
Hydric Soil Present?	Yes ____	No ✓		
Wetland Hydrology Present?	Yes ____	No ✓		

Remarks:
Moderate Drought in area during assessment (Drought.gov)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: *)			
1. unidentifiable grass (no reproductive structures)	60%	Y	NA
2. Bassia scoparia	20%	Y	FAC
3. Astragalus crassicarpus	5%	N	NI
4. Chenopodium album	2%	N	FACU
5. Carduus nutans	2%	N	UPL
6. Senecio crassulus	1%	N	FACU
7.			
8.			
9.			
10.			
11.			
= Total Cover	90%		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 10%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	50%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	20	x 3 = 60
FACU species	3	x 4 = 12
UPL species	2	x 5 = 10
Column Totals:	25 (A)	82 (B)

Prevalence Index = B/A = 3.28

Hydrophytic Vegetation Indicators:

- – 1 - Rapid Test for Hydrophytic Vegetation
- – 2 - Dominance Test is >50%
- – 3 - Prevalence Index is ≤3.0[1]
- – 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- – 5 - Wetland Non-Vascular Plants[1]
- – Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:
*sampled entire plant community

SOIL

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-11.5	10YR2/2	100%					sandy clay	moist.
11.5-20	10YR3/2	99%	10YR5/8	1%			sandy clay	hard, dry
20-28	10YR3/2	98%	10YR5/8	2%	C	M	sandy clay	hard, dry

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): >28"

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 5/13/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 2

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): Concave Slope (%): 1%

Subregion (LRR): D Lat: N 38.774002 Long: W 104.610502 Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____ No ✓	
Wetland Hydrology Present?	Yes ____ No ✓	

Remarks:
Moderate drought in area during assessment (drought.gov)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: *)	Absolute % Cover	Dominant Species?	Indicator Status
1. Elaeagnus angustifolia	90%	Y	FAC
2.			
3.			
4.			
	90% = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: *)			
1. Bassia scoparia	20%	Y	FAC
2. unidentifiable grass (warm season bunchgrass)	20%	Y	NA
3. Convolvulus arvensis	10%	N	NI
4. Salsola tragus	5%	N	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	55% = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 45%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	110	x 3 =	330
FACU species	5	x 4 =	20
UPL species		x 5 =	
Column Totals:	115	(A)	350 (B)

Prevalence Index = B/A = 3.04

Hydrophytic Vegetation Indicators:

- – 1 - Rapid Test for Hydrophytic Vegetation
- + 2 - Dominance Test is >50%
- – 3 - Prevalence Index is ≤3.0[1]
- – 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- – 5 - Wetland Non-Vascular Plants[1]
- – Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:
* sampled entire plant community

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/2	100%					Sandy clay loam	moist
6-13	10YR 2/2	100%					clay	dry, moic compact, $CaCO_3$
13-21	10YR 3/2	99%	10YR 3/6	1%	C	PL	clay	moist
21-31	10YR 4/2	50%	~~10YR~~				clay	moist, $CaCO_3$.
	10YR 2/2	50%						
31-42	10YR 5/3	98%	10YR 5/8	2%	C	M	loamy sand	moist

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- + Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): >42"

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): > 42"

Wetland Hydrology Present? **Yes** ___ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 5/13/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 3

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): drainage swale Local relief (concave, convex, none): concave Slope (%): 0-3%

Subregion (LRR): D Lat: N 38.777078 Long: W104.613583 Datum: WGS 84

Soil Map Unit Name: Ellicott loamy coarse sand NWI classification: R4SBA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ✓	**Is the Sampled Area within a Wetland?** Yes ____ No ✓
Hydric Soil Present?	Yes ____ No ✓	
Wetland Hydrology Present?	Yes ____ No ✓	

Remarks:
Moderate drought in area during assessment (drought.gov)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: *)			
1. Rosa woodsii	5%	Y	FACU
2.			
3.			
4.			
5.			
= Total Cover	5%		
Herb Stratum (Plot size: *)			
1. unidentifiable grass (no reproductive structures)	40%	Y	NA
2. Bassia scoparia	30%	Y	FAC
3. Rumex crispus	5%	N	FAC
4. Salsola tragus	5%	N	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80%		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 20%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	35	x 3 = 105
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	45 (A)	145 (B)

Prevalence Index = B/A = 3.22

Hydrophytic Vegetation Indicators:

– 1 - Rapid Test for Hydrophytic Vegetation
– 2 - Dominance Test is >50%
– 3 - Prevalence Index is ≤3.0[1]
– 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
– 5 - Wetland Non-Vascular Plants[1]
– Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:
* sampled entire plant community

Sampling Point: 3

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10 YR 4/2	100%					Sandy loam	
3-12	10YR 4/2	100%					sandy loam,	moist.
12-20	10 YR 5/4	99%	10YR 3/6	1%	C	PL	loamy sand	moist
20-33	10 YR 5/4	100%					sand.	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1) (**except MLRA 1**)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

__ 2 cm Muck (A10)
__ Red Parent Material (TF2)
__ Very Shallow Dark Surface (TF12)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes ____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1)
__ Sediment Deposits (B2)
__ Drift Deposits (B3)
__ Algal Mat or Crust (B4)
__ Iron Deposits (B5)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Sparsely Vegetated Concave Surface (B8)
__ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
__ Salt Crust (B11)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Stunted or Stressed Plants (D1) (**LRR A**)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Saturation Visible on Aerial Imagery (C9)
__ Geomorphic Position (D2)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)
__ Raised Ant Mounds (D6) (**LRR A**)
__ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): >52"

Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches): >52"

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 5/14/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 4

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): flat w/in trib. boundary Local relief (concave, convex, none): none Slope (%): 0%

Subregion (LRR): D Lat: N38°46.414' Long: W104°36.626 Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓
Hydric Soil Present?	Yes ____	No ✓
Wetland Hydrology Present?	Yes ____	No ✓

Is the Sampled Area within a Wetland? Yes ____ No ✓

Remarks:
Moderate drought in area during assessment (drought.gov)

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: *)			
1. Bassia scoparia	40%	Y	FAC
2. Convolvulus arvensis	40%	Y	NI
3. Chenopodium album	10%	N	FACU
4. unidentifiable grass (no reproductive structures)	5%	N	NA
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	95%		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 5%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	40	x 3 =	120
FACU species	10	x 4 =	40
UPL species		x 5 =	
Column Totals:	50	(A)	160 (B)

Prevalence Index = B/A = 3.20

Hydrophytic Vegetation Indicators:

– 1 - Rapid Test for Hydrophytic Vegetation
– 2 - Dominance Test is >50%
– 3 - Prevalence Index is ≤3.0[1]
– 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
– 5 - Wetland Non-Vascular Plants[1]
– Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:
* sampled entire plant community

SOIL

Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/2	100%					sandy loam	dry
3-9.5	10YR 2/2	100%					sandy clay loam	moist.
9.5-38	10YR 2/2	99%	10YR 3/6	1%	C	PL	sandy clay loam	compacted, dry

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes ___ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) **(LRR A)**
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ~~[illegible]~~

Water Table Present? Yes ___ No ✓ Depth (inches): >38"

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ___

Wetland Hydrology Present? Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 5/14/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 5

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): Concave Slope (%): 0-5

Subregion (LRR): D Lat: 38°46.413 N Long: W104°36.647 Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No ✓
Hydric Soil Present?	Yes ____	No ✓
Wetland Hydrology Present?	Yes ✓	No ____

Is the Sampled Area within a Wetland? Yes ____ No ✓

Remarks: Moderate drought in area during assessment (drought.gov)

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: *)			
1. unidentifiable grass (no reproductive structures)	40%	Y	NA
2. Convolvulus arvensis	20%	Y	NI
3. Chenopodium album	10%	N	FACU
4. Bassia scoparia	10%	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80%		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 20%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	10	x 3 =	30
FACU species	10	x 4 =	40
UPL species		x 5 =	
Column Totals:	20 (A)		70 (B)

Prevalence Index = B/A = 3.5

Hydrophytic Vegetation Indicators:

- _ 1 - Rapid Test for Hydrophytic Vegetation
- _ 2 - Dominance Test is >50%
- _ 3 - Prevalence Index is ≤3.0[1]
- _ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- _ 5 - Wetland Non-Vascular Plants[1]
- _ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks: *Sampled entire plant community

SOIL

Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4.5	10YR 2/2						sandy clay	moist
4.5-7.5	10YR 2/2	98%	7.5YR 3/4	2%	C	PL	sandy clay	composted
7.5-11	10YR 2/2	97%	7.5YR 3/4	3%	C	PL	sandy clay	
11-19	10YR 2/2	97%	10YR 3/6	3%	C	M	sandy clay	dry
19-21	10YR 3/1	93%	10YR 3/6	7%	C	M	sandy clay	
21-22	10YR 5/4	95%	10YR 3/6	5%	C	M	sandy loam	
22-38	10YR 5/4	100%					sandy loam	dry

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B)**
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- \+ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- \+ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): >38"

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): >38"

Wetland Hydrology Present? **Yes** ✓ **No** ~~FBTs~~

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 8/7/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 6

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S12 T15S R65W

Landform (hillslope, terrace, etc.): drainage channel for onsite well Local relief (concave, convex, none): concave Slope (%): 0-2%

Subregion (LRR): D Lat: N 38° 45.642′ Long: W 104° 37.478′ Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ____
Hydric Soil Present?	Yes ✓	No ____
Wetland Hydrology Present?	Yes ✓	No ____

Is the Sampled Area within a Wetland? Yes ✓ No ____

Remarks:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: *)			
1. Hordeum jubatum	30	Y	FAC
2. Bassia scoparia	30	Y	FAC
3. Chenopodium album	15	N	FACU
4. Cirsium arvense	2	N	FAC
5. Convolvulus arvensis	2	N	NI
6. Cuscuta approximata	2	N	NI
7. Rumex crispus	1	N	FAC
8. Andropogon gerardii	1	N	FACU
9. Helianthus annus	1	N	FACU
10. Verbesina encelioides	1	N	FACU
11.			
= Total Cover	85		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 20%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	63	x 3 = 189
FACU species	18	x 4 = 72
UPL species	0	x 5 = 0
Column Totals:	81 (A)	261 (B)

Prevalence Index = B/A = 3.22

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
+ 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- 5 - Wetland Non-Vascular Plants[1]
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:

* Sampled entire plant community

Sampling Point: 6

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/2	100					Sandy loam	
4-6	10YR 2/2	97	10YR 3/6	3%	C	PL	↓	Prominent
6-12	10YR 2/2	95	10YR 3/6	5%	C	PL	↓	
12-16	10YR 2/2	98	10YR 3/6	2	C	PL	~~[illegible]~~	
16-22	10YR 3/2	97	10YR 4/6	3%			Sandy Clay	prom.
22-27	10YR 4/2	95	10YR 4/6	5%	C	PL	sandy clay loam	
27-30	10YR 4/2	99	10YR 4/6	1%	C	M	loamy sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

– Histosol (A1)
– Histic Epipedon (A2)
– Black Histic (A3)
– Hydrogen Sulfide (A4)
– Depleted Below Dark Surface (A11)
– Thick Dark Surface (A12)
– Sandy Mucky Mineral (S1)
– Sandy Gleyed Matrix (S4)
– Sandy Redox (S5)
– Stripped Matrix (S6)
– Loamy Mucky Mineral (F1) **(except MLRA 1)**
– Loamy Gleyed Matrix (F2)
– Depleted Matrix (F3)
+ Redox Dark Surface (F6)
– Depleted Dark Surface (F7)
– Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

– 2 cm Muck (A10)
– Red Parent Material (TF2)
– Very Shallow Dark Surface (TF12)
_ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ No ____

Remarks: ≤3/≤2 5% dist/prom redox in upper 12"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

+ Surface Water (A1)
– High Water Table (A2)
– Saturation (A3)
– Water Marks (B1)
– Sediment Deposits (B2)
– Drift Deposits (B3)
+ Algal Mat or Crust (B4)
– Iron Deposits (B5)
+ Surface Soil Cracks (B6)
– Inundation Visible on Aerial Imagery (B7)
– Sparsely Vegetated Concave Surface (B8)
– Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
– Salt Crust (B11)
– Aquatic Invertebrates (B13)
– Hydrogen Sulfide Odor (C1)
+ Oxidized Rhizospheres along Living Roots (C3)
– Presence of Reduced Iron (C4)
– Recent Iron Reduction in Tilled Soils (C6)
– Stunted or Stressed Plants (D1) **(LRR A)**
_ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

– Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
– Drainage Patterns (B10)
– Dry-Season Water Table (C2)
– Saturation Visible on Aerial Imagery (C9)
+ Geomorphic Position (D2)
– Shallow Aquitard (D3)
– FAC-Neutral Test (D5)
– Raised Ant Mounds (D6) **(LRR A)**
– Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ✓ No – Depth (inches): 0-11"
Water Table Present? Yes ____ No ____ Depth (inches): >48 w/sp
Saturation Present? (includes capillary fringe) Yes – No ____ Depth (inches): >48

Wetland Hydrology Present? Yes ✓ No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 8/7/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 7

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S12T15S R65W

Landform (hillslope, terrace, etc.): end of drainage channel. Local relief (concave, convex, none): none-concave Slope (%): 2-3%

Subregion (LRR): D Lat: N 38° 45.625' Long: W 104° 37.456' Datum: WGS 84

Soil Map Unit Name: Sampson Loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ✓	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____ No ✓	
Wetland Hydrology Present?	Yes ____ No ✓	

Remarks:
No drought at time of assessment in El Paso (drought.gov)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: *)			
1. Bouteloua gracilis	30%	Y	NI
2. Bassia scoparia	30%	Y	FAC
3. Chenopodium album	20%	N	FACU
4. Cuscuta ~~campestris~~ approximata	10%	N	NI
5. Poa annua	10%	N	FAC
6. Panicum miliaceum	5%	N	NI
7. Helianthus annuus	2%	N	FACU
8. Verbesina encelioides	2%	N	FACU
9. Pascopyrum smithii	1%	N	FACU
10.			
11.			
= Total Cover	110		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	40	x 3 = 120
FACU species	25	x 4 = 100
UPL species	0	x 5 = 0
Column Totals:	65 (A)	225 (B)

Prevalence Index = B/A = 3.46

Hydrophytic Vegetation Indicators:

- – 1 - Rapid Test for Hydrophytic Vegetation
- – 2 - Dominance Test is >50%
- – 3 - Prevalence Index is ≤3.0[1]
- – 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- – 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:
*Sampled entire plant community

SOIL

Sampling Point: 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-9	10YR2/2	100%					silty clay (loam)	
9-16	10YR2/2	99%	10YR3/6	1%	C	PL	sandy loam	prom
16-30	10YR2/2	99%	10YR3/6	1%	C	M	clay loam	calcium deposits

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______________

Depth (inches): ______________

Hydric Soil Present? Yes ______ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ______ No ✓ Depth (inches): ______

Water Table Present? Yes ______ No ✓ Depth (inches): >30"

Saturation Present? (includes capillary fringe) Yes ______ No ✓ Depth (inches): ______

Wetland Hydrology Present? Yes ______ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 8/8/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 8

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): ~~flat~~ w/in trib. boundary Local relief (concave, convex, none): none Slope (%): 0-2%

Subregion (LRR): D Lat: 38°45.735' Long: W104°37.478' Datum: WGS84

Soil Map Unit Name: Sampson loam NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No ✓	Is the Sampled Area within a Wetland?	Yes ___ No ✓
Hydric Soil Present?	Yes ___ No ✓		
Wetland Hydrology Present?	Yes ___ No ✓		

Remarks:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: ✗)			
1. Bouteloua gracilis	50%	Y	NI
2. Chenopodium album	20%	Y	FACU
3. Amaranthus retroflexus	20%	Y	FACU
4. ~~Chamomilla suaveolens~~ Matricaria discoidea BTW	10%	N	FACU ~~NI~~ BTW
5. Bassia scoparia	~~5~~ 5%	N	FAC
6. Verbesina ~~occidentalis~~ encelioides BTW	3%	N	FACU
7. Rumex crispus	2%	N	FAC
8. Convolvulus arvensis	1%	N	NI
9. Cirsium arvense	1%	N	FAC
10.			
11.			
= Total Cover	112		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	8	x 3 = 24
FACU species	53	x 4 = ~~212~~ 212 BTW
UPL species		x 5 =
Column Totals:	61 (A)	236 (B)

Prevalence Index = B/A = 3.87

Hydrophytic Vegetation Indicators:

– 1 - Rapid Test for Hydrophytic Vegetation

– 2 - Dominance Test is >50%

– 3 - Prevalence Index is ≤3.0[1]

– 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

– 5 - Wetland Non-Vascular Plants[1]

– Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No ✓

Remarks:

SOIL

Sampling Point: 8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-13	10YR 2/2	100%					clay loam	dry
13-30	10YR 3/2	100%					silty loam	↓
30-48	10YR 3/2	100%					sandy loam	↓

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10)
- __ Red Parent Material (TF2)
- __ Very Shallow Dark Surface (TF12)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1)
- __ Sediment Deposits (B2)
- __ Drift Deposits (B3)
- __ Algal Mat or Crust (B4)
- __ Iron Deposits (B5)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Sparsely Vegetated Concave Surface (B8)
- __ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- __ Salt Crust (B11)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Stunted or Stressed Plants (D1) (**LRR A**)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Geomorphic Position (D2)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)
- __ Raised Ant Mounds (D6) (**LRR A**)
- __ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ______

Water Table Present? Yes ____ No ____ Depth (inches): >48"

Saturation Present? (includes capillary fringe) Yes ____ No ____ Depth (inches): >48"

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Request for Approved Jurisdictional Determination for Rolling Meadows El Paso County, Colorado

Prepared for:

Pueblo U.S. Army Corps of Engineers, Regulatory Field Office
201 West 8th Street, Suite 350
Pueblo, CO 81003

On Behalf of:

The Landhuis Company
212 N Wahsatch Ave #301
Colorado Springs, CO, 80903

Prepared by:

Matrix
Excellence by Design

707 17th Street, Suite 3150
Denver, CO 80202
Contact: Justin Apfel

December 13, 2022

Table of Contents

Appendices

To whom this may concern,

Matrix Design Group, Inc. (Matrix) is submitting this request for an Approved Jurisdictional Determination (AJD) on behalf of the Landhuis Company for aquatic resources associated with six unnamed drainages on the Rolling Meadows property (Property) located in El Paso County, Colorado. The Property is approximately 1,869 acres and is located south of Drennan Road and north of the Grand Mountain School. Matrix visited the Property on October 12, 2022 and December 5, 2022, to evaluate the characteristics of the unnamed drainages and their potential connection to downstream waters subject to Clean Water Act (CWA) Section 404 jurisdiction. In the following request, we provide background on the Property location, field methodology, and details on the characteristics of the unnamed drainages and our evaluation of the potential jurisdictional status of aquatic resources on the Property. Please refer to the figures in Appendix A for a depiction of the Property and representative images in Appendix B.

1.0 Location

The Property is approximately 1,869-acres and is located southeast of Colorado Springs, approximately 3.5 miles southeast of the Colorado Springs Airport. The Property is situated within Section 1, 12 and 13, Township 15 South, and Range 65 West. The approximate center of the primary drainage feature, Unnamed Drainage 1, within the Property is in UTM Zone 13S, NAD83; 533224.33m E, 4290806.97m N; Latitude 38.764447, Longitude -104.617576; U.S. Geological Survey (USGS) Colorado Springs, CO Quadrangle. The Property is located within Hydrologic Unit Code (HUC) 11020303, an approximately 928 square mile watershed. Based on National Weather Service 30-year precipitation data, Colorado Springs receives 15.91 inches of annual precipitation on average with 13.14 inches per year as rain and 2.77 inches per year as snow.

Bradley Road runs east to west through the approximate center of the Property and two unnamed drainage features are conveyed under the road through culverts. The Property is currently undeveloped and has historically been used for grazing.

2.0 Project Applicant and Consultant

2.1 Applicant

The Landhuis Company
Jeff Mark
212 N. Wwahsatch Ave, Suite 301
Colorado Springs, CO 80903
jmark@landhuisco.com
(719) 635-3200

2.2 Consultant

Matrix Design Group, Inc.
Justin Apfel
707 17th Street, Suite 3150
Denver, CO 80202
justin.apfel@matrixdesigngroup.com
(757) 817-4267

3.0 Assessment Methods

Matrix staff originally visited a portion of the Property on May 13-14 and August 7-8, 2021, to evaluate the characteristics and potential surface or subsurface connections of one drainage located in the northern section of the Property, north of Bradley Road. The methodology and results of the original site visit can be found in the Wetland Assessment and Delineation Report in Appendix D. Matrix conducted additional site visits on October 12, 2022, and December 5, 2022 to evaluate the characteristics and potential surface or subsurface connections of the six unnamed drainages located throughout the Property to known or expected CWA jurisdictional Waters of the U.S. (WOTUS). Prior to conducting field-based assessments, Matrix reviewed current and historic aerial imagery (Google Earth, 2022), current and historic USGS topographic maps, National Oceanic and Atmospheric Administration National Weather Service Weather

Forecast Office (NOAA, 2022), Natural Resources Conservation Service Web Soil Survey (Figure 5; NRCS, 2022), and US Fish and Wildlife Service (USFWS) National Wetlands Inventory and US Geological Survey (USGS) National Hydrography Dataset (Figure 4; NHD and NWI; USGS, 2022 and USFWS, 2022).

Drainage features were evaluated to characterize areas with defined bed and bank and identify manmade or natural breaks in the drainage features, if present, to determine if a hydrologic connection existed with downstream WOTUS. Matrix evaluated potential wetlands using the United States Army Corps of Engineers (USACE) 1987 Wetlands Delineation Manual (Environmental Laboratory, 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coasts Region (Version 2.0) (Regional Supplement) (USACE, 2008a).

During the field investigation, plant species were recorded to assess vegetation communities, the area was inspected for indicators of wetland hydrology, and the soils were inspected for indicators of hydric conditions. The 2020 National Wetland Plant List (NWPL) website, Version 3.2 (Lichvar, et al., 2020) was used to determine the indicator status of plant species. Taxonomy of plant species follows Lichvar, et al. (2016) and the NRCS PLANTS Database (United States Department of Agriculture [USDA] NRCS, 2017). At those sites where the vegetation, soil, and hydrology criteria were met, the site was identified as a wetland and categorized following suggestions of Cowardin, et al. (1979).

4.0 Results

4.1 Background Review

Based on the historic aerials and topographic maps, there are no obvious or significant land use or topology changes since the earliest aerial imagery record of 1999 (Google, 2022). According to the National Wetland Inventory and National Hydrology Database, six drainages extend through the Property. All six drainages are shown as intermittent streams on the USGS Corral Bluffs and Fountain NE quadrangles and by the NHD (USGS 2022). The USFWS NWI classifies the drainages as Riverine – Intermittent, Streambed Temporarily Flooded (R4SBA; USFWS 2020).

4.2 Land Use

The land use within the Property is primarily undisturbed grasslands with small patches of upland scrub/shrub communities. A housing development exists southwest of the Property with undisturbed grasslands in all other directions.

4.3 Aquatic Resources

Six unnamed drainages (Unnamed Drainage 1, Unnamed Drainage 2, Unnamed Drainage 3, Unnamed Drainage 4, Unnamed Drainage 5, and Unnamed Drainage 6) are located on the larger 1,869-acre Property. Small depressional features and a detention basin with an earthen dam were also observed on the Property during the site visit. Vegetation, hydrology, and soils throughout the Property are described in greater detail in the following sections.

4.3.1 Vegetation

Two distinct vegetation communities were observed within the Property: upland grasslands within the drainage channels and adjacent uplands and Palustrine Emergent Wetlands (PEM) associated with small depressional features. A riparian corridor was not observed surrounding the drainages within the Property. The vegetation community in the uplands extended into the drainage features and was mostly comprised of upland species. The wetland vegetation community types are based on the Cowardin, et al. (1979) classification system (Cowardin, 1979). Please refer to Appendix B for representative photographs of the vegetation observed within the Property.

Vegetation within the Property has been practically undisturbed by the lack of access and activities within the Property. The drainage channels are almost entirely vegetated with upland species, except for the small depressions. The dominant species within the drainage channels include blue grama (*Bouteloua gracilis*, No Indicator [NI]), western wheatgrass (*Pascopyrum smithii*, Facultative Upland [FACU]), and kochia (*Bassia scoparia*, Facultative [FAC]). Only subtle differences in dominate vegetation species were observed between the drainage channels and adjacent uplands which were dominated by blue grama, fetid marigold (*Dyssodia papposa*, NI), winterfat (*Krascheninnikovia lanata*, NI), and rubber rabbitbrush (*Ericnameria nauseosa*, NI). Depressional features observed within the property are sparsely vegetated with a narrow emergent fringe. Dominant species within the depressions include mountain rush (*Juncus arcticus* ssp. *littoralis*, Facultative Wetland [FACW]), vine mesquite (*Panicum* obtusum, FACU), common spikerush (*Eleocharis palustris,* Obligate [OBL]), barnyardgrass (*Echinochloa crus-galli*, FAC), and Pennsylvania smartweed (*Persicaria pennsylcanicum*, FACW).

4.3.2 Hydrology

The East Fork of Jimmy Camp Creek is an ungauged tributary to the mainstem of Jimmy Camp Creek (JCC). The proposed project is located 1.6 miles from the confluence of JCC and the East Fork of JCC. JCC is considered ephemeral from its headwaters to its crossing at Link Rd, over 3 miles south of the confluence with East Fork JCC. The closest stream gauge in the basin is located on JCC, 1.5 miles upstream of the confluence with Fountain Creek and measures an average flow between 1 and 3 CFS (Kiowa 2015).

Hydrologic studies have been conducted to determine the flows along the East Fork of JCC. Matrix reviewed the effective Federal Emergency Management Agency (FEMA) Flood Insurance Maps (FIS), the 2015 Drainage Basin Planning Study (DBPS), a 2013 memo on low flow estimation for the basin, and Matrix's internal regional regression equations. There are significant inconsistencies between each of these hydrologic studies. A revised study is currently underway for the basin, but the data is not available at this time.

Review of aerial imagery and field observations confirmed the location and extents of all six unnamed drainages, which traverse through the center of the Property and one detention basin, which included a ponding area behind an earthen dam. No culvert connection or overflow structure was observed along the earthen dam during the site visit; however, a vegetated drainage channel was observed downstream of the dam which confluences with Unnamed Drainage 1. No standing water was observed in the detention basin during the site visit. Based on NHD mapping, all drainage headwaters originate east of the Property (Figure 4), and flow, if present, would be conveyed from the northeast to the southwest across the Property, and adjacent lands, before converging with an intermittent stream, Jimmy Camp Creek, east of Marksheffel Road. Fountain Creek is the closest naturally occurring, year-round flowing feature with a continuous ordinary high-water mark (OHWM). It is approximately 13 river miles and approximately 6.5 aerial miles from the downstream end of the Property. The drainages are generally situated within a relatively flat grassland with gentle slopes from east to the southwest and within the mapped 100-year floodplain. The surrounding landscape is typical of the region, with rolling hills dominated by prairie grassland species. Annual precipitation values for the El Paso County based on 20-year averages (2002 through 2022) are 15.27 inches of rainfall, within the month of October (NOAA, 2022).

At the time of the field assessment, potential flow indicators (e.g., water-stained leaves, drift lines, sediment deposits) within the drainage were not observed and no evidence of recent flows were noted. No surface water, flowing or stagnant, was observed within the drainage channels at the time of the site visit. The drainage channels are fully vegetated and do not contain a defined bed and bank. These drainage channels are largely driven by topographic changes over the landscape, but do not receive flows frequently enough to create OHWM indicators or a defined bed and bank. The unnamed drainages are wide and deep (roughly 40 feet wide and greater than four feet deep), but poorly defined. Several small, actively eroding head cuts were observed along the drainage channels; however, the channel was not well defined upstream or downstream of the head cuts and remained vegetated. The drainages were almost completely vegetated with no defined bed and bank or OHWM. The channels lack consistency and connectivity throughout the Property. OHWM forms can be found in Appendix C.

Several pocket depressions throughout the unnamed drainages support 26 areas of isolated wetlands, including hydrophytic vegetation, hydric soils, and indicators of wetland hydrology. No concentrated flow paths were observed on the downstream ends of the depressions and depressions may sever flows to downstream drainage features in normal years. These depressions were delineated in the field and are shown in Table 1 and on Figure 7A and Figure 7B. Wetland determination forms can be referenced in Appendix C. Though flows were not recently evident in the channel or at the time of the site assessment, nor were they observed on aerial imagery, it is believed that the drainages collect surface runoff from adjacent hillslopes and roadways in addition to direct precipitation. Based on field and aerial imagery observations, it is our professional opinion that the flow regime of the unnamed drainages may best be described as ephemeral, and largely driven by stormwater and overland flows. Table 1 describes the aquatic features found within the Property.

Table 1. Aquatic Resources Within the Property

Name	Flow Frequency	Flows to	Proximity	More info Needed	Size: Length, width, square feet
Drainage 1	< 3 mo/yr	Jimmy Camp Creek		Yes	13,963 ft, ~40ft wide
Drainage 2	< 3 mo/yr	Jimmy Camp Creek		Yes	918 ft, ~20ft wide
Drainage 3	< 3 mo/yr	Jimmy Camp Creek		Yes	3,795 ft, ~40ft wide
Drainage 4	< 3 mo/yr	Jimmy Camp Creek		Yes	1,305 ft, ~15ft wide
Drainage 5	< 3 mo/yr	Jimmy Camp Creek		Yes	5,243 ft, ~25ft wide
Drainage 6	< 3 mo/yr	Jimmy Camp Creek		Yes	15,586 ft, ~40ft wide
				Total Drainage Length within Property	**40,810 ft**
Wetland 1		Drainage 1	Abutting	Yes	957.23
Wetland 2		Drainage 1	Abutting	Yes	342.50
Wetland 3		Drainage 1	Abutting	Yes	7,014.58
Wetland 4		Drainage 1	Abutting	Yes	1,004.73
Wetland 5		Drainage 1	Abutting	Yes	393.88
Wetland 6		Drainage 1	Abutting	Yes	854.68
Wetland 7		Drainage 1	Abutting	Yes	2,745.70
Wetland 8		Drainage 1	Abutting	Yes	2,128.62
Wetland 9		Drainage 1	Adjacent	Yes	753.57
Wetland 10		Drainage 1	Abutting	Yes	3,186.88
Wetland 11		Drainage 6	Abutting	Yes	5,130.13
Wetland 12		Drainage 1	Abutting	Yes	1,668.00
Wetland 13		Drainage 1	Abutting	Yes	13175.83
Wetland 14		Drainage 6	Abutting	Yes	8,955.15
Wetland 15		Drainage 6	Abutting	Yes	4,240.34
Wetland 16		Drainage 1	Abutting	Yes	366.75
Wetland 17		Isolated – no outlet	Isolated	Yes	22,173.98
Wetland 18		Drainage 1	Abutting	Yes	1,397.86
Wetland 19		Drainage 6	Abutting	Yes	686.02
Wetland 20		Drainage 1	Abutting	Yes	455.03
Wetland 21		Drainage 1	Abutting	Yes	638.37
Wetland 22		Drainage 1	Adjacent	Yes	1,686.31
Wetland 23		Drainage 1	Adjacent	Yes	397.35
Wetland 24		Drainage 1	Abutting	Yes	1,857.29
Wetland 25		Drainage 1	Abutting	Yes	1,596.11
Wetland 26		Isolated – no outlet	Isolated	Yes	2,702.99
				Total Wetlands in Property	86,509.88 sf / 1.99 ac

4.3.3 Soils

Based on the NRCS Web Soil Survey for El Paso County, Nevada (NRCS, 2022), the Property contains eight mapped soil units (Figure 5). Descriptions of the mapped soil types are provided below.

- Ascalon sandy loam, 1 to 3 percent slopes – Ascalon sandy soils are well drained with low runoff potential and moderately high to high permeability. Based on the national hydric soils list, this soil is not classified as hydric in El Paso County, Colorado (NRCS, 2022).
- Ascalon sandy loam, 3 to 9 percent slopes – Ascalon sandy soils are well drained with medium runoff potential and moderately high to high permeability. Based on the national hydric soils list, this soil is not classified as hydric in El Paso County, Colorado (NRCS, 2022).
- Manzanst clay loam, 0 to 3 percent slopes – Manzanst clay soils are well drained and moderately low to moderately high permeability. Based on the national hydric soils list, this soil is not classified as hydric in El Paso County, Colorado (NRCS, 2022).
- Nelson-Tassel fine sandy loam, 3 to 18 percent slopes – Nelson-Tassel fine sandy soils are well drained with medium runoff potential and moderately low to moderately high permeability. Based on the national hydric soils list, this soil is not classified as hydric in El Paso County, Colorado (NRCS, 2022).
- Razor-Midway complex – Razor-Midway complex soils are well drained with medium runoff potential and moderately low to moderately high permeability. Based on the national hydric soils list, this soil is not classified as hydric in El Paso County, Colorado (NRCS, 2022).
- Sampson loam, 0 to 3 percent slopes – Sampson loam soils are well drained with low runoff potential and moderately high to high permeability. Based on the national hydric soils list, this soil is not classified as hydric in El Paso County, Colorado (NRCS, 2022).
- Tassel fine sandy loam, 3 to 18 percent slopes –Tassel fine sandy soils are well drained with medium runoff potential and moderately high permeability. Based on the national hydric soils list, this soil is not classified as hydric in El Paso County, Colorado (NRCS, 2022).
- Olnest sandy loam, 0 to 3 percent slopes – Olnest sandy loam soils are well drained with low runoff potential and moderately high to high permeability. Based on the national hydric soils list, this soil is not classified as hydric in El Paso County, Colorado (NRCS, 2022).

At the time of the field assessment, soil pits were sampled in various depressions and upland areas, to determine hydric soil indicators. Soils within the pocket depressions tended to be moist, dark in color, with redox depressions throughout the soil profile and upland soil samples tended to be lighter in color, dry and crumbly, with no hydric indicators.

5.0 Wildlife

The Property likely provides habitat for small mammals (rabbits, voles, mice, etc.) and larger mammals such as mule deer, pronghorn, and coyotes. Six pronghorns were observed within the Property during the site visit but were not seen using the detention basin or small depressional wetland features, likely because these features did not contain any water. Active prairie dog colonies were also observed on portions of the Property. The Property does not contain habitat for federally listed threatened or endangered species.

6.0 Significant Nexus Evaluation

In implementing the 2008 Rapanos guidance for non-navigable tributaries that are not relatively permanent, Matrix assessed all six unnamed drainages for physical indicators of flow – bed and bank, and OHWM indicators– to identify signs of a direct surface connection, or in absence, to determine if the drainage contributes to the chemical, physical, or biological functions to downstream waters, thus meeting the definition of a “significant nexus.” From our field evaluations and review of historic Google Earth imagery, the unnamed drainages do not appear to support a continuous hydrologic connection between upstream and downstream channel segments. It is assumed that much of the precipitation that falls on the Property infiltrates in the undeveloped uplands, while small amounts likely reach the drainage channels as surface runoff. Wetlands were observed in isolated depressional features and may be supported by runoff and direct precipitation. The lack of sufficient duration and volume of flows within the channel may preclude development of in-channel and adjacent wetlands. There is a lack of evident flows within the channel and no defined channel, bed and bank, or OHWM indicators. Based on these observations, Matrix believes that channel flows within the drainage do not connect to lower sections of the drainage in a normal year and the drainages only contain water during major storm events. Further, Matrix believes that flows within the drainages are infrequent and driven by major storm events, and that consequently the drainage may contribute insubstantially to the chemical, physical, and biological integrity of a downstream navigable water.

7.0 Discussion

Matrix evaluated the Property for the presence, location, and extent of aquatic resources and, reviewed available data sources to assist USACE in making a jurisdictional determination. Following field evaluations and review of available aerial imagery, Matrix identified six unnamed drainage features on the Property. The Landhuis Company requests an approved JD of the unnamed drainages, as described above. Please let us know if you need any additional information to complete your review and make this determination. I can be reached at: justin.apfel@matrixdesigngroup.com or 757-817-4267.

Sincerely,

Justin Apfel

Ecologist, Matrix Design Group, Inc.

8.0 References

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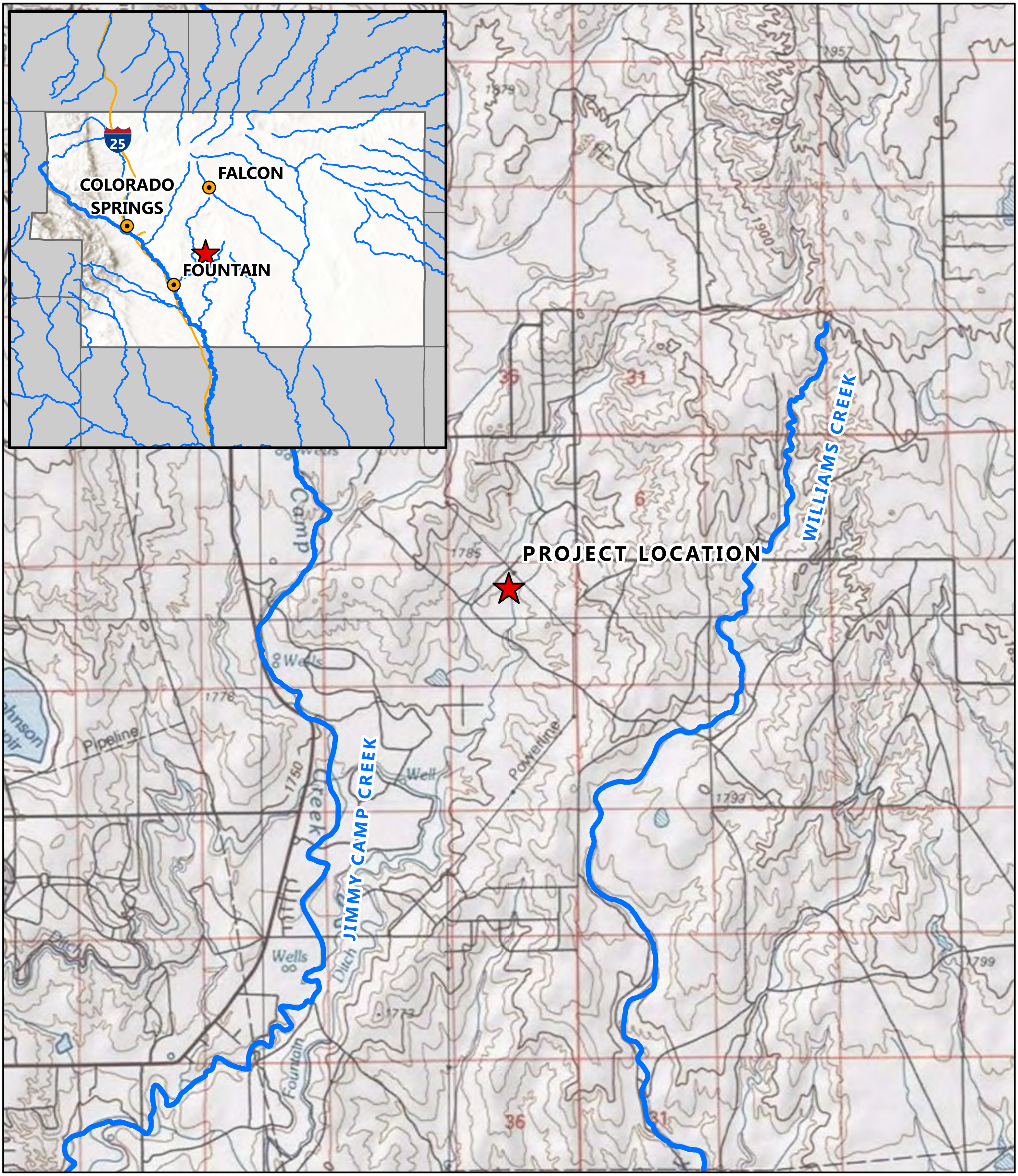
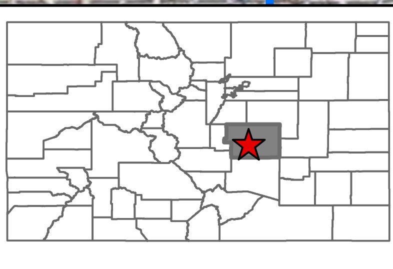
Appendix A: Figures



ROLLING MEADOWS
FIGURE 1: VICINITY MAP



N

Mile
0 0.5 1

EL PASO COUNTY
NAD 1983 STATE PLANE (2011) COLORADO CENTRAL
SOURCE(S): USGS, ESRI

Matrix

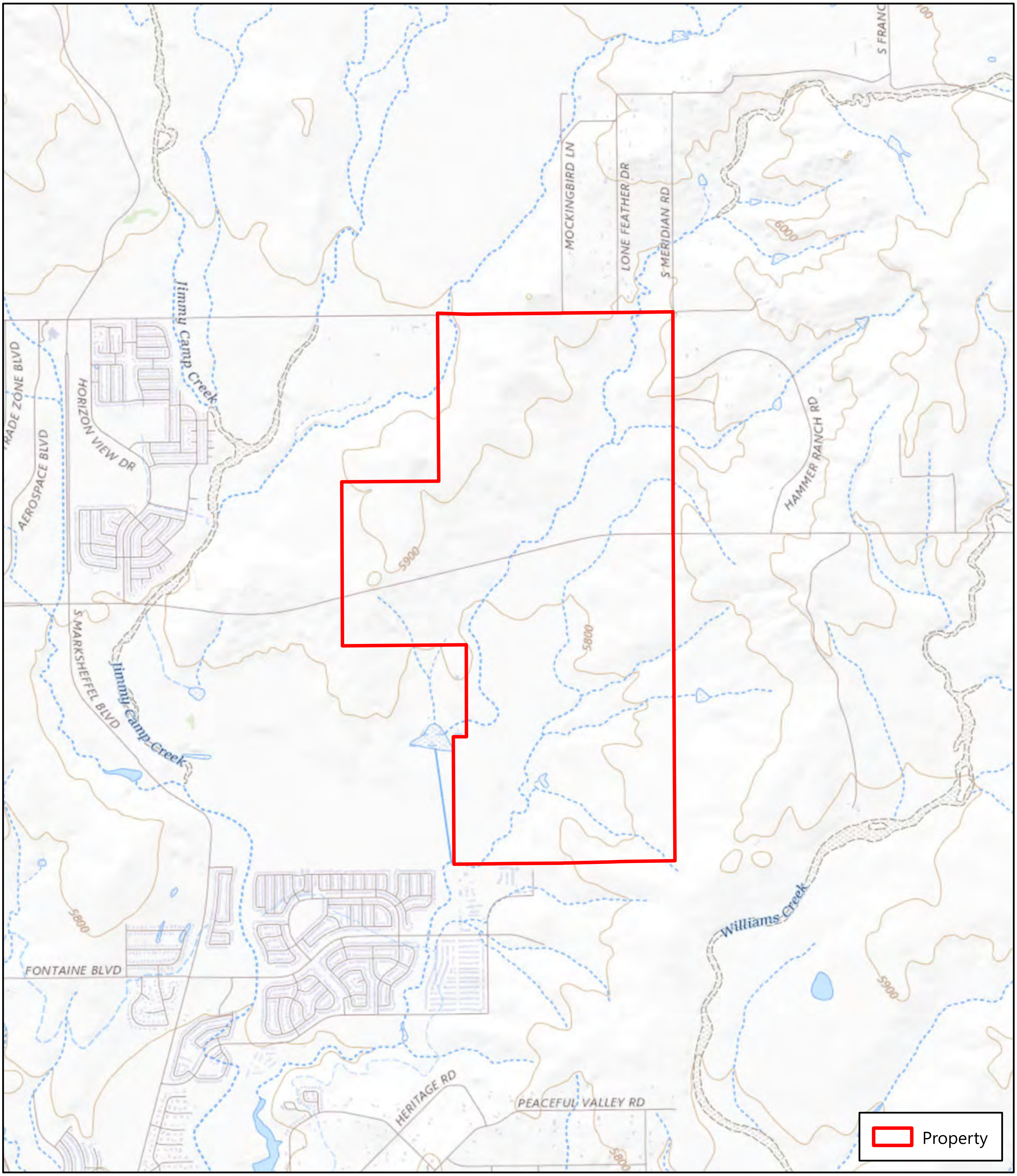
ROLLING MEADOWS
FIGURE 2: PROPERTY

N

Feet
0 500 1,000

EL PASO COUNTY
NAD 1983 STATE PLANE (2011) COLORADO CENTRAL
SOURCE(S): ESRI

Matrix



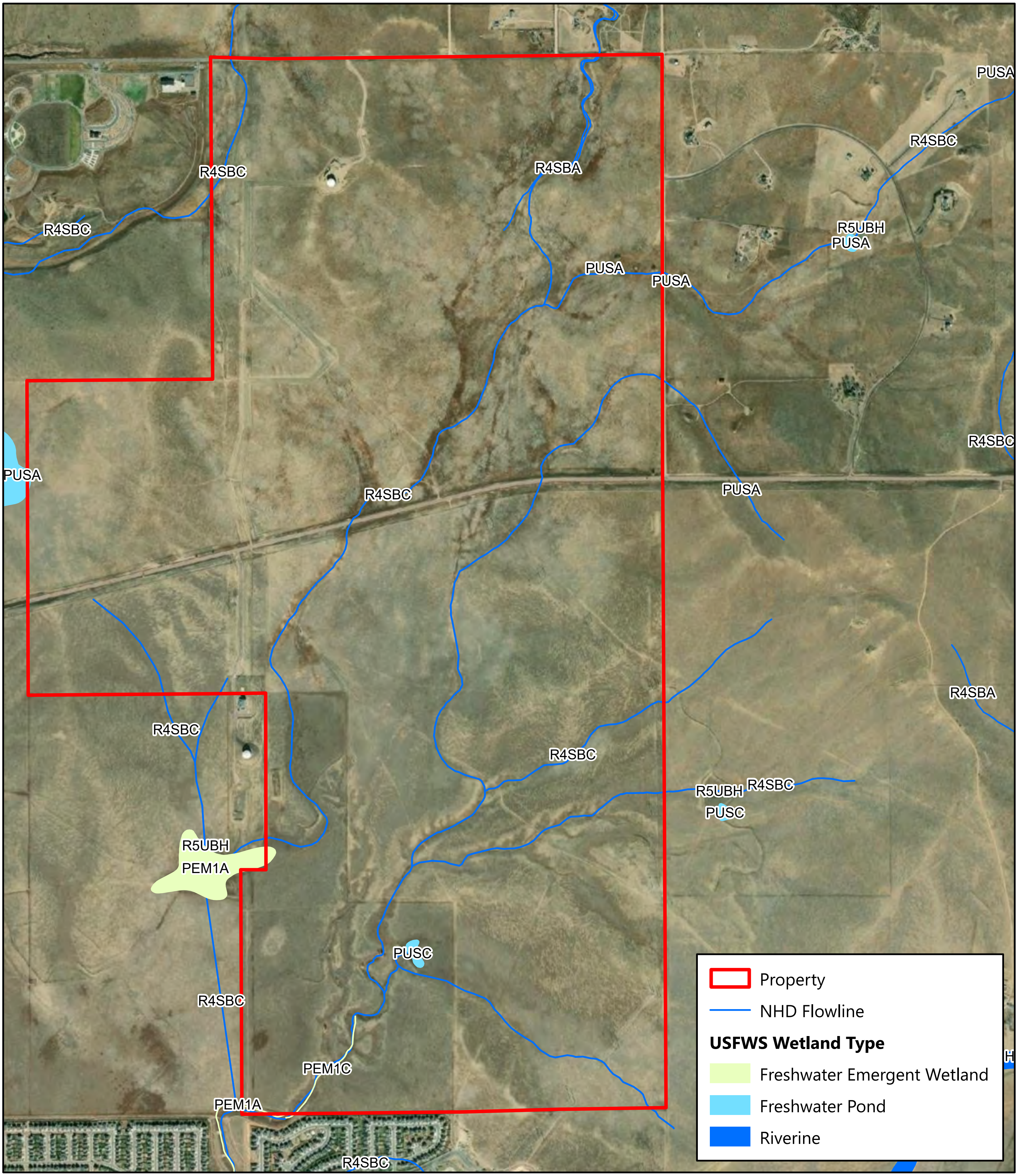
ROLLING MEADOWS
FIGURE 3: TOPOGRAPHIC MAP

N

0 1,500 3,000 Feet

EL PASO COUNTY
NAD 1983 STATE PLANE (2011) COLORADO CENTRAL
SOURCE(S): ESRI, USGS

Matrix



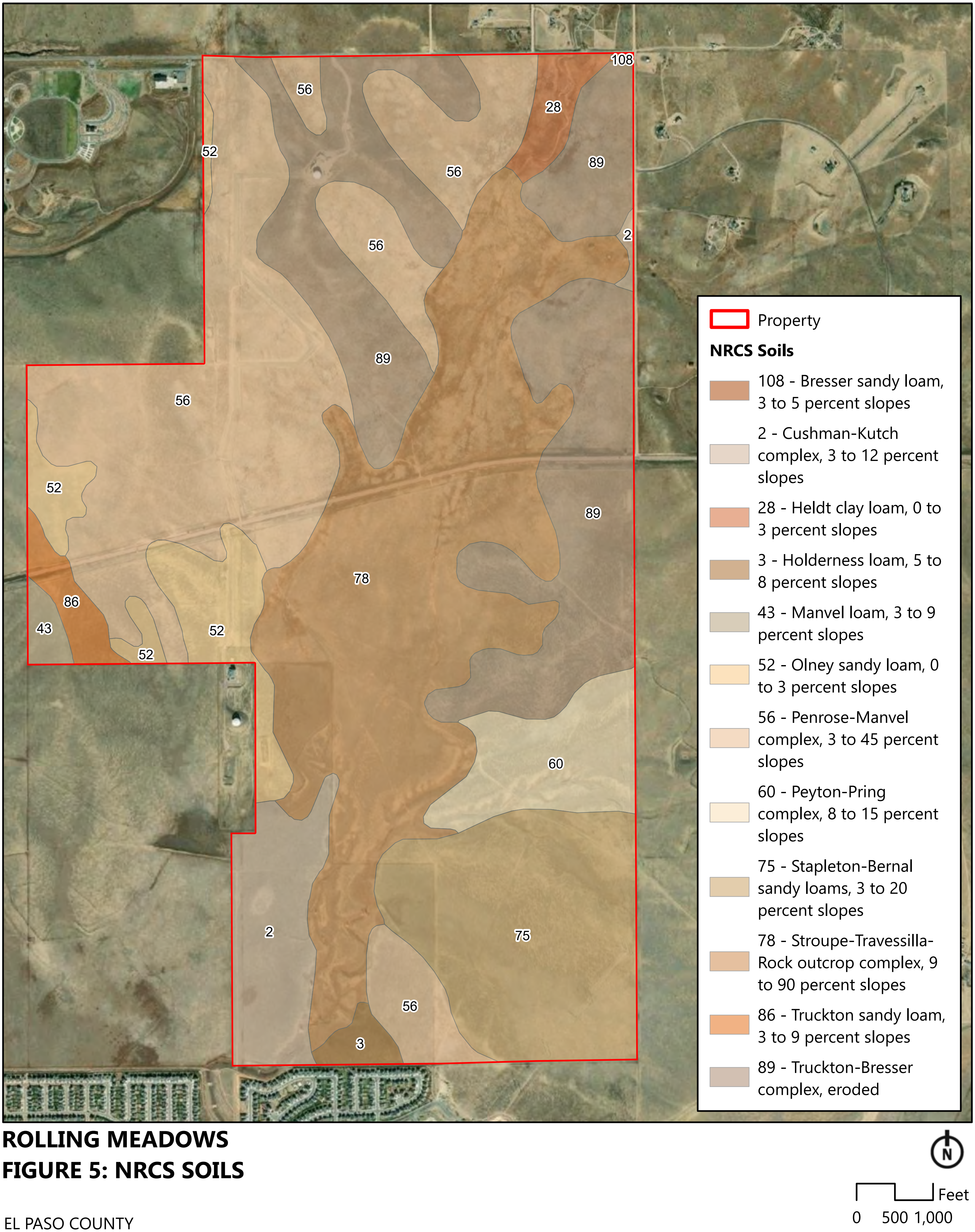
ROLLING MEADOWS
FIGURE 4: USGS NHD AND USFWS NWI

EL PASO COUNTY
NAD 1983 STATE PLANE (2011) COLORADO CENTRAL
SOURCE(S): ESRI, USGS, USFWS

N

0 500 1,000 Feet

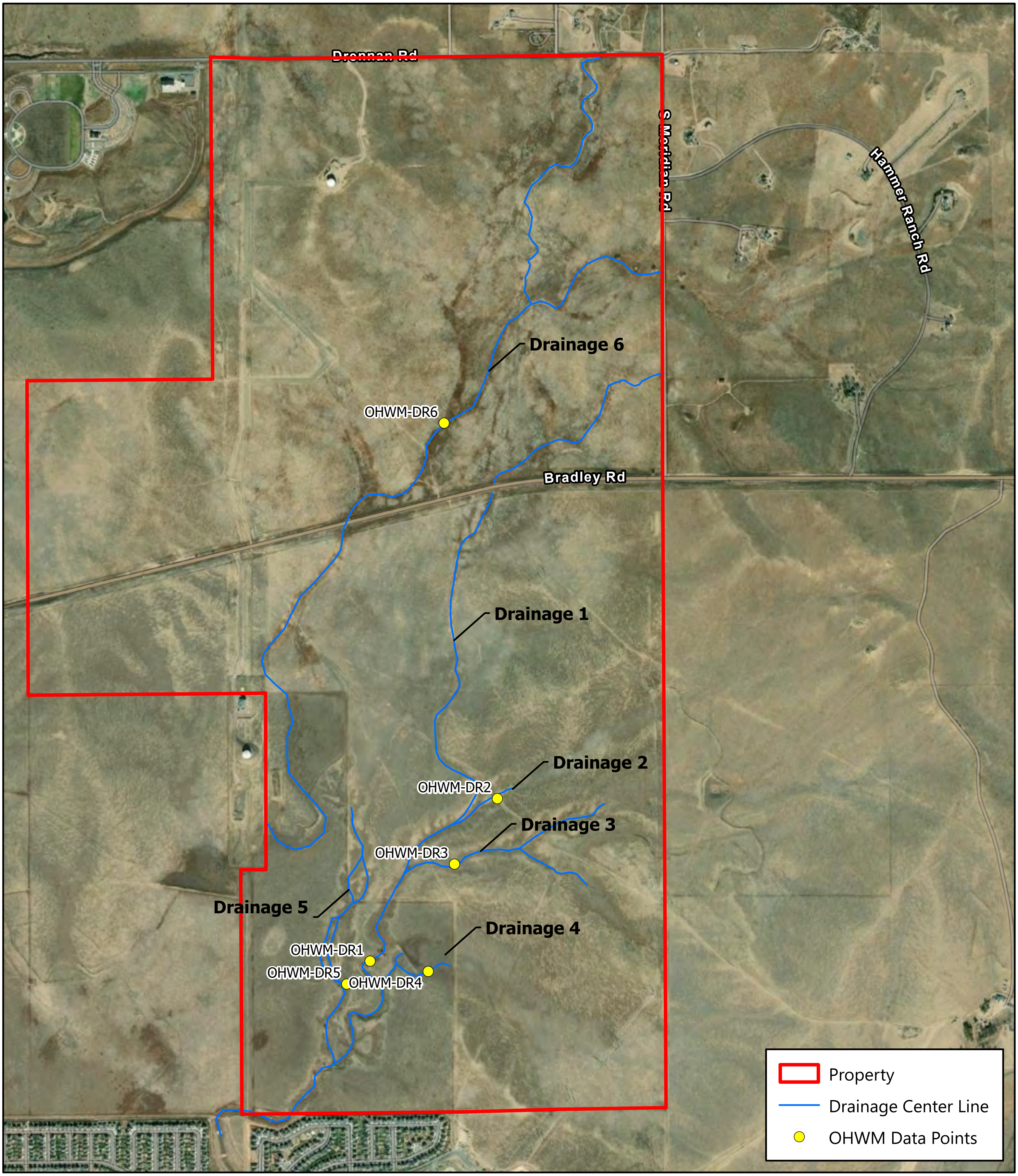
Matrix



ROLLING MEADOWS
FIGURE 5: NRCS SOILS

EL PASO COUNTY
NAD 1983 STATE PLANE (2011) COLORADO CENTRAL
SOURCE(S): ESRI, NRCS

Matrix



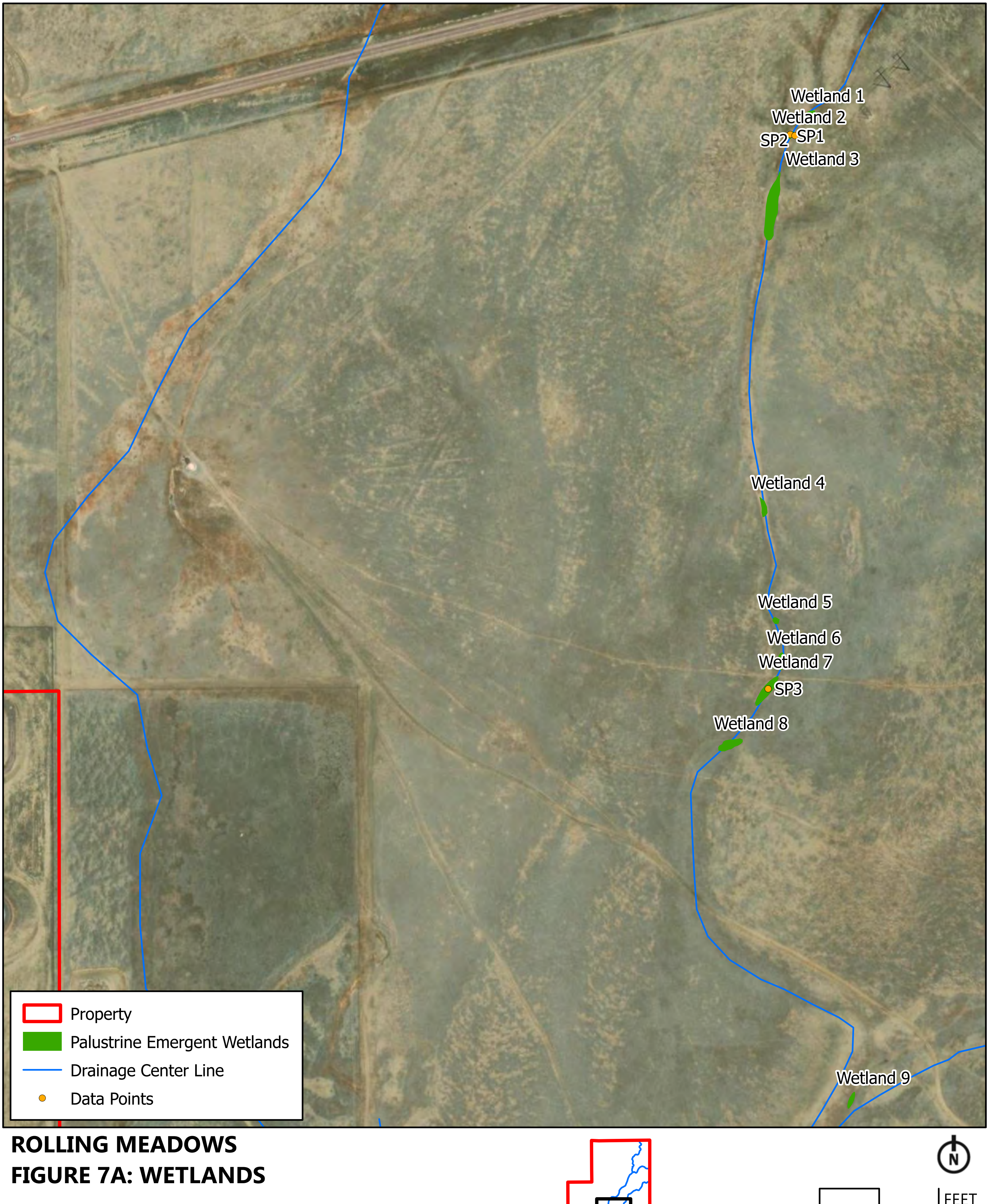
ROLLING MEADOWS
FIGURE 6: SITE FEATURES

N

Feet
0 500 1,000

EL PASO COUNTY
NAD 1983 STATE PLANE (2011) COLORADO CENTRAL
SOURCE(S): ESRI

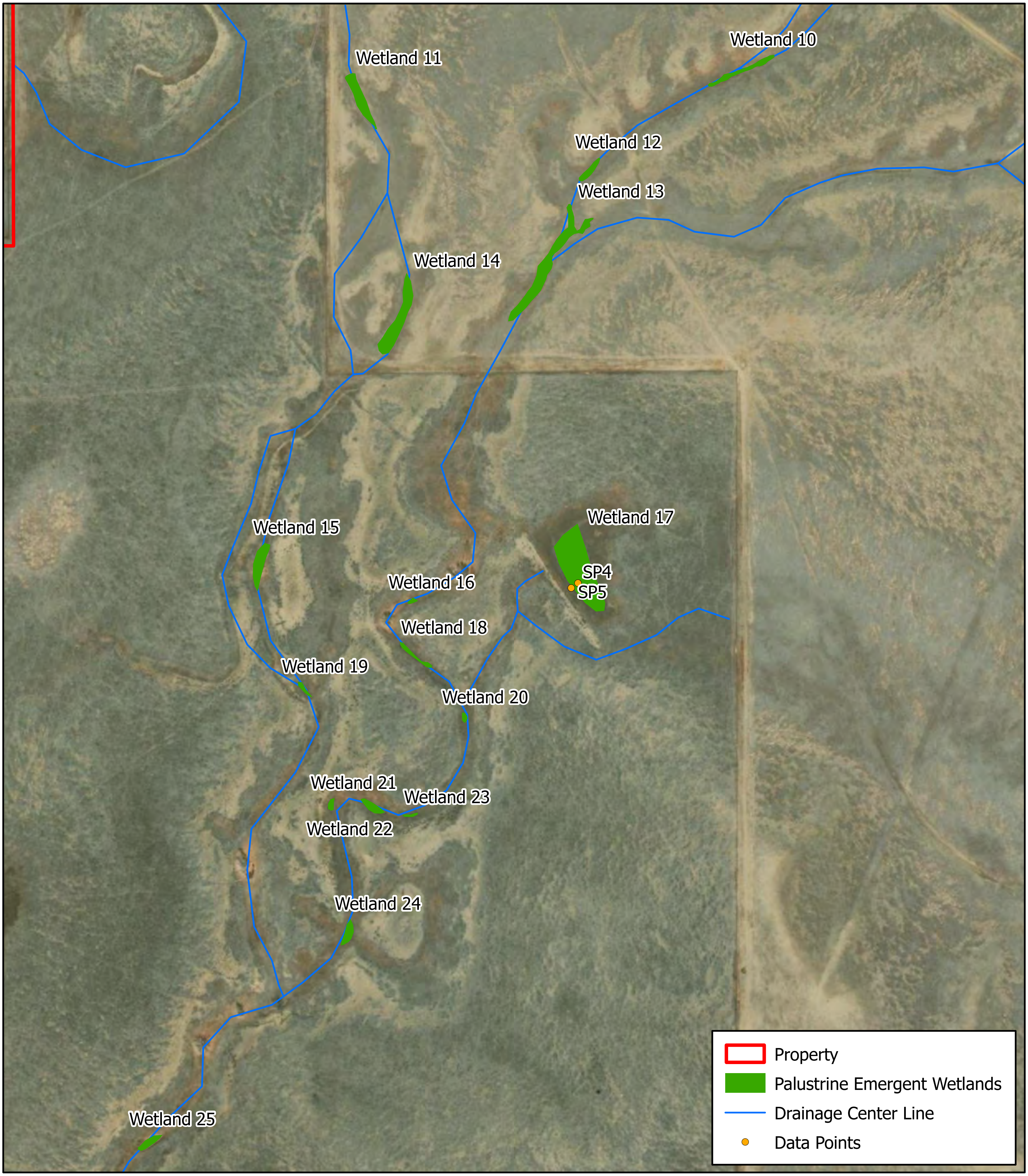
Matrix



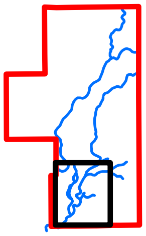
ROLLING MEADOWS
FIGURE 7A: WETLANDS

EL PASO
NAD 1983 STATE PLANE (2011) COLORADO CENTRAL
SOURCE(S): USGS, ESRI

Matrix



ROLLING MEADOWS
FIGURE 7B: WETLANDS



N

0 200 400 FEET

EL PASO
NAD 1983 STATE PLANE (2011) COLORADO CENTRAL
SOURCE(S): USGS, ESRI

Matrix

Appendix B: Representative Images

Photo 1: Standing at the northern side of the Property, looking north, towards the culvert crossing.

Photo 2: Standing away from the northern side of the Property, looking north, towards the culvert crossing.

Photo 3: Representative photo of the channel within the northern section of the Property.

Photo 4: Representative photo of the lack of channel connectivity, throughout the drainage.

Photo 5: Representative of fully vegetated channel, near the center of the Property.

Photo 6: Representative photo of an isolated depression within the channel.

Photo 7: Representative photo of the top soil within the isolated depressions.

Photo 8: Representative photo of an earthen dam, dividing the channel.

Photo 9: Depression within the channel.

Photo 10: Standing in the channel, facing northwest, on the southern end of the Property.

Photo 11: Representative photo of the channel on the south end of the Property.

Photo 12: Representative photo of a rock structure within the channel, near the south end of the Property.

Photo 13: Representative photo of the upland soil profile, throughout the Property.

Photo 14: Representative photo of the isolated wetland depressional soil profile, throughout the Property.

Appendix C: Wetland Determination and OHWM Forms

U.S. Army Corps of Engineers

WETLAND DETERMINATION DATA SHEET – Western Mountains, Valleys, and Coast Region

See ERDC/EL TR-10-3; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Rolling Meadows   City/County: Colorado Springs   Sampling Date: 10/12/22

Applicant/Owner: The Landhuis Company   State: CO   Sampling Point: SP1

Investigator(s): S. O'Brien and J. Apfel   Section, Township, Range: 12, 15S, 65W

Landform (hillside, terrace, etc.): Depression   Local relief (concave, convex, none): Concave   Slope (%): 1-3

Subregion (LRR): LRR E   Lat: 38.7642625   Long: -104.6174996   Datum: NAD 83

Soil Map Unit Name: Stroupe-Travessilla-Rock outcrop complex, 9 to 90 percent slopes   NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation N , Soil N , or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N , Soil N , or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes X	No X
Wetland Hydrology Present?	Yes X	No ___

Is the Sampled Area within a Wetland? **Yes** X **No** ___

Remarks:
Disconnected PEM wetland depression within the channel.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
=Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
=Total Cover			
Herb Stratum (Plot size: 10 sq ft)			
1. *Echinochloa crus-galli*	85	Yes	FAC
2. *Pascopyrum smithii*	5	No	FACU
3. *Salsola kali*	5	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
=Total Cover	95		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
=Total Cover			

% Bare Ground in Herb Stratum 5

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	85	x 3 =	255
FACU species	10	x 4 =	40
UPL species	0	x 5 =	0
Column Totals:	95 (A)		295 (B)

Prevalence Index = B/A = 3.11

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks:
Almost completely barnyeard grass

SOIL

Sampling Point: SP1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10yr 3/1	96	2.5yr 4/8	4			Loamy/Clayey	Dry on top/moist on bottom

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ 1 cm Muck (A9) **(LRR D, G)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR A, E)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: None

Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:
Redox throughout. Dry on the surface, compact and moist from 6" and below.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Large surface cracks within depression within drainage area.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Western Mountains, Valleys, and Coast Region
See ERDC/EL TR-10-3; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Rolling Meadows City/County: Colorado Springs Sampling Date: 10/12/22
Applicant/Owner: The Landhuis Company State: CO Sampling Point: SP2
Investigator(s): S. O'Brien and J. Apfel Section, Township, Range: 12, 15S, 65W
Landform (hillside, terrace, etc.): Slight hillslope Local relief (concave, convex, none): none Slope (%): 2-5
Subregion (LRR): LRR E Lat: 38.7642678 Long: -104.6174788 Datum: NAD 83
Soil Map Unit Name: Stroupe-Travessilla-Rock outcrop complex, 9 to 90 percent slopes NWI classification: Upland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation N , Soil N , or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation N , Soil N , or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes ___	No X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

Remarks:
Paired point to SP1_WET, taken adjacent to depressional feature.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Herb Stratum (Plot size: 10 sq ft)			
1. *Cirsium undulatum*	69	Yes	FACW
2. *Dyssodia papposa*	10	No	UPL
3. *Bouteloua gracilis*	10	No	UPL
4. *Pascopyrum smithii*	5	No	FACU
5. *Centaurea diffusa*	4	No	UPL
6. *Salsola kali*	2	No	FACU
7.			
8.			
9.			
10.			
11.			
	100	=Total Cover	
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
		=Total Cover	
% Bare Ground in Herb Stratum ___			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	69	x 2 =	138
FAC species	0	x 3 =	0
FACU species	7	x 4 =	28
UPL species	24	x 5 =	120
Column Totals:	100 (A)		286 (B)

Prevalence Index = B/A = 2.86

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks:
None. Upland.

SOIL

Sampling Point: SP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10yr 4/3	100					Loamy/Clayey	Dry and blocky

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ 1 cm Muck (A9) **(LRR D, G)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) **(LRR A, E)**
___ Iron-Manganese Masses (F12) **(LRR D)**
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: None
Depth (inches): ______

Hydric Soil Present? Yes ___ No X

Remarks:
None. Upland

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
X Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
X Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) (**LRR A**)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) (**MLRA 1, 2 4A, and 4B**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
X FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) (**LRR A**)
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
None. Upland

U.S. Army Corps of Engineers

WETLAND DETERMINATION DATA SHEET – Western Mountains, Valleys, and Coast Region

See ERDC/EL TR-10-3; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Rolling Meadows City/County: Colorado Springs Sampling Date: 10/12/22

Applicant/Owner: The Landhuis Company State: CO Sampling Point: SP3

Investigator(s): S. O'Brien and J. Apfel Section, Township, Range: 12, 15S, 65W

Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR E Lat: ____ Long: ____ Datum: NAD 83

Soil Map Unit Name: Stroupe-Travessilla-Rock outcrop complex, 9 to 90 percent slopes NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation N , Soil N , or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N , Soil N , or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes ___	No X

Is the Sampled Area within a Wetland? **Yes** X **No** ___

Remarks:
Depressional feature. No defined channel leading up to or exiting the depression. No water in depression at the time of the site visit.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Herb Stratum (Plot size: 10 sq ft)			
1. *Juncus arcticus*	20	Yes	FACW
2. *Echinochloa crus-galli*	10	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	30	=Total Cover	
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
		=Total Cover	
% Bare Ground in Herb Stratum 70			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	20	x 2 =	40
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	30 (A)		70 (B)

Prevalence Index = B/A = 2.33

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks:
Depression with hydrophytic vegetation.

SOIL

Sampling Point: SP3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10yr 5/3	100					Sandy	Dry and blocky
2-12	10yr 2/1	98	10yr 3/6	2	C	M	Loamy/Clayey	Faint redox
12-16	10yr 4/2	100					Loamy/Clayey	No redox

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ 1 cm Muck (A9) **(LRR D, G)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) **(LRR A, E)**
___ Iron-Manganese Masses (F12) **(LRR D)**
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
Type: None
Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
X Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
X Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) (**LRR A**)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) (**MLRA 1, 2 4A, and 4B**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
X FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) (**LRR A**)
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
No water in depression at the time of the site visit, but likely holds water from overland flow during storm events.

U.S. Army Corps of Engineers WETLAND DETERMINATION DATA SHEET – Western Mountains, Valleys, and Coast Region See ERDC/EL TR-10-3; the proponent agency is CECW-CO-R	OMB Control #: 0710-0024, Exp: 11/30/2024 Requirement Control Symbol EXEMPT: (Authority: AR 335-15, paragraph 5-2a)

Project/Site: Rolling Meadows City/County: Colorado Springs Sampling Date: 10/12/22

Applicant/Owner: The Landhuis Company State: CO Sampling Point: SP4

Investigator(s): S. O'Brien and J. Apfel Section, Township, Range: 13, 15S, 65W

Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 1-3

Subregion (LRR): LRR E Lat: 38.7500779 Long: -104.6198798 Datum: NAD 83

Soil Map Unit Name: Stapleton-Bernal sandy loams, 3 to 20 percent slopes NWI classification: PEM (isolated)

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation N , Soil N , or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N , Soil N , or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___	**Is the Sampled Area within a Wetland?** **Yes** X **No** ___
Hydric Soil Present?	Yes X	No ___	
Wetland Hydrology Present?	Yes X	No ___	

Remarks:
Disconnected PEM wetland retention pond, with dam. Visible on ariel and on the NWI layer as a wetland.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 10 sq ft)			
1. *Potentilla norvegica*	32	Yes	FAC
2. *Bassia scoparia*	5	No	FAC
3. *Chenopodium album*	3	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	40 =Total Cover		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
	=Total Cover		
% Bare Ground in Herb Stratum 60			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	37	x 3 =	111
FACU species	3	x 4 =	12
UPL species	0	x 5 =	0
Column Totals:	40 (A)		123 (B)

Prevalence Index = B/A = 3.08

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ___

Remarks:
Problimatic vegetation due to pond, dam, and likely heavy salt content within soil

SOIL

Sampling Point: SP4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	10yr 4/1	100				PL/M	Loamy/Clayey	Dry
1-12	10yr 3/2	85	10yr 4/6	15		PL/M	Loamy/Clayey	Moist
12-18	10yr 3/2	98	10yr 4/6	2		PL/M	Loamy/Clayey	Moist

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ 1 cm Muck (A9) **(LRR D, G)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- X Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(LRR A, E)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: None

Depth (inches): ______

Hydric Soil Present? Yes X No ___

Remarks:
Moist with redox throughout. Dry and blocky

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- X Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Ponging. No Draiange or connecter to main channel.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Western Mountains, Valleys, and Coast Region
See ERDC/EL TR-10-3; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Rolling Meadows City/County: Colorado Springs Sampling Date: 10/12/22
Applicant/Owner: The Landhuis Company State: CO Sampling Point: SP5
Investigator(s): S. O'Brien and J. Apfel Section, Township, Range: 13, 15S, 65W
Landform (hillside, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 10-15
Subregion (LRR): LRR E Lat: 38.7500484 Long: -104.6199312 Datum: NAD 83
Soil Map Unit Name: Stapleton-Bernal sandy loams, 3 to 20 percent slopes NWI classification: Upland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation N , Soil N , or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation N , Soil N , or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___	No X
Hydric Soil Present?	Yes ___	No X
Wetland Hydrology Present?	Yes ___	No X

Is the Sampled Area within a Wetland? **Yes** ___ **No** X

Remarks:
Upland point

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		=Total Cover	
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
		=Total Cover	
Herb Stratum (Plot size: 10 sq ft)			
1. *Salsola*	35	Yes	FACU
2. *Helianthus annuus*	8	No	FACU
3. *Convolvulus arvensis*	7	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	50	=Total Cover	
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
		=Total Cover	
% Bare Ground in Herb Stratum 50			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	50	x 4 =	200
UPL species	0	x 5 =	0
Column Totals:	50 (A)		200 (B)

Prevalence Index = B/A = 4.00

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - Wetland Non-Vascular Plants[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks:
None. Hillside to the pond

SOIL

Sampling Point: SP5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10yr 4/1	60	7.5yr 5/8	40	C	M	Loamy/Clayey	Dry and blocky
6-16	10yr 3/1	90	10yr 4/6	10	C	M	Loamy/Clayey	Dry and blocky

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ 1 cm Muck (A9) **(LRR D, G)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ 2.5 cm Mucky Peat or Peat (S2) **(LRR G)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1) **(except MLRA 1)**
___ Loamy Gleyed Matrix (F2)
X Depleted Matrix (F3)
X Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
X Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) **(LRR A, E)**
___ Iron-Manganese Masses (F12) **(LRR D)**
___ Red Parent Material (F21)
___ Very Shallow Dark Surface (F22)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: None

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:
Upland. Pond hillside. Wet when filled.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
X Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Sparsely Vegetated Concave Surface (B8)
___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
___ Salt Crust (B11)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres on Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Stunted or Stressed Plants (D1) (**LRR A**)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water-Stained Leaves (B9) (**MLRA 1, 2 4A, and 4B**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Raised Ant Mounds (D6) (**LRR A**)
___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
None. Hillside

Project: Rolling Hills
Project Number: 21.1129.009
Stream: Drainage 1
Investigator(s): S O'Brien and J. Apfel

Date: 10/12/2022 **Time: 9:45**
Town: CO Springs **State: CO**
Photo begin file# **Photo end file#**

Y ☒ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☒ Is the site significantly disturbed?

Location Details: Located just south of Bradely Rd
Datum:
Coordinates: 38.749935, -104.621694

Notes: OHWM is not present throughout the entire channel corridor. Present in several locations throughout the channel right-of-way.

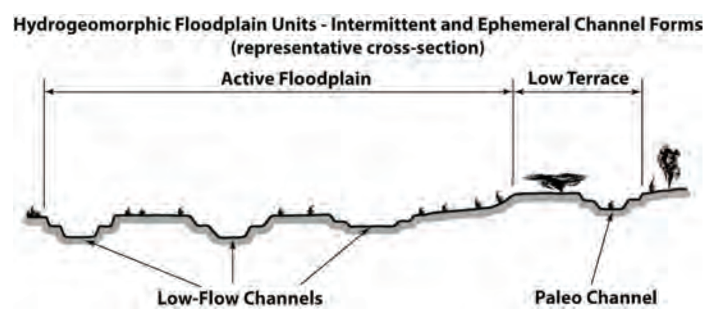
Brief site description: Fully vegetated drainage feature, with topographic breaks on both sides. OHWM and other hydrology indicators, not consistent throughout the channel corridor.

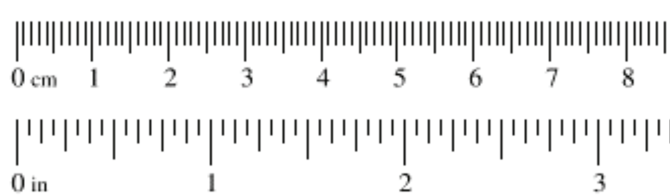
Checklist of resources (if available):

- ☒ Aerial photography
  Dates:
- ☒ Topographic maps
  Scale:
- ☐ Geologic maps
- ☒ Vegetation maps
- ☒ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ Clinometer / level
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

The dominant Wentworth size class that imparts a characteristic texture to each zone of a channel cross-section is recorded in the average sediment texture field under the characteristics section for the zone of interest.

Millimeters (mm)	Inches (in)	Wentworth size class	
		Boulder	Gravel
10.08	256		
		Cobble	
2.56	64		
		Pebble	
0.157	4		
		Granule	
0.079	2.00		
		Very coarse sand	Sand
0.039	1.00		
		Coarse sand	
0.020	0.50		
		Medium sand	
1/2 0.0098	0.25		
		Fine sand	
1/4 0.005	0.125		
		Very fine sand	
1/8 0.0025	0.0625		
		Coarse silt	Silt
1/16 0.0012	0.031		
		Medium silt	
1/32 0.00061	0.0156		
		Fine silt	
1/64 0.00031	0.0078		
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud





☒	**Walk the channel and floodplain within the study area to get an impression of the vegetation and geomorphology present at the site. Record any potential anthropogenic influences on the channel system in "Notes" above.**
☒	**Locate the low-flow channel (lowest part of the channel). Record observations.** Characteristics of the low-flow channel: Average sediment texture: _Silt__ Total veg cover: __80__ % Tree: __0__ Shrub: __0__% Herb: __80__% % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☒ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Western wheat (*Pascopyrum smithii*), Field bindweed (*Convolvulus arvensis*), Kochia (*Bassia scoparia*) Other: ☒ _No bed and bank for low flow channel____ ☒ _No evidence of recent flows____ ☐ ____ ☐ ____
☒	**Walk away from the low-flow channel along cross-section. Record characteristics of the low-flow/active floodplain boundary.** Characteristics used to delineate the low-flow/active floodplain boundary: ☐ Change in total veg cover ☐ Tree ☐ Shrub ☒ Herb ☐ Change in overall vegetation maturity ☐ Change in dominant species present ☐ Other ☐ Presence of bed and bank ☐ Drift and/or debris ☒ Other: Change in slope ☐ Other:____
☒	**Continue walking the channel cross-section. Record observations below.** Characteristics of the low-flow channel: Average sediment texture: __Silt ____ Total veg cover: __70_ % Tree: __0__% Shrub: __0_% Herb: _70_% Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☒ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Western wheat (*Pascopyrum smithii*), Field bindweed (*Convolvulus arvensis*), Kochia (*Bassia scoparia*), Blue grama (*Bouteloua gracilis*) Other: ☒ Depressional features within drainage (sparsley vegetated)____ ☐ ____ ☐ ____ ☐ ____

☒	**Continue walking the channel cross-section. Record indicators of the active floodplain/low terrace boundary.** <u>Characteristics used to delineate the active floodplain/ low terrace boundary:</u> ☐ Change in average sediment texture ☐ Change in total veg cover ☐ Tree ☐ Shrub ☒ Herb ☐ Change in overall vegetation maturity ☐ Change in dominant species present ☐ Other ☐ Presence of bed and bank ☐ Drift and/or debris ☒ Other: _No Change ___________________ ☐ Other: ________________________________
☒	**Walk the active floodplain/low terrace boundary both upstream and downstream of the cross-section to verify that the indicators used to identify the transition are consistently associated the transition in both directions.** <u>Consistency of indicators used to delineate the active floodplain/low terrace boundary:</u> Y ☐ N ☒ Change in average sediment texture Y ☒ N ☐ Change in total veg cover ☐ Tree ☒ Shrub ☒ Herb Y ☒ N ☐ Change in overall vegetation maturity Y ☒ N ☐ Change in dominant species present Y ☒ N ☐ Other: Y ☐ N ☒ Presence of bed and bank Y ☐ N ☒ Drift and/or debris Y ☒ N ☐ Other: _Slope (Slightly)_____ Y ☐ N ☐ Other: ____________________
☒	**If the characteristics used to delineate the active floodplain/low terrace boundary were NOT consistently associated with the transition in both the upstream and downstream directions, repeat all steps above.**
☒	**Continue walking the channel cross-section. Record characteristics of the low terrace.** <u>Characteristics of the low terrace:</u> Average sediment texture: Silt_______________ Total veg cover: __75_ % Tree: __0__ Shrub: __20_% Herb: __55_% <u>% Community successional stage:</u> ☐ NA ☒ Mid (herbaceous, shrubs, saplings) ☐ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) <u>Dominant species present</u>: Western wheat (*Pascopyrum smithii*), Field bindweed (*Convolvulus arvensis*), Kochia (*Bassia scoparia*), Blue grama (*Bouteloua gracilis*), Yellow bush lupine (*Lupinus arboreus*), Rabbit brush (*Ericameria nauseosa*) <u>Other:</u> ☐ ______________________________ ☐ ______________________________ ☐ ______________________________ ☐ ______________________________
☒	**If characteristics used to delineate the active floodplain/low terrace boundary were deemed reliable, acquire boundary.** <u>Active floodplain/low terrace boundary acquired via:</u> ☒ Mapping on aerial photograph ☒ GPS ☐ Digitized on computer ☐ Other: ______________________________

Project: Rolling Meadows
Project Number: 21.1129.009
Stream: Drainage 2
Investigator(s): Seymone O'Brien

Date: 12/6/2022 **Time: 1pm**
Town: Colorado Springs **State: CO**
Photo begin file# **Photo end file#**

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Tributary to drainage 1, located on the east side of the project area.
Datum: **Projection:**
Coordinates: 38.755488, -104.61603

Notes: Discontinuous stream channel. Very shallow and completely dry without evidence of recent flows.

Brief site description: Fully vegetated drainage. Contributes to the main drainage 1, within the Project Area.

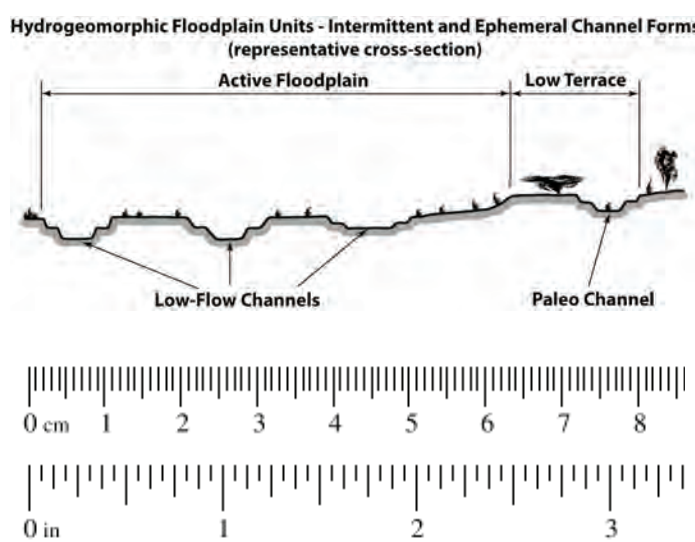
Checklist of resources (if available):

[X] Aerial photography
Dates:
[X] Topographic maps
Scale:
[ ] Geologic maps
[X] Vegetation maps
[X] Soils maps
[ ] Rainfall/precipitation maps
[ ] Existing delineation(s) for site
[X] Global positioning system (GPS)
[ ] Other studies

[ ] Stream gage data
Gage number:
Period of record:
[ ] Clinometer / level
[ ] History of recent effective discharges
[ ] Results of flood frequency analysis
[ ] Most recent shift-adjusted rating
[ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

The dominant Wentworth size class that imparts a characteristic texture to each zone of a channel cross-section is recorded in the average sediment texture field under the characteristics section for the zone of interest.

Millimeters (mm)		Inches (in)	Wentworth size class	
			Boulder	Gravel
	10.08	256		
			Cobble	Gravel
	2.56	64		
			Pebble	Gravel
	0.157	4		
			Granule	Gravel
	0.079	2.00		
			Very coarse sand	Sand
	0.039	1.00		
			Coarse sand	Sand
	0.020	0.50		
			Medium sand	Sand
1/2	0.0098	0.25		
			Fine sand	Sand
1/4	0.005	0.125		
			Very fine sand	Sand
1/8	0.0025	0.0625		
			Coarse silt	Silt
1/16	0.0012	0.031		
			Medium silt	Silt
1/32	0.00061	0.0156		
			Fine silt	Silt
1/64	0.00031	0.0078		
			Very fine silt	Silt
1/128	0.00015	0.0039		
			Clay	Mud



[X]	**Walk the channel and floodplain within the study area to get an impression of the vegetation and geomorphology present at the site. Record any potential anthropogenic influences on the channel system in "Notes" above.**
[X]	**Locate the low-flow channel (lowest part of the channel). Record observations.** Characteristics of the low-flow channel: Average sediment texture: Sandy-loam/Clay Total veg cover: 80 % Tree: 0 % Shrub: 0 % Herb: 80 % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) [X] Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*), crested wheatgrass (*Agropyron cristatum*) Other: ☐ No bed and bank for low flow channel ☐ No evidence of recent flows ☐ ☐
[X]	**Walk away from the low-flow channel along cross-section. Record characteristics of the low-flow/active floodplain boundary.** Characteristics used to delineate the low-flow/active floodplain boundary: ☐ Change in total veg cover ☐ Tree ☐ Shrub [X] Herb ☐ Change in overall vegetation maturity ☐ Change in dominant species present No Change ☐ Other ☐ Presence of bed and bank ☐ Drift and/or debris ☐ Other: ☐ Other:
[X]	**Continue walking the channel cross-section. Record observations below.** Characteristics of the low-flow channel: Average sediment texture: Clay Total veg cover: 20 % Tree: 0 % Shrub: 0 % Herb: 20 % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) [X] Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*), crested wheatgrass (*Agropyron cristatum*) Other: ☐ ☐ ☐ ☐

[X]	**Continue walking the channel cross-section. Record indicators of the active floodplain/low terrace boundary.** Characteristics used to delineate the active floodplain/ low terrace boundary: [ ] Change in average sediment texture [ ] Change in total veg cover [ ] Tree [ ] Shrub [X] Herb [ ] Change in overall vegetation maturity [ ] Change in dominant species present No Change [ ] Other [ ] Presence of bed and bank [ ] Drift and/or debris [ ] Other: ______ [ ] Other: ______
[X]	**Walk the active floodplain/low terrace boundary both upstream and downstream of the cross-section to verify that the indicators used to identify the transition are consistently associated the transition in both directions.** Consistency of indicators used to delineate the active floodplain/low terrace boundary: Y [ ] N [X] Change in average sediment texture Y [ ] N [X] Change in total veg cover [ ] Tree [ ] Shrub [ ] Herb Y [ ] N [X] Change in overall vegetation maturity Y [ ] N [X] Change in dominant species present Y [ ] N [X] Other: Y [ ] N [ ] Presence of bed and bank Y [ ] N [ ] Drift and/or debris Y [ ] N [ ] Other: ______ Y [ ] N [ ] Other: ______
[X]	**If the characteristics used to delineate the active floodplain/low terrace boundary were NOT consistently associated with the transition in both the upstream and downstream directions, repeat all steps above.**
[X]	**Continue walking the channel cross-section. Record characteristics of the low terrace.** Characteristics of the low terrace: Average sediment texture: Clay Total veg cover: 20 % Tree: 0 % Shrub: 0 % Herb: 20 % Community successional stage: [ ] NA [ ] Mid (herbaceous, shrubs, saplings) [X] Early (herbaceous & seedlings) [ ] Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*), crested wheatgrass (*Agropyron cristatum*) Other: [ ] ______ [ ] ______ [ ] ______ [ ] ______
[ ]	**If characteristics used to delineate the active floodplain/low terrace boundary were deemed reliable, acquire boundary.** Active floodplain/low terrace boundary acquired via: [ ] Mapping on aerial photograph [ ] GPS [ ] Digitized on computer [ ] Other: ______

Project: Rolling Meadows **Project Number:** 21.1129.009 **Stream:** Drainage 3 **Investigator(s):** Seymone O'Brien	**Date:** 12/6/2022 **Time:** 1pm **Town:** Colorado Springs **State:** CO **Photo begin file#** **Photo end file#**
Y ☒ / N ☐ Do normal circumstances exist on the site? Y ☐ / N ☒ Is the site significantly disturbed?	**Location Details:** North side of the Project Area. **Datum:** **Projection:** **Coordinates:** 38.753248, -104.617944

Notes: Discontinuous stream channel. Very shallow and completely dry without evidence of recent flows.

Brief site description: Fully vegetated drainage. Within the eastern section of the Project Area.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates:
- ☒ Topographic maps
  Scale:
- ☐ Geologic maps
- ☒ Vegetation maps
- ☒ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☒ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ Clinometer / level
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

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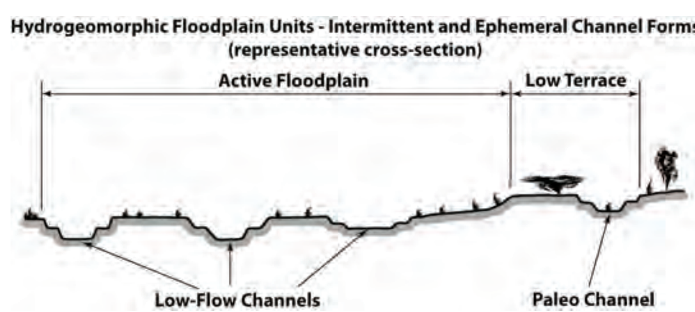
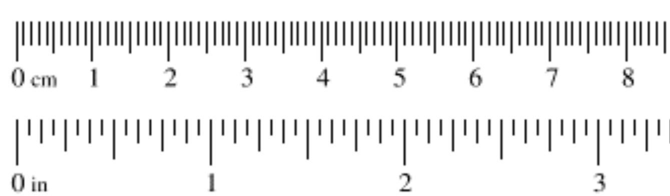
	10.08	256	Boulder	Gravel
	2.56	64	Cobble	Gravel
	0.157	4	Pebble	Gravel
	0.079	2.00	Granule	Gravel
	0.039	1.00	Very coarse sand	Sand
	0.020	0.50	Coarse sand	Sand
1/2	0.0098	0.25	Medium sand	Sand
1/4	0.005	0.125	Fine sand	Sand
1/8	0.0025	0.0625	Very fine sand	Sand
1/16	0.0012	0.031	Coarse silt	Silt
1/32	0.00061	0.0156	Medium silt	Silt
1/64	0.00031	0.0078	Fine silt	Silt
1/128	0.00015	0.0039	Very fine silt	Silt
			Clay	Mud





☒	**Walk the channel and floodplain within the study area to get an impression of the vegetation and geomorphology present at the site. Record any potential anthropogenic influences on the channel system in "Notes" above.**
☒	**Locate the low-flow channel (lowest part of the channel). Record observations.** Characteristics of the low-flow channel: Average sediment texture: Sandy-loam/Clay Total veg cover: 80 % Tree: 0 % Shrub: 0 % Herb: 80 % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☒ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*) Other: ☒ No bed and bank or low flow channel ☒ No evidence of recent flows ☐ ☐
☒	**Walk away from the low-flow channel along cross-section. Record characteristics of the low-flow/active floodplain boundary.** Characteristics used to delineate the low-flow/active floodplain boundary: ☐ Change in total veg cover ☐ Tree ☐ Shrub ☒ Herb ☐ Change in overall vegetation maturity ☐ Change in dominant species present No Change ☐ Other ☐ Presence of bed and bank ☐ Drift and/or debris ☐ Other: ☐ Other:
☒	**Continue walking the channel cross-section. Record observations below.** Characteristics of the low-flow channel: Average sediment texture: Clay Total veg cover: 20 % Tree: 0 % Shrub: 0 % Herb: 20 % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☒ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*) Other: ☐ ☐ ☐ ☐

[X]	**Continue walking the channel cross-section. Record indicators of the active floodplain/low terrace boundary.** Characteristics used to delineate the active floodplain/ low terrace boundary: ☐ Change in average sediment texture ☐ Change in total veg cover ☐ Tree ☐ Shrub [X] Herb ☐ Change in overall vegetation maturity ☐ Change in dominant species present ☐ Other ☐ Presence of bed and bank ☐ Drift and/or debris ☐ Other: ________ ☐ Other: ________ No Change
[X]	**Walk the active floodplain/low terrace boundary both upstream and downstream of the cross-section to verify that the indicators used to identify the transition are consistently associated the transition in both directions.** Consistency of indicators used to delineate the active floodplain/low terrace boundary: Y ☐ N [X] Change in average sediment texture Y ☐ N [X] Change in total veg cover ☐ Tree ☐ Shrub ☐ Herb Y ☐ N [X] Change in overall vegetation maturity Y ☐ N [X] Change in dominant species present Y ☐ N [X] Other: Y ☐ N ☐ Presence of bed and bank Y ☐ N ☐ Drift and/or debris Y ☐ N ☐ Other: ________ Y ☐ N ☐ Other: ________
[X]	**If the characteristics used to delineate the active floodplain/low terrace boundary were NOT consistently associated with the transition in both the upstream and downstream directions, repeat all steps above.**
[X]	**Continue walking the channel cross-section. Record characteristics of the low terrace.** Characteristics of the low terrace: Average sediment texture: Clay Total veg cover: 20 % Tree: 0 % Shrub: 0 % Herb: 20 % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) [X] Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*) Other: ☐ ________ ☐ ________ ☐ ________ ☐ ________
☐	**If characteristics used to delineate the active floodplain/low terrace boundary were deemed reliable, acquire boundary.** Active floodplain/low terrace boundary acquired via: ☐ Mapping on aerial photograph ☐ GPS ☐ Digitized on computer ☐ Other: ________

Project: Rolling Meadows **Project Number: 21.1129.009** **Stream: Drainage 4** **Investigator(s): Seymone O'Brien**	**Date: 12/6/2022** **Time: 1pm** **Town: Colorado Springs** **State: CO** **Photo begin file#** **Photo end file#**
Y ☒ / N ☐ Do normal circumstances exist on the site? Y ☐ / N ☒ Is the site significantly disturbed?	**Location Details: North side of the Project Area.** **Datum:** **Projection:** **Coordinates:** 38.74956, -104.619144

Notes: Discontinuous stream channel. Very shallow and completely dry without evidence of recent flows.

Brief site description: Fully vegetated drainage. Within the eastern section of the Project Area.

Checklist of resources (if available):

- ☒ Aerial photography
  Dates:
- ☒ Topographic maps
  Scale:
- ☐ Geologic maps
- ☒ Vegetation maps
- ☒ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☒ Global positioning system (GPS)
- ☐ Other studies

- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ Clinometer / level
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

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Millimeters (mm)		Inches (in)	Wentworth size class	
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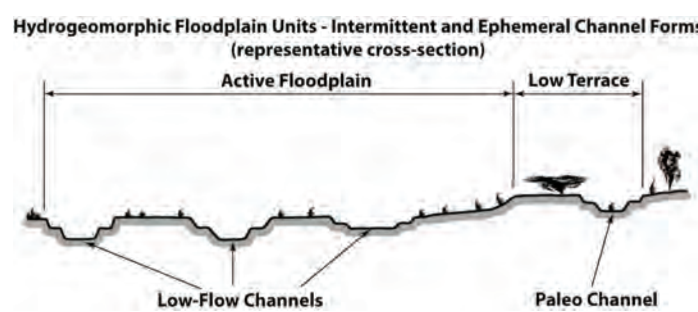
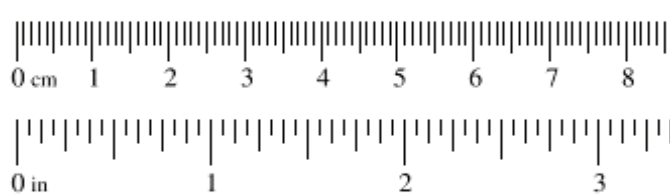
			Pebble	
	0.157	4		
			Granule	
	0.079	2.00		
			Very coarse sand	Sand
	0.039	1.00		
			Coarse sand	
	0.020	0.50		
			Medium sand	
1/2	0.0098	0.25		
			Fine sand	
1/4	0.005	0.125		
			Very fine sand	
1/8	0.0025	0.0625		
			Coarse silt	Silt
1/16	0.0012	0.031		
			Medium silt	
1/32	0.00061	0.0156		
			Fine silt	
1/64	0.00031	0.0078		
			Very fine silt	
1/128	0.00015	0.0039		
			Clay	Mud





[X]	**Walk the channel and floodplain within the study area to get an impression of the vegetation and geomorphology present at the site. Record any potential anthropogenic influences on the channel system in "Notes" above.**
[X]	**Locate the low-flow channel (lowest part of the channel). Record observations.** Characteristics of the low-flow channel: Average sediment texture: Sandy-loam/Clay Total veg cover: 80 % Tree: 0 % Shrub: 0 % Herb: 80 % Community successional stage: [ ] NA [ ] Mid (herbaceous, shrubs, saplings) [X] Early (herbaceous & seedlings) [ ] Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*), crested wheatgrass (Agropyron cristatum) Other: [ ] No bed and bank or low flow channel [ ] No evidence of recent flows [ ] [ ]
[X]	**Walk away from the low-flow channel along cross-section. Record characteristics of the low-flow/active floodplain boundary.** Characteristics used to delineate the low-flow/active floodplain boundary: [ ] Change in total veg cover [ ] Tree [ ] Shrub [X] Herb [ ] Change in overall vegetation maturity [ ] Change in dominant species present No Change [ ] Other [ ] Presence of bed and bank [ ] Drift and/or debris [ ] Other: [ ] Other:
[X]	**Continue walking the channel cross-section. Record observations below.** Characteristics of the low-flow channel: Average sediment texture: Clay Total veg cover: 20 % Tree: 0 % Shrub: 0 % Herb: 20 % Community successional stage: [ ] NA [ ] Mid (herbaceous, shrubs, saplings) [X] Early (herbaceous & seedlings) [ ] Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*),crested wheatgrass (Agropyron cristatum) Other: [ ] [ ] [ ] [ ]

[X]	**Continue walking the channel cross-section. Record indicators of the active floodplain/low terrace boundary.** Characteristics used to delineate the active floodplain/ low terrace boundary: [ ] Change in average sediment texture [ ] Change in total veg cover [ ] Tree [ ] Shrub [X] Herb [ ] Change in overall vegetation maturity [ ] Change in dominant species present — No Change [ ] Other [ ] Presence of bed and bank [ ] Drift and/or debris [ ] Other: ____ [ ] Other: ____
[X]	**Walk the active floodplain/low terrace boundary both upstream and downstream of the cross-section to verify that the indicators used to identify the transition are consistently associated the transition in both directions.** Consistency of indicators used to delineate the active floodplain/low terrace boundary: Y [ ] N [X] Change in average sediment texture Y [ ] N [X] Change in total veg cover [ ] Tree [ ] Shrub [ ] Herb Y [ ] N [X] Change in overall vegetation maturity Y [ ] N [X] Change in dominant species present Y [ ] N [X] Other: Y [ ] N [ ] Presence of bed and bank Y [ ] N [ ] Drift and/or debris Y [ ] N [ ] Other: ____ Y [ ] N [ ] Other: ____
[X]	**If the characteristics used to delineate the active floodplain/low terrace boundary were NOT consistently associated with the transition in both the upstream and downstream directions, repeat all steps above.**
[X]	**Continue walking the channel cross-section. Record characteristics of the low terrace.** Characteristics of the low terrace: Average sediment texture: Clay Total veg cover: 20 % Tree: 0 % Shrub: 0 % Herb: 20 % Community successional stage: [ ] NA [ ] Mid (herbaceous, shrubs, saplings) [X] Early (herbaceous & seedlings) [ ] Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama *(Bouteloua gracilis),* fetid marigold *(Dyssodia papposa),* Russian thistle *(Salsola kali)* Other: [ ] ____ [ ] ____ [ ] ____ [ ] ____
[ ]	**If characteristics used to delineate the active floodplain/low terrace boundary were deemed reliable, acquire boundary.** Active floodplain/low terrace boundary acquired via: [ ] Mapping on aerial photograph [ ] GPS [ ] Digitized on computer [ ] Other: ____

Project: Rolling Meadows
Project Number: 21.1129.009
Stream: Drainage 5
Investigator(s): Seymone O'Brien

Date: 12/6/2022 **Time: 1pm**
Town: Colorado Springs **State: CO**
Photo begin file# **Photo end file#**

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: Tributary to drainage 1, located on the east side of the project area.
Datum: **Projection:**
Coordinates: 38.749153, -104.622732

Notes: Discontinuous stream channel. Very shallow and completely dry without evidence of recent flows.

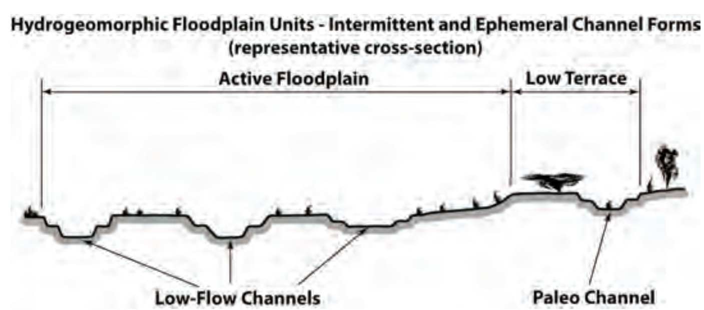
Brief site description: Fully vegetated drainage. Contributes to the main drainage 1, within the Project Area. Head cut on the west side of the channel.

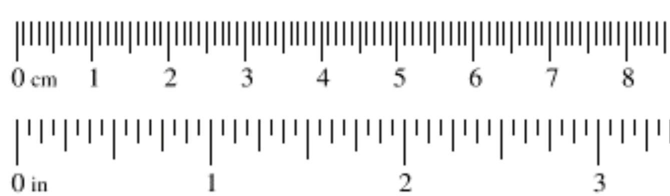
Checklist of resources (if available):

- [X] Aerial photography
  Dates:
- [X] Topographic maps
  Scale:
- [ ] Geologic maps
- [X] Vegetation maps
- [X] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [X] Global positioning system (GPS)
- [ ] Other studies
- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] Clinometer / level
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

The dominant Wentworth size class that imparts a characteristic texture to each zone of a channel cross-section is recorded in the average sediment texture field under the characteristics section for the zone of interest.

Millimeters (mm)	Inches (in)	Wentworth size class	
		Boulder	Gravel
10.08	256		
		Cobble	
2.56	64		
		Pebble	
0.157	4		
		Granule	
0.079	2.00		
		Very coarse sand	Sand
0.039	1.00		
		Coarse sand	
0.020	0.50		
		Medium sand	
1/2 0.0098	0.25		
		Fine sand	
1/4 0.005	0.125		
		Very fine sand	
1/8 0.0025	0.0625		
		Coarse silt	Silt
1/16 0.0012	0.031		
		Medium silt	
1/32 0.00061	0.0156		
		Fine silt	
1/64 0.00031	0.0078		
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud





☒	**Walk the channel and floodplain within the study area to get an impression of the vegetation and geomorphology present at the site. Record any potential anthropogenic influences on the channel system in "Notes" above.**
☒	**Locate the low-flow channel (lowest part of the channel). Record observations.** Characteristics of the low-flow channel: Average sediment texture: Sandy-loam/Clay Total veg cover: 90 % Tree: 0 % Shrub: 0 % Herb: 90 % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☒ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), Russian thistle (*Salsola kali*), crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*Pascopyrum smithii*), kochia (*Bassia prostrata*), scotch thistle (*Onopordum acanthium*) Other: ☒ No evidence of recent flows ☐ ☐ ☐
☒	**Walk away from the low-flow channel along cross-section. Record characteristics of the low-flow/active floodplain boundary.** Characteristics used to delineate the low-flow/active floodplain boundary: ☐ Change in total veg cover ☐ Tree ☐ Shrub ☒ Herb ☐ Change in overall vegetation maturity ☒ Change in dominant species present ☐ Other ☐ Presence of bed and bank ☐ Drift and/or debris ☐ Other: ☐ Other:
☒	**Continue walking the channel cross-section. Record observations below.** Characteristics of the low-flow channel: Average sediment texture: Clay Total veg cover: 80 % Tree: 0 % Shrub: 0 % Herb: 80 % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☒ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), Russian thistle (*Salsola kali)*, crested wheatgrass (*Agropyron cristatum*), western wheatgrass (*Pascopyrum smithii*), kochia (*Bassia prostrata*), scotch thistle (*Onopordum acanthium*) Other: ☐ ☐ ☐ ☐

[X]	**Continue walking the channel cross-section. Record indicators of the active floodplain/low terrace boundary.** Characteristics used to delineate the active floodplain/ low terrace boundary: [ ] Change in average sediment texture [ ] Change in total veg cover [ ] Tree [X] Shrub [X] Herb [ ] Change in overall vegetation maturity [ ] Change in dominant species present [ ] Other [ ] Presence of bed and bank [ ] Drift and/or debris [ ] Other: ________________ [ ] Other: ________________
[X]	**Walk the active floodplain/low terrace boundary both upstream and downstream of the cross-section to verify that the indicators used to identify the transition are consistently associated the transition in both directions.** Consistency of indicators used to delineate the active floodplain/low terrace boundary: Y [ ] N [X] Change in average sediment texture Y [X] N [ ] Change in total veg cover [ ] Tree [X] Shrub [X] Herb Y [X] N [ ] Change in overall vegetation maturity Y [X] N [ ] Change in dominant species present Y [ ] N [X] Other: Y [ ] N [ ] Presence of bed and bank Y [ ] N [ ] Drift and/or debris Y [ ] N [ ] Other: ____________ Y [ ] N [ ] Other: ____________
[X]	**If the characteristics used to delineate the active floodplain/low terrace boundary were NOT consistently associated with the transition in both the upstream and downstream directions, repeat all steps above.**
[X]	**Continue walking the channel cross-section. Record characteristics of the low terrace.** Characteristics of the low terrace: Average sediment texture: Clay Total veg cover: 60 % Tree: 0 % Shrub: 10 % Herb: 50 % Community successional stage: [ ] NA [X] Mid (herbaceous, shrubs, saplings) [X] Early (herbaceous & seedlings) [ ] Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*), crested wheatgrass (*Agropyron cristatum*), winterfat (*Krascheninnikovia lanata*), rabbit brush (*Chrysothamnus*), big sagebrush (*Artemisia tridentata*), prickly pear (*Opuntia*) Other: [ ] ____________ [ ] ____________ [ ] ____________ [ ] ____________
[ ]	**If characteristics used to delineate the active floodplain/low terrace boundary were deemed reliable, acquire boundary.** Active floodplain/low terrace boundary acquired via: [ ] Mapping on aerial photograph [ ] GPS [ ] Digitized on computer [ ] Other: ____________

Project: Rolling Meadows
Project Number: 21.1129.009
Stream: Drainage 6
Investigator(s): Seymone O'Brien

Date: 12/6/2022 **Time: 1pm**
Town: Colorado Springs **State: CO**
Photo begin file# **Photo end file#**

Y [X] / N [ ] Do normal circumstances exist on the site?

Y [ ] / N [X] Is the site significantly disturbed?

Location Details: North side of the Project Area.
Datum: **Projection:**
Coordinates: 38.768436, -104.618213

Notes: Discontinuous stream channel. Very shallow and completely dry without evidence of recent flows.

Brief site description: Fully vegetated drainage. Within the northern section of the Project Area. North of Bradley Road

Checklist of resources (if available):

- [X] Aerial photography
  Dates:
- [X] Topographic maps
  Scale:
- [ ] Geologic maps
- [X] Vegetation maps
- [X] Soils maps
- [ ] Rainfall/precipitation maps
- [ ] Existing delineation(s) for site
- [X] Global positioning system (GPS)
- [ ] Other studies

- [ ] Stream gage data
  Gage number:
  Period of record:
  - [ ] Clinometer / level
  - [ ] History of recent effective discharges
  - [ ] Results of flood frequency analysis
  - [ ] Most recent shift-adjusted rating
  - [ ] Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

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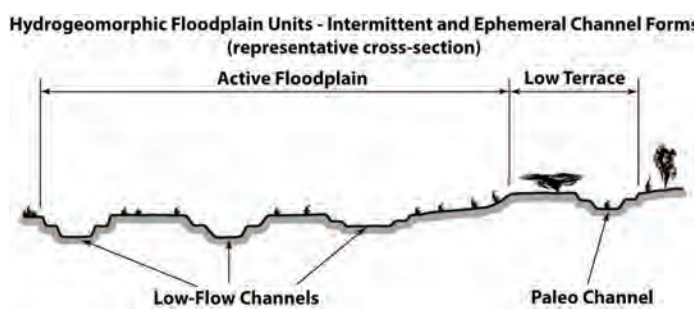
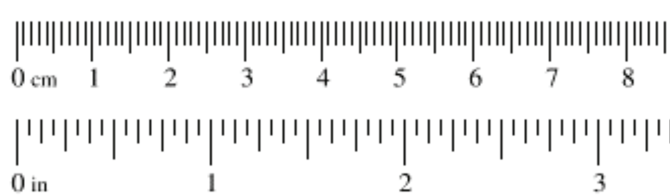
		Cobble	
2.56	64		
		Pebble	
0.157	4		
		Granule	
0.079	2.00		
		Very coarse sand	Sand
0.039	1.00		
		Coarse sand	
0.020	0.50		
		Medium sand	
1/2 0.0098	0.25		
		Fine sand	
1/4 0.005	0.125		
		Very fine sand	
1/8 0.0025	0.0625		
		Coarse silt	Silt
1/16 0.0012	0.031		
		Medium silt	
1/32 0.00061	0.0156		
		Fine silt	
1/64 0.00031	0.0078		
		Very fine silt	
1/128 0.00015	0.0039		
		Clay	Mud





☒	**Walk the channel and floodplain within the study area to get an impression of the vegetation and geomorphology present at the site. Record any potential anthropogenic influences on the channel system in "Notes" above.**
☒	**Locate the low-flow channel (lowest part of the channel). Record observations.** Characteristics of the low-flow channel: Average sediment texture: Sandy-loam/Clay Total veg cover: 80 % Tree: 0 % Shrub: 0 % Herb: 80 % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☒ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*) Other: ☐ No bed and bank or low flow channel ☐ No evidence of recent flows ☐ ☐
☒	**Walk away from the low-flow channel along cross-section. Record characteristics of the low-flow/active floodplain boundary.** Characteristics used to delineate the low-flow/active floodplain boundary: ☐ Change in total veg cover ☐ Tree ☐ Shrub ☒ Herb ☐ Change in overall vegetation maturity ☐ Change in dominant species present No Change ☐ Other ☐ Presence of bed and bank ☐ Drift and/or debris ☐ Other: ☐ Other:
☒	**Continue walking the channel cross-section. Record observations below.** Characteristics of the low-flow channel: Average sediment texture: Clay Total veg cover: 20 % Tree: 0 % Shrub: 0 % Herb: 20 % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☒ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama (*Bouteloua gracilis*), fetid marigold (*Dyssodia papposa*), Russian thistle (*Salsola kali*) Other: ☐ ☐ ☐ ☐

[X]	**Continue walking the channel cross-section. Record indicators of the active floodplain/low terrace boundary.** Characteristics used to delineate the active floodplain/ low terrace boundary: [ ] Change in average sediment texture [ ] Change in total veg cover [ ] Tree [ ] Shrub [X] Herb [ ] Change in overall vegetation maturity [ ] Change in dominant species present [ ] Other [ ] Presence of bed and bank [ ] Drift and/or debris [ ] Other: ____ [ ] Other: ____ No Change
[X]	**Walk the active floodplain/low terrace boundary both upstream and downstream of the cross-section to verify that the indicators used to identify the transition are consistently associated the transition in both directions.** Consistency of indicators used to delineate the active floodplain/low terrace boundary: Y [ ] N [X] Change in average sediment texture Y [ ] N [X] Change in total veg cover [ ] Tree [ ] Shrub [ ] Herb Y [ ] N [X] Change in overall vegetation maturity Y [ ] N [X] Change in dominant species present Y [ ] N [X] Other: Y [ ] N [ ] Presence of bed and bank Y [ ] N [ ] Drift and/or debris Y [ ] N [ ] Other: ____ Y [ ] N [ ] Other: ____
[X]	**If the characteristics used to delineate the active floodplain/low terrace boundary were NOT consistently associated with the transition in both the upstream and downstream directions, repeat all steps above.**
[X]	**Continue walking the channel cross-section. Record characteristics of the low terrace.** Characteristics of the low terrace: Average sediment texture: Clay Total veg cover: 20 % Tree: 0 % Shrub: 0 % Herb: 20 % Community successional stage: [ ] NA [ ] Mid (herbaceous, shrubs, saplings) [X] Early (herbaceous & seedlings) [ ] Late (herbaceous, shrubs, mature trees) Dominant species present: Blue grama *(Bouteloua gracilis),* fetid marigold *(Dyssodia papposa),* Russian thistle *(Salsola kali)* Other: [ ] ____ [ ] ____ [ ] ____ [ ] ____
[ ]	**If characteristics used to delineate the active floodplain/low terrace boundary were deemed reliable, acquire boundary.** Active floodplain/low terrace boundary acquired via: [ ] Mapping on aerial photograph [ ] GPS [ ] Digitized on computer [ ] Other: ____

Appendix D: 2021 Wetland Assessment and Delineation Report

Matrix ENVIRONMENTAL

2435 Research Pkwy, Suite 300
Colorado Springs, Colorado 80920
Phone: 719.575.0100
Fax: 719.575.0208
matrixdesigngroup.com

Date: 22 September 2021

To: Tony Martinez, U.S. Army Corps of Engineers

From: Tierney Walsh, Matrix Environmental Services

Subject: Wetland Assessment and Delineation Report – Rolling Hills Development at Jimmy Camp Creek East Tributary, West of S Meridian Road and South of Drennan Road, El Paso County, Colorado

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Mr. Martinez,

On behalf of the Landhuis Company, Matrix Environmental Services, LLC (MES) is pleased to submit this report summarizing the assessment and delineation of wetlands within the Rolling Hills development area (the Site), which is located west of S. Meridian Road and south of Drennan Road in El Paso County, Colorado.

The scope of work for the wetland assessment and delineation included the entire Site, which totals approximately 1,025 acres. Similar plant communities were identified throughout the Site; therefore, the observed plant communities were divided into eight distinct communities with one data sample point collected in each community.

The assessment and delineation field work were conducted May 13-14, 2021 (Communities 1-5) and August 7-8, 2021 (Communities 6-8). Climatic and hydrologic conditions at the Site were drier than average for the time of year during the May assessment due to below-normal rainfall; however, conditions were normal during the August assessment. The wet season in Colorado Springs is between April and September, peaking in July and August.

Community 1 includes the relatively flat area identified as a seasonally flooded, intermittent riverine system by the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), which is unnamed and shown by the USFWS NWI to converge with the Jimmy Camp Creek East Tributary at a point approximately 1.75-miles southwest. Community 1 is dominated by common kochia (*Bassia scoparia*) and a grass that was not identifiable at the time of assessment due to the lack of inflorescence. Community 1 vegetation also includes minor amounts of groundplum milkvetch (*Astragalus crassicarpus*), lamb's quarters (*Chenopodium album*) and musk thistle (*Carduus nutans*). No hydric soil indicators were observed within the area's sandy clay soils. Additionally, saturation and a water table were not observed within Community 1: soil was dry to a depth of 28 inches. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of hydric soils and a lack of wetland hydrology.

Community 2 includes a small depression near the eastern boundary of the Site, which is dominated by Russian olive (*Elaeagnus angustifolia*), common kochia (*Bassia scoparia*) and a grass that was not identifiable at the time of assessment due to the lack of inflorescence. Community 2 vegetation also includes minor amounts of field bindweed (*Convolvulus arvensis*) and Russian thistle (*Salsola tragus*). No hydric soil indicators were observed within the area's sandy clay loam and clay soils. Additionally, saturation and a water table were not observed within Community 2 despite the soil pit being advanced to 42 inches below the ground surface. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of hydric soils and a lack of wetland hydrology.

Community 3 includes the drainage swale identified as Jimmy Camp Creek East Tributary, which is dominated by common kochia (*Bassia scoparia*), a grass that was not identifiable at the time of assessment due to the lack of inflorescence and Woods' rose (*Rosa woodsii*). Community 3 vegetation also includes minor amounts of curly dock (*Rumex crispus*) and Russian thistle (*Salsola tragus*). No hydric soil indicators were observed within the area's sandy loam, loamy sand and sand soils. Additionally, saturation and a water table were not observed within Community 3 despite the soil pit being advanced to 52 inches below the ground surface. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of hydric soils and a lack of wetland hydrology.

Community 4 includes the relatively flat area identified as a seasonally flooded, intermittent riverine system by the USFWS NWI, which the NWI shows to converge onsite with Jimmy Camp Creek East Tributary. Community 4 is dominated by common kochia (*Bassia scoparia*) and field bindweed (*Convolvulus arvensis*) with minor amounts of lamb's quarters (*Chenopodium album*) and a grass that was not identifiable at the time of assessment due to the lack of inflorescence. No hydric soil indicators were observed within the area's sandy loam and sandy clay loam soils. Additionally, saturation and a water table were not observed within Community 4 despite the soil pit being advanced to 38 inches below the ground surface. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of dominance of hydrophytic vegetation, a negative prevalence index, the lack of hydric soils and a lack of wetland hydrology.

Community 5 includes a depression near the eastern boundary of the Site within the area identified as a seasonally flooded, intermittent riverine system by the USFWS NWI. Community 5 is dominated by field bindweed (*Convolvulus arvensis*) and a grass that was not identifiable at the time of assessment due to the lack of inflorescence. Vegetation in Community 5 also includes minor amounts of lamb's quarters (*Chenopodium album*) and common kochia (*Bassia scoparia*). No hydric soil indicators were observed within the area's sandy clay and sandy loam soils. Additionally, saturation and a water table were not observed within Community 5: soil was dry to a depth of 38 inches. However, oxidized rhizospheres along living roots were detectable within 12 inches of the soil surface. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of hydric soils.

Community 6 is approximately 0.18 acres and includes a drainage channel associated with a windmill-powered well south of Bradley Road. Community 6 is dominated by foxtail barley (*Hordeum jubatum*) and common kochia (*Bassia scoparia*) with minor amounts of lamb's quarters (*Chenopodium album*), Canada thistle (*Cirsium arvense*), field bindweed (*Convolvulus arvensis*) and alfalfa dodder (*Cuscuta approximata*). The community had visible surface water in approximately 30% of the area, surface soil cracks, algal mats and oxidized rhizospheres along living roots from 4-12 inches. Additionally, 5% prominent redox concentrations from 4-12 inches satisfy the criteria for redox dark surface. In my professional opinion, this community meets the criteria to be identified as a wetland based on the predominance of hydrophytic vegetation and the observation of hydric soil and wetland hydrology indicators.

Community 7 is located immediately south of Community 6 and includes the southern edge of the drainage channel that forms Community 6. Community 7 is dominated by blue grama (*Bouteloua gracilis*) and common kochia (*Bassia scoparia*) with minor amounts of lamb's quarters (*Chenopodium album*), alfalfa dodder (*Cuscuta approximata*), annual meadow grass (*Poa annua*), proso millet (*Panicum miliaceum*), common sunflower (*Helianthus annuus*) and golden crownbeard (*Verbesina encelioides*). No hydric soil indicators were observed within the area's silty clay loam and sandy loam soils. Additionally, saturation and a water table were not observed within Community 7: soil was dry to a depth of 30 inches. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of dominance of hydrophytic vegetation, a negative prevalence index, lack of hydric soils, and a lack of wetland hydrology indicators.

Community 8 includes the relatively flat area identified as Jimmy Camp Creek East Tributary south of Bradley Road, which the USFWS NWI describes as a seasonally flooded, intermittent riverine system. Community 8 is dominated by blue grama (*Bouteloua gracilis*), lamb's quarters (*Chenopodium album*) and red-root amaranth (*Amaranthus retroflexus*) with minor amounts of pineapple-weed (*Matricaria discoidea*), common kochia (*Bassia scoparia*), golden crownbeard (*Verbesina encelioides*) and curly dock (*Rumex crispus*). No hydric soil indicators were observed within the area's clay loam and silty loam soils. Additionally, saturation and a water table were not observed within Community 8: soil was dry to a depth of 48 inches. In my professional opinion, this community does not meet the criteria of a wetland based on the lack of dominance of hydrophytic vegetation, a negative prevalence index, the lack of hydric soils and a lack of wetland hydrology.

According to the National Resources Conservation Service's Web Soil Survey, most soils within the Site are classified as Sampson loam, except soils within Community 3 which are classified as Ellicott loamy coarse sand. Additionally, portions of the Site are classified as wetlands according to the USFWS NWI map, including communities 1, 3, 4, 5 and 8 which the NWI describes as temporarily or seasonally flooded riverine habitats.

Flags were placed along the boundaries of areas identified as wetlands within the Site, which was limited to Community 6 as indicated in the attached figure.

The professional opinions made in this report regarding the location and extent of areas that do or do not satisfy the criteria of a wetland were determined pursuant to the Army Corps of Engineer's Regional Supplement and appropriate guidance and pursuant to confirmation by appropriate regulatory staff including but not limited to the Army Corps of Engineers.

Please contact Ms. Tierney Walsh at 719-457-5613 or Tierney.Walsh@matrixdesigngroup.com should you have any questions or comments.

Sincerely,

Matrix Environmental Services, LLC

Tierney Walsh

Environmental Scientist

Enclosures:

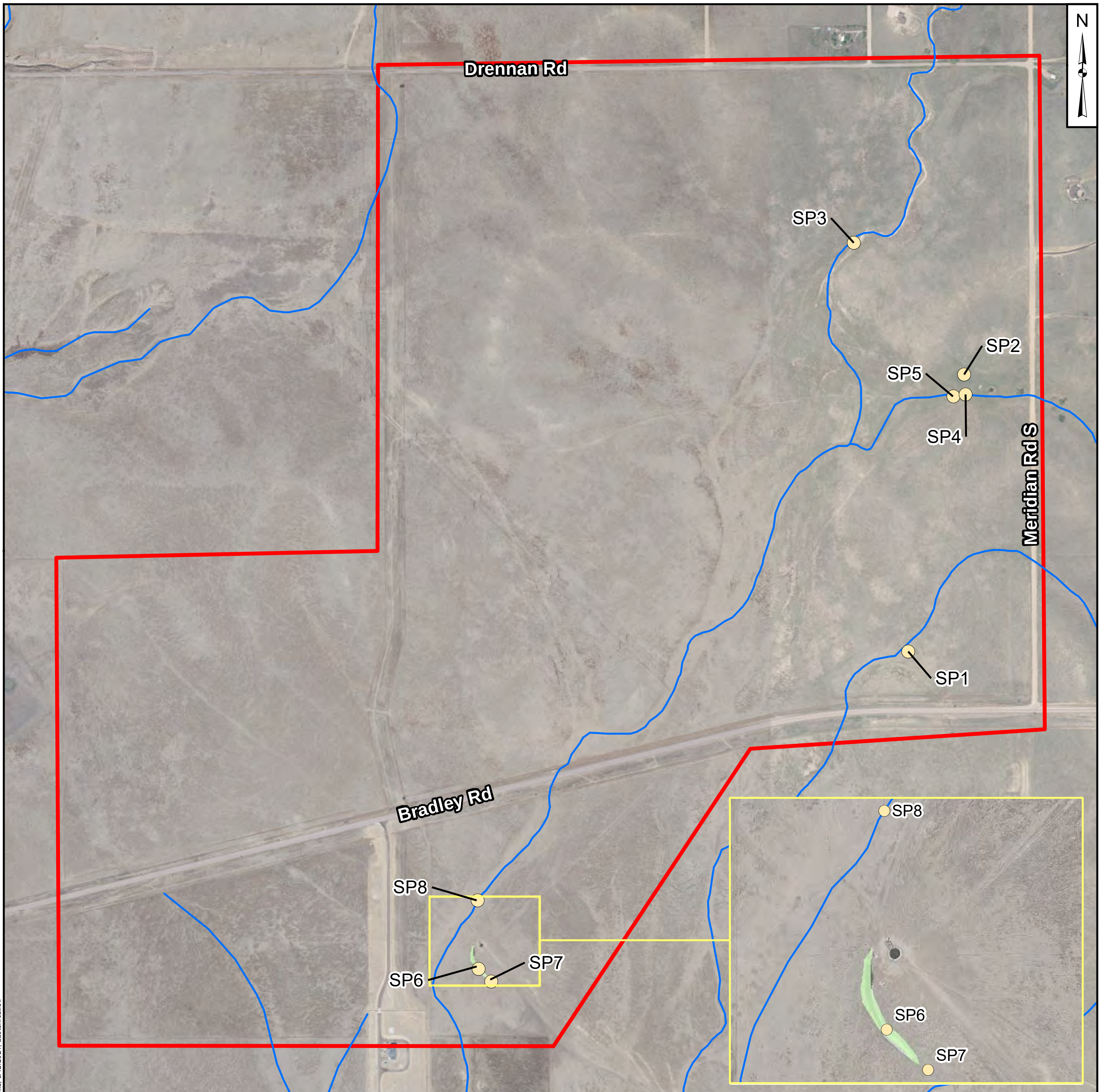
Site Figure

Photolog

Field Data Forms

cc: Mr. Jeff Mark, The Landhuis Company

Figures



FILE: G:\gis_projects\MES_RollingHills\active\apps\FigureX_RollingHills_WetlandDelineation_2021_08_12_AKC.mxd, 8/12/2021, austen.cutrell

Legend

- Sampling Point
- Ephemeral Stream
- Wetland
- Site Boundary

0 1,200 2,400 Feet

Rolling Hills Wetland Delineation

Matrix ENVIRONMENTAL

Figure 1

Photolog

Photo Log
Wetland Delineation for Rolling Hills Development
Colorado Springs, Colorado

Photo 1 – Community 1 includes a relatively flat area identified as a seasonally flooded riverine system by the USFWS NWI. Test pit shown in center of foreground.

Photo 2 – Community 1's sandy clay soils didn't exhibit hydric soil indicators. Additionally, saturation and a water table were not encountered despite the soil pit extending to a depth of 28 inches.

Photo 3 – Community 2 includes a small depression near the eastern boundary of the Site. Test pit is in the center of the middle ground.

Photo 4 – Community 2's sandy clay loam and clay soils didn't exhibit hydric soil indicators. Additionally, saturation and a water table were not encountered despite the soil pit extending to a depth of 42 inches.

Photo 5 – Community 3 includes the drainage swale identified as Jimmy Camp Creek East Tributary. Test pit is in the center of the foreground.

Photo 6 – Community 3's sandy loam, loamy sand and sand soils didn't exhibit hydric soil indicators, and saturation and a water table were not encountered despite the soil pit extending to a depth of 52 inches.

Photo 7 – Community 4 includes a relatively flat area identified as a seasonally flooded riverine system by the USFWS NWI. Test pit is in the center of the middle ground.

Photo 8 – Community 4's sandy loam and sandy clay loam soils didn't exhibit hydric soil indicators, and saturation and a water table were not encountered despite the soil pit extending to a depth of 38 inches.

Photo Log
Wetland Delineation for Rolling Hills Development
Colorado Springs, Colorado

Photo 9 – Community 5 includes a depression near the eastern boundary of the Site within the area identified as a seasonally flooded riverine system by the USFWS NWI. Test pit is on the left in the middle ground.

Photo 10 – Community 5's sandy clay and sandy loam soils didn't exhibit hydric soil indicators; however, oxidized rhizospheres along living roots were detectable within 12 inches of the soil surface.

Photo 11 – Community 6 is approximately 0.18 acres and includes a drainage channel associated with a windmill-powered well south of Bradley Road. Test pit is partially shown in the center of the foreground.

Photo 12 – Community 6's sandy loam soils contained 5% prominent redox concentrations from 4-12 inches, which satisfied the criteria for redox dark surface.

Photo 13 – Community 7 includes the southern edge of the drainage channel that forms Community 6. Test pit is in the center of the middle ground.

Photo 14 – Community 7's silty clay loam and sandy loam soils didn't exhibit hydric soil indicators, and saturation and a water table were not encountered despite the soil pit extending to a depth of 30 inches.

Photo 15 – Community 8 includes a relatively flat area identified as a seasonally flooded riverine system by the USFWS NWI. Test pit is in the center of the foreground.

Photo 16 – Community 8's clay loam and silty loam soils didn't exhibit hydric soil indicators, and saturation and a water table were not encountered despite the soil pit extending to a depth of 48 inches.

Field Forms

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 5/13/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 1

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): flat w/ [illegible] NWI trib. boundary Local relief (concave, convex, none): none Slope (%): 0-3%

Subregion (LRR): D Lat: N38.767754 Long: W104.612189 Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✓
Hydric Soil Present?		✓
Wetland Hydrology Present?		✓

Is the Sampled Area within a Wetland? Yes ____ No ✓

Remarks:
Moderate Drought in area during assessment (Drought.gov)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: *)			
1. unidentifiable grass (no reproductive structures)	60%	Y	NA
2. Bassia scoparia	20%	Y	FAC
3. Astragalus crassicarpus	5%	N	NI
4. Chenopodium album	2%	N	FACU
5. Carduus nutans	2%	N	UPL
6. Senecio crassulus	1%	N	FACU
7.			
8.			
9.			
10.			
11.			
= Total Cover	90%		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 10%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	20	x 3 = 60
FACU species	3	x 4 = 12
UPL species	2	x 5 = 10
Column Totals:	25 (A)	82 (B)

Prevalence Index = B/A = 3.28

Hydrophytic Vegetation Indicators:

- – 1 - Rapid Test for Hydrophytic Vegetation
- – 2 - Dominance Test is >50%
- – 3 - Prevalence Index is ≤3.0[1]
- – 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- – 5 - Wetland Non-Vascular Plants[1]
- – Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:
*sampled entire plant community

SOIL

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-11.5	10YR 2/2	100%					sandy clay	moist.
11.5-20	10YR3/2	99%	10YR5/8	1%			sandy clay	hard, dry
20-28	10YR3/2	98%	10YR5/8	2%	C	M	sandy clay	hard, dry

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10)
- __ Red Parent Material (TF2)
- __ Very Shallow Dark Surface (TF12)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ____ **No** ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1)
- __ Sediment Deposits (B2)
- __ Drift Deposits (B3)
- __ Algal Mat or Crust (B4)
- __ Iron Deposits (B5)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Sparsely Vegetated Concave Surface (B8)
- __ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- __ Salt Crust (B11)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Stunted or Stressed Plants (D1) (**LRR A**)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Geomorphic Position (D2)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)
- __ Raised Ant Mounds (D6) (**LRR A**)
- __ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ______

Water Table Present? Yes ____ No ✓ Depth (inches): >28"

Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches): ______

Wetland Hydrology Present? **Yes** ____ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 5/13/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 2

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): Concave Slope (%): 1%

Subregion (LRR): D Lat: N 38.774002 Long: W 104.610502 Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ____	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____ No ✓	
Wetland Hydrology Present?	Yes ____ No ✓	

Remarks:
Moderate drought in area during assessment (drought.gov)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: *)	Absolute % Cover	Dominant Species?	Indicator Status
1. Elaeagnus angustifolia	90%	Y	FAC
2.			
3.			
4.			
	90% = Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
Herb Stratum (Plot size: *)			
1. Bassia scoparia	20%	Y	FAC
2. unidentifiable grass (warm season bunch grass)	20%	Y	NA
3. Convolvulus arvensis	10%	N	NI
4. Salsola tragus	5%	N	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	55% = Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum 45%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	110	x 3 = 330
FACU species	5	x 4 = 20
UPL species		x 5 =
Column Totals:	115 (A)	350 (B)

Prevalence Index = B/A = 3.04

Hydrophytic Vegetation Indicators:

- – 1 - Rapid Test for Hydrophytic Vegetation
- + 2 - Dominance Test is >50%
- – 3 - Prevalence Index is ≤3.0[1]
- – 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- – 5 - Wetland Non-Vascular Plants[1]
- – Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ____

Remarks:
* sampled entire plant community

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/2	100%					Sandy clay loam	mist
6-13	10YR 2/2	100%					clay	dry, moic compact, $CaCO_3$
13-21	10YR 3/2	99%	10YR 3/2	1%	C	PL	clay	moist
21-31	10YR 4/2	50%	~~10YR~~				clay	moist, $CaCO_3$.
	10YR 2/2	50%						
31-42	10YR 5/3	98%	10YR 5/8	2%	C	M	loamy sand	moist

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

– Histosol (A1)
– Histic Epipedon (A2)
– Black Histic (A3)
– Hydrogen Sulfide (A4)
– Depleted Below Dark Surface (A11)
– Thick Dark Surface (A12)
– Sandy Mucky Mineral (S1)
– Sandy Gleyed Matrix (S4)
– Sandy Redox (S5)
– Stripped Matrix (S6)
– Loamy Mucky Mineral (F1) (**except MLRA 1**)
– Loamy Gleyed Matrix (F2)
– Depleted Matrix (F3)
– Redox Dark Surface (F6)
– Depleted Dark Surface (F7)
– Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

– 2 cm Muck (A10)
– Red Parent Material (TF2)
– Very Shallow Dark Surface (TF12)
– Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ____

Depth (inches): ____

Hydric Soil Present? Yes ____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

– Surface Water (A1)
– High Water Table (A2)
– Saturation (A3)
– Water Marks (B1)
– Sediment Deposits (B2)
– Drift Deposits (B3)
– Algal Mat or Crust (B4)
– Iron Deposits (B5)
– Surface Soil Cracks (B6)
– Inundation Visible on Aerial Imagery (B7)
– Sparsely Vegetated Concave Surface (B8)
– Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
– Salt Crust (B11)
– Aquatic Invertebrates (B13)
– Hydrogen Sulfide Odor (C1)
– Oxidized Rhizospheres along Living Roots (C3)
– Presence of Reduced Iron (C4)
– Recent Iron Reduction in Tilled Soils (C6)
– Stunted or Stressed Plants (D1) (**LRR A**)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

– Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
– Drainage Patterns (B10)
– Dry-Season Water Table (C2)
– Saturation Visible on Aerial Imagery (C9)
+ Geomorphic Position (D2)
– Shallow Aquitard (D3)
– FAC-Neutral Test (D5)
– Raised Ant Mounds (D6) (**LRR A**)
– Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): >42"

Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches): >42"

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 5/13/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 3

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): drainage swale Local relief (concave, convex, none): concave Slope (%): 0-3%

Subregion (LRR): D Lat: N 38.777078 Long: W104.613583. Datum: WGS 84

Soil Map Unit Name: Ellicott loamy coarse sand NWI classification: R4SBA

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ✓	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____ No ✓	
Wetland Hydrology Present?	Yes ____ No ✓	

Remarks:
Moderate drought in area during assessment (drought.gov)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: *)			
1. Rosa woodsii	5%	Y	FACU
2.			
3.			
4.			
5.			
= Total Cover	5%		
Herb Stratum (Plot size: *)			
1. unidentifiable grass (no reproductive structures)	40%	Y	NA
2. Bassia scoparia	30%	Y	FAC
3. Rumex crispus	5%	N	FAC
4. Salsola tragus	5%	N	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80%		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 20%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	35	x 3 = 105
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	45 (A)	145 (B)

Prevalence Index = B/A = 3.22

Hydrophytic Vegetation Indicators:

– 1 - Rapid Test for Hydrophytic Vegetation
– 2 - Dominance Test is >50%
– 3 - Prevalence Index is ≤3.0[1]
– 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
– 5 - Wetland Non-Vascular Plants[1]
– Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:
* sampled entire plant community

SOIL

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10 YR 4/2	100%					Sandy loam	
3-12	10 YR 4/2	100%					Sandy loam, moist.	
12-20	10 YR 5/4	99%	10YR 3/6	1%	C	PL	loamy sand moist	
20-33	10 YR 5/4	100%					sand.	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- __ 2 cm Muck (A10)
- __ Red Parent Material (TF2)
- __ Very Shallow Dark Surface (TF12)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1)
- __ Sediment Deposits (B2)
- __ Drift Deposits (B3)
- __ Algal Mat or Crust (B4)
- __ Iron Deposits (B5)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Sparsely Vegetated Concave Surface (B8)
- __ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- __ Salt Crust (B11)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Stunted or Stressed Plants (D1) (**LRR A**)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Geomorphic Position (D2)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)
- __ Raised Ant Mounds (D6) (**LRR A**)
- __ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ______

Water Table Present? Yes ____ No ✓ Depth (inches): >52"

Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches): >52"

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 5/14/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 4

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): flat w/in trib. boundary Local relief (concave, convex, none): none Slope (%): 0%

Subregion (LRR): D Lat: N 38°46.414' Long: W104°36.626 Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No ✓ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ___ No ✓	Is the Sampled Area within a Wetland? Yes ___ No ✓
Hydric Soil Present?	Yes ___ No ✓	
Wetland Hydrology Present?	Yes ___ No ✓	

Remarks:
Moderate drought in area during assessment (drought.gov)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: *)			
1. Bassia scoparia	40%	Y	FAC
2. Convolvulus arvensis	40%	Y	NI
3. Chenopodium album	10%	N	FACU
4. unidentifiable grass (no reproductive structures)	5%	N	NA
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	95%		
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 5%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	40	x 3 = 120
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	50 (A)	160 (B)

Prevalence Index = B/A = 3.20

Hydrophytic Vegetation Indicators:

- – 1 - Rapid Test for Hydrophytic Vegetation
- – 2 - Dominance Test is >50%
- – 3 - Prevalence Index is ≤3.0[1]
- – 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- – 5 - Wetland Non-Vascular Plants[1]
- – Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ___ No ✓

Remarks:
* sampled entire plant community

SOIL

Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/2	100%	-				sandy loam	dry
3-9.5	10YR 2/2	100%					sandy clay loam	moist.
9.5-38	10YR 2/2	99%	10YR 3/6	1%	C	PL	sandy clay loam	compacted, dry

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

_ Histosol (A1)
_ Histic Epipedon (A2)
_ Black Histic (A3)
_ Hydrogen Sulfide (A4)
_ Depleted Below Dark Surface (A11)
_ Thick Dark Surface (A12)
_ Sandy Mucky Mineral (S1)
_ Sandy Gleyed Matrix (S4)
_ Sandy Redox (S5)
_ Stripped Matrix (S6)
_ Loamy Mucky Mineral (F1) **(except MLRA 1)**
_ Loamy Gleyed Matrix (F2)
_ Depleted Matrix (F3)
_ Redox Dark Surface (F6)
_ Depleted Dark Surface (F7)
_ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

_ 2 cm Muck (A10)
_ Red Parent Material (TF2)
_ Very Shallow Dark Surface (TF12)
_ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? **Yes** ___ **No** ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

_ Surface Water (A1)
_ High Water Table (A2)
_ Saturation (A3)
_ Water Marks (B1)
_ Sediment Deposits (B2)
_ Drift Deposits (B3)
_ Algal Mat or Crust (B4)
_ Iron Deposits (B5)
_ Surface Soil Cracks (B6)
_ Inundation Visible on Aerial Imagery (B7)
_ Sparsely Vegetated Concave Surface (B8)
_ Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
_ Salt Crust (B11)
_ Aquatic Invertebrates (B13)
_ Hydrogen Sulfide Odor (C1)
_ Oxidized Rhizospheres along Living Roots (C3)
_ Presence of Reduced Iron (C4)
_ Recent Iron Reduction in Tilled Soils (C6)
_ Stunted or Stressed Plants (D1) **(LRR A)**
_ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

_ Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
_ Drainage Patterns (B10)
_ Dry-Season Water Table (C2)
_ Saturation Visible on Aerial Imagery (C9)
_ Geomorphic Position (D2)
_ Shallow Aquitard (D3)
_ FAC-Neutral Test (D5)
_ Raised Ant Mounds (D6) **(LRR A)**
_ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ___ No ✓ Depth (inches): ~~38~~
Water Table Present? Yes ___ No ✓ Depth (inches): >38''
Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ______

Wetland Hydrology Present? **Yes** ___ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 5/14/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 5

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): 0-5

Subregion (LRR): D Lat: 38°46.413 N Long: W104°36.647 Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ✓ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✓
Hydric Soil Present?		✓
Wetland Hydrology Present?	✓	

Is the Sampled Area within a Wetland? Yes ____ No ✓

Remarks:
Moderate drought in area during assessment (drought.gov)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
= Total Cover			
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
= Total Cover			
Herb Stratum (Plot size: *)			
1. unidentifiable grass (no reproductive structures)	40%	Y	NA
2. Convolvulus arvensis	20%	Y	NI
3. Chenopodium album	10%	N	FACU
4. Bassia scoparia	10%	N	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	80%		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
= Total Cover			

% Bare Ground in Herb Stratum 20%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	10	x 3 = 30
FACU species	10	x 4 = 40
UPL species		x 5 =
Column Totals:	20 (A)	70 (B)

Prevalence Index = B/A = 3.5

Hydrophytic Vegetation Indicators:

- – 1 - Rapid Test for Hydrophytic Vegetation
- – 2 - Dominance Test is >50%
- – 3 - Prevalence Index is ≤3.0[1]
- – 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- – 5 - Wetland Non-Vascular Plants[1]
- – Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:
* sampled entire plant community

SOIL

Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4.5	10YR 2/2						sandy clay	moist
4.5-7.5	10YR 2/2	98%	7.5YR 3/4	2%	C	PL	sandy clay	composite
7.5-11	10YR 2/2	97%	7.5YR 3/4	3%	C	PL	sandy clay	
11-19	10YR 2/2	97%	10YR 3/6	3%	C	M	sandy clay	dry
19-21	10YR 3/1	93%	10YR 3/6	7%	C	M	sandy clay	
21-22	10YR 5/4	95%	10YR 3/6	5%	C	M	sandy loam	
22-38	10YR 5/4	100%					sandy loam	dry

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1) (**except MLRA 1**)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- 2 cm Muck (A10)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- + Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Stunted or Stressed Plants (D1) (**LRR A**)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Saturation Visible on Aerial Imagery (C9)
- + Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Raised Ant Mounds (D6) (**LRR A**)
- Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ____	No ✓	Depth (inches): ____
Water Table Present?	Yes ____	No ✓	Depth (inches): >38"
Saturation Present? (includes capillary fringe)	Yes ____	No ✓	Depth (inches): >38"

Wetland Hydrology Present? Yes ✓ No ~~JBT~~

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 8/7/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 6

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S12 T15S R65W

Landform (hillslope, terrace, etc.): drainage channel for onsite well Local relief (concave, convex, none): concave Slope (%): 0-2%

Subregion (LRR): D Lat: N38° 45.642' Long: W104° 37.478' Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ___	Is the Sampled Area within a Wetland? Yes ✓ No ___
Hydric Soil Present?	Yes ✓ No ___	
Wetland Hydrology Present?	Yes ✓ No ___	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ___)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum (Plot size: ___)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum (Plot size: *)			
1. Hordeum jubatum	30	Y	FAC
2. Bassia scoparia	30	Y	FAC
3. Chenopodium album	15	N	FACU
4. Cirsium arvense	2	N	FAC
5. Convolvulus arvensis	2	N	NI
6. Cuscuta approximata	2	N	NI
7. Rumex crispus	1	N	FAC
8. Andropogon gerardii	1	N	FACU
9. Helianthus annus	1	N	FACU
10. Verbesina encelioides	1	N	FACU
11.			
	85	= Total Cover	
Woody Vine Stratum (Plot size: ___)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum 20%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	63	x 3 = 189
FACU species	18	x 4 = 72
UPL species	0	x 5 = 0
Column Totals:	81 (A)	261 (B)

Prevalence Index = B/A = 3.22

Hydrophytic Vegetation Indicators:

- – 1 - Rapid Test for Hydrophytic Vegetation
- + 2 - Dominance Test is >50%
- – 3 - Prevalence Index is ≤3.0[1]
- – 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- – 5 - Wetland Non-Vascular Plants[1]
- – Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ✓ No ___

Remarks:
* Sampled entire plant community

Sampling Point: 6

SOIL

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/2	100					Sandy loam	
4-6	10YR 2/2	97	10YR 3/6	3%	C	PL	↓	Prominent
6-12	10YR 2/2	95	10YR 3/6	5%	C	PL	↓	
12-16	10YR 3/2	98	10YR 3/6	2	C	PL	~~[illegible]~~	
16-22	10YR 3/2	97	10YR 4/6	3%			Sandy Clay	prom.
22-27	10YR 4/2	95	10YR 4/6	5%	C	PL	sandy clay loam	
27-30	10YR 4/2	99	10YR 4/6	1%	C	M	loamy sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- – Histosol (A1)
- – Histic Epipedon (A2)
- – Black Histic (A3)
- – Hydrogen Sulfide (A4)
- – Depleted Below Dark Surface (A11)
- – Thick Dark Surface (A12)
- – Sandy Mucky Mineral (S1)
- – Sandy Gleyed Matrix (S4)
- – Sandy Redox (S5)
- – Stripped Matrix (S6)
- – Loamy Mucky Mineral (F1) **(except MLRA 1)**
- – Loamy Gleyed Matrix (F2)
- – Depleted Matrix (F3)
- + Redox Dark Surface (F6)
- – Depleted Dark Surface (F7)
- – Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- – 2 cm Muck (A10)
- – Red Parent Material (TF2)
- – Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ No ______

Remarks: ≤3/≤2 5% dist/prom redox in upper 12"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- + Surface Water (A1)
- – High Water Table (A2)
- – Saturation (A3)
- – Water Marks (B1)
- – Sediment Deposits (B2)
- – Drift Deposits (B3)
- + Algal Mat or Crust (B4)
- – Iron Deposits (B5)
- + Surface Soil Cracks (B6)
- – Inundation Visible on Aerial Imagery (B7)
- – Sparsely Vegetated Concave Surface (B8)
- – Water-Stained Leaves (B9) **(except MLRA 1, 2, 4A, and 4B)**
- – Salt Crust (B11)
- – Aquatic Invertebrates (B13)
- – Hydrogen Sulfide Odor (C1)
- + Oxidized Rhizospheres along Living Roots (C3)
- – Presence of Reduced Iron (C4)
- – Recent Iron Reduction in Tilled Soils (C6)
- – Stunted or Stressed Plants (D1) **(LRR A)**
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- – Water-Stained Leaves (B9) **(MLRA 1, 2, 4A, and 4B)**
- – Drainage Patterns (B10)
- – Dry-Season Water Table (C2)
- – Saturation Visible on Aerial Imagery (C9)
- + Geomorphic Position (D2)
- – Shallow Aquitard (D3)
- – FAC-Neutral Test (D5)
- – Raised Ant Mounds (D6) **(LRR A)**
- – Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present?	Yes ✓	No ___	Depth (inches): 0-11"
Water Table Present?	Yes ___	No ___	Depth (inches): >48 w/sp
Saturation Present? (includes capillary fringe)	Yes ___	No ___	Depth (inches): >48

Wetland Hydrology Present? Yes ✓ No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 8/7/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 7

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S12T15S R65W

Landform (hillslope, terrace, etc.): end of drainage channel. Local relief (concave, convex, none): none-concave Slope (%): 2-3%

Subregion (LRR): D Lat: N 38° 45.625' Long: W 104° 37.456' Datum: WGS 84

Soil Map Unit Name: Sampson Loam NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ✓	Is the Sampled Area within a Wetland? Yes ____ No ✓
Hydric Soil Present?	Yes ____ No ✓	
Wetland Hydrology Present?	Yes ____ No ✓	

Remarks:
No drought at time of assessment in El Paso (drought.gov)

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum (Plot size: *)			
1. Bouteloua gracilis	30%	Y	NI
2. Bassia scoparia	30%	Y	FAC
3. Chenopodium album	20%	N	FACU
4. Cuscuta ~~campestris~~ approximata	10%	N	NI
5. Poa annua	10%	N	FAC
6. Panicum miliaceum	5%	N	NI
7. Helianthus annuus	2%	N	FACU
8. Verbesina encelioides	2%	N	FACU
9. Pascopyrum smithii	1%	N	FACU
10.			
11.			
	110	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	0	x 1 = 0
FACW species	0	x 2 = 0
FAC species	40	x 3 = 120
FACU species	25	x 4 = 100
UPL species	0	x 5 = 0
Column Totals:	65 (A)	225 (B)

Prevalence Index = B/A = 3.46

Hydrophytic Vegetation Indicators:

- – 1 - Rapid Test for Hydrophytic Vegetation
- – 2 - Dominance Test is >50%
- – 3 - Prevalence Index is ≤3.0[1]
- – 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- – 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:
*Sampled entire plant community

SOIL

Sampling Point: 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-9	10YR2/2	100%					silty clay (Barn)	
9-16	10YR2/2	99%	10YR3/6	1%	C	PL	sandy loam	prom
16-30	10YR2/2	99%	10YR3/6	1%	C	M	clay loam	calcium deposits

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- — Histosol (A1)
- — Histic Epipedon (A2)
- — Black Histic (A3)
- — Hydrogen Sulfide (A4)
- — Depleted Below Dark Surface (A11)
- — Thick Dark Surface (A12)
- — Sandy Mucky Mineral (S1)
- — Sandy Gleyed Matrix (S4)
- — Sandy Redox (S5)
- — Stripped Matrix (S6)
- — Loamy Mucky Mineral (F1) (**except MLRA 1**)
- — Loamy Gleyed Matrix (F2)
- — Depleted Matrix (F3)
- — Redox Dark Surface (F6)
- — Depleted Dark Surface (F7)
- — Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- — 2 cm Muck (A10)
- — Red Parent Material (TF2)
- — Very Shallow Dark Surface (TF12)
- — Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- — Surface Water (A1)
- — High Water Table (A2)
- — Saturation (A3)
- — Water Marks (B1)
- — Sediment Deposits (B2)
- — Drift Deposits (B3)
- — Algal Mat or Crust (B4)
- — Iron Deposits (B5)
- — Surface Soil Cracks (B6)
- — Inundation Visible on Aerial Imagery (B7)
- — Sparsely Vegetated Concave Surface (B8)
- — Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- — Salt Crust (B11)
- — Aquatic Invertebrates (B13)
- — Hydrogen Sulfide Odor (C1)
- — Oxidized Rhizospheres along Living Roots (C3)
- — Presence of Reduced Iron (C4)
- — Recent Iron Reduction in Tilled Soils (C6)
- — Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- — Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- — Drainage Patterns (B10)
- — Dry-Season Water Table (C2)
- — Saturation Visible on Aerial Imagery (C9)
- — Geomorphic Position (D2)
- — Shallow Aquitard (D3)
- — FAC-Neutral Test (D5)
- — Raised Ant Mounds (D6) (**LRR A**)
- — Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ______

Water Table Present? Yes ____ No ✓ Depth (inches): >30"

Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches): ______

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Rolling Hills - East Tributary to Jimmy Camp Creek City/County: Colorado Springs - El Paso County Sampling Date: 8/8/21

Applicant/Owner: Murray Fountain LLC State: CO Sampling Point: 8

Investigator(s): T. Walsh and A. Davis Section, Township, Range: S1 T15S R65W

Landform (hillslope, terrace, etc.): ~~[illegible]~~ w/in trib. boundary Local relief (concave, convex, none): none Slope (%): 0-2%

Subregion (LRR): D Lat: 38°45.735' Long: W104°37.478' Datum: WGS 84

Soil Map Unit Name: Sampson loam NWI classification: R4SBC

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ✓	Is the Sampled Area within a Wetland?	Yes ____ No ✓
Hydric Soil Present?	Yes ____ No ✓		
Wetland Hydrology Present?	Yes ____ No ✓		

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
		= Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
Herb Stratum (Plot size: 2)			
1. Bouteloua gracilis	60%	Y	NI
2. Chenopodium album	20%	Y	FACU
3. Amaranthus retroflexus	20%	Y	FACU
4. ~~Chamomilla suaveolens~~ Matricaria discoidea BTW	10%	N	~~NI~~ FACU BTW
5. Bassia scoparia	5%	N	FAC
6. Verbesina ~~occidentalis~~ BTW encelioides	3%	N	FACU
7. Rumex crispus	2%	N	FAC
8. Convolvulus arvensis	1%	N	NI
9. Cirsium arvense	1%	N	FAC
10.			
11.			
	112	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	8	x 3 = 24
FACU species	53	x 4 = 212 BTW
UPL species		x 5 =
Column Totals:	61 (A)	236 (B)

Prevalence Index = B/A = 3.87

Hydrophytic Vegetation Indicators:

- – 1 - Rapid Test for Hydrophytic Vegetation
- – 2 - Dominance Test is >50%
- – 3 - Prevalence Index is ≤3.0[1]
- – 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- – 5 - Wetland Non-Vascular Plants[1]
- – Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ____ No ✓

Remarks:

SOIL

Sampling Point: 8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-13	10YR 2/2	100%					clay loam	dry
13-30	10YR 3/2	100%					silty loam	
30-48	10YR 3/2	100%					sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1) (**except MLRA 1**)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- 2 cm Muck (A10)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ____ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Stunted or Stressed Plants (D1) (**LRR A**)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)
- Raised Ant Mounds (D6) (**LRR A**)
- Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ____ No ✓ Depth (inches): ______

Water Table Present? Yes ____ No ____ Depth (inches): >48"

Saturation Present? (includes capillary fringe) Yes ____ No ____ Depth (inches): >48"

Wetland Hydrology Present? Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Appendix E

NRCS Web Soil Survey

United States Department of Agriculture

NRCS

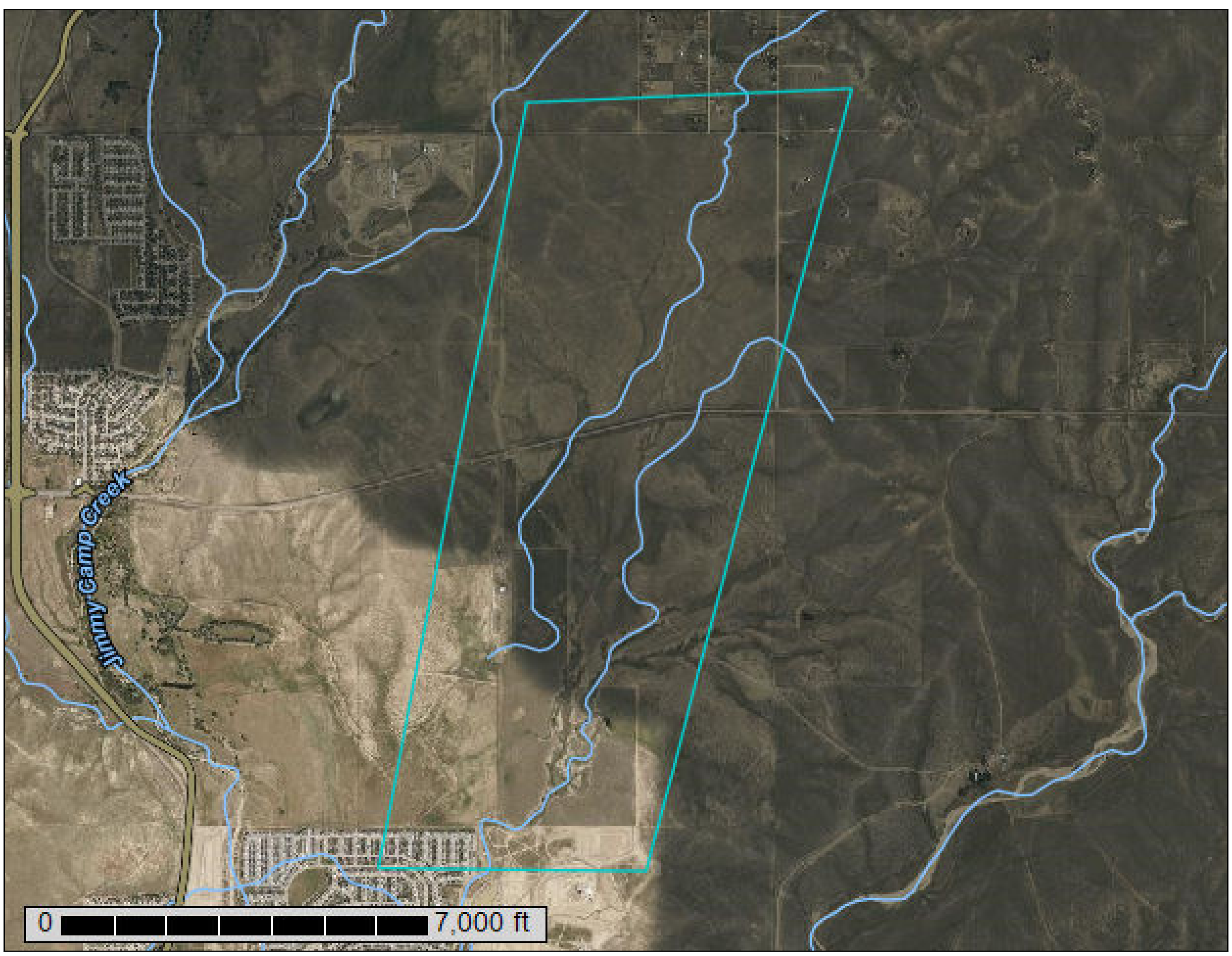
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

El Paso County Area, Colorado

Rolling Meadows



August 2, 2022

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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Contents

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 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.

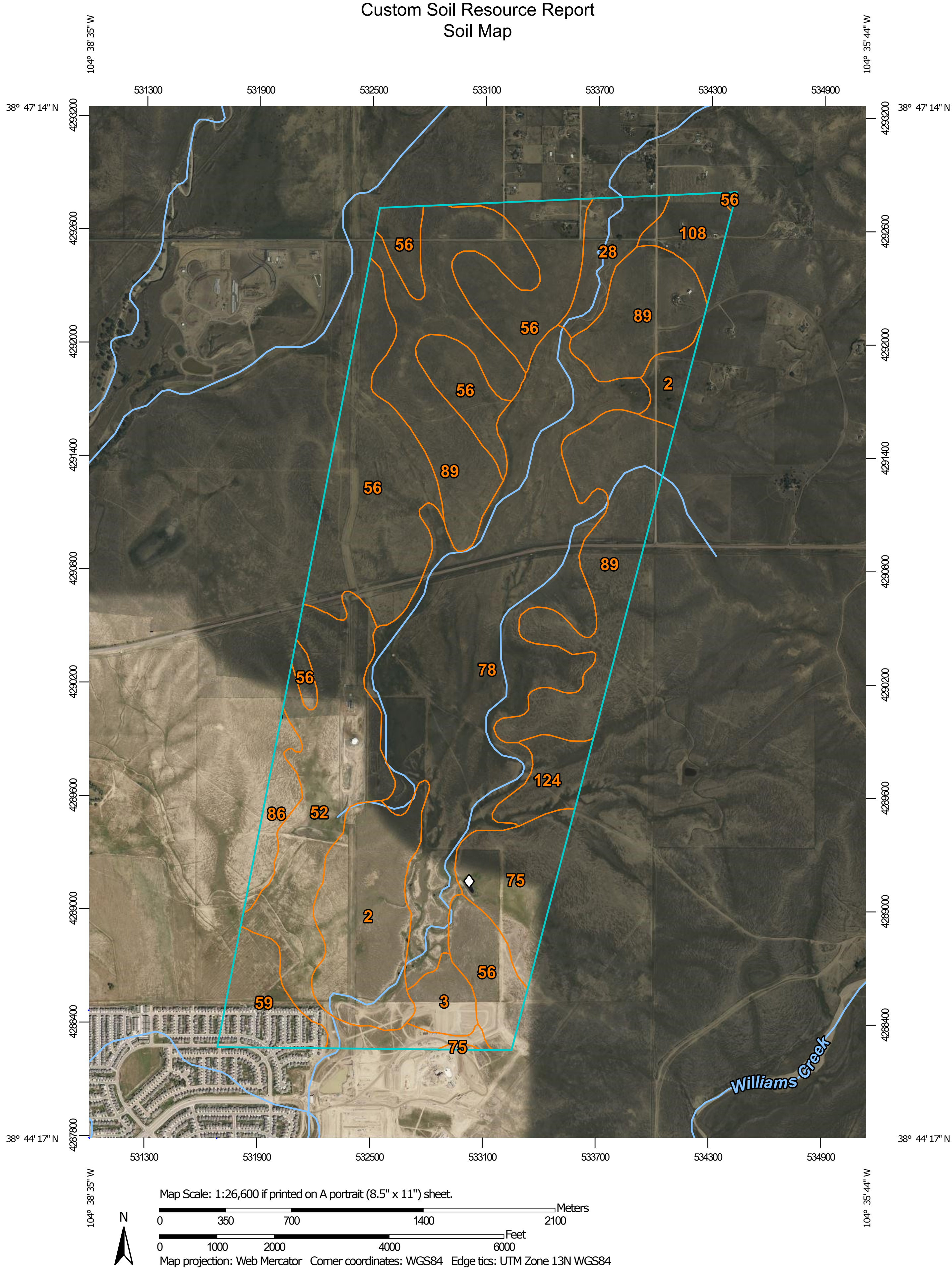
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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 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



Map Scale: 1:26,600 if printed on A portrait (8.5" x 11") sheet.

0 350 700 1400 2100 Meters

0 1000 2000 4000 6000 Feet

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

MAP LEGEND

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

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

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

Water Features
Streams and Canals

Transportation
Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background
Aerial Photography

MAP INFORMATION

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Aug 14, 2018—Oct 20, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Ascalon sandy loam, 1 to 3 percent slopes	154.3	8.0%
3	Ascalon sandy loam, 3 to 9 percent slopes	27.3	1.4%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	44.5	2.3%
52	Manzanst clay loam, 0 to 3 percent slopes	206.2	10.7%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	375.2	19.5%
59	Nunn clay loam, 0 to 3 percent slopes	53.1	2.8%
75	Razor-Midway complex	78.1	4.1%
78	Sampson loam, 0 to 3 percent slopes	477.5	24.9%
86	Stoneham sandy loam, 3 to 8 percent slopes	29.2	1.5%
89	Tassel fine sandy loam, 3 to 18 percent slopes	404.6	21.1%
108	Wiley silt loam, 3 to 9 percent slopes	35.6	1.9%
124	Olnest sandy loam, 0 to 3 percent slopes	35.7	1.9%
Totals for Area of Interest		**1,921.3**	**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, 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

2—Ascalon sandy loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367q
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ascalon and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium and/or eolian deposits

Typical profile

A - 0 to 8 inches: sandy loam
Bt - 8 to 21 inches: sandy clay loam
BC - 21 to 27 inches: sandy loam
Ck1 - 27 to 48 inches: sandy loam
Ck2 - 48 to 60 inches: loamy sand

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R069XY026CO - Sandy Plains LRU's A and B
Other vegetative classification: SANDY PLAINS (069BY026CO)
Hydric soil rating: No

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

3—Ascalon sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2tlny
Elevation: 3,870 to 5,960 feet
Mean annual precipitation: 13 to 18 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 95 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ascalon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind-reworked alluvium and/or calcareous sandy eolian deposits

Typical profile

Ap - 0 to 6 inches: sandy loam
Bt1 - 6 to 12 inches: sandy clay loam
Bt2 - 12 to 19 inches: sandy clay loam
Bk1 - 19 to 35 inches: fine sandy loam
Bk2 - 35 to 80 inches: fine sandy loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 5.98 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline (0.1 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Minor Components

Olnest

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Vona

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

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

Map Unit Setting

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

Map Unit Composition

Ellicott and similar soils: 97 percent
Minor components: 3 percent

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

Description of Ellicott

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

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

Minor Components

Fluvaquentic haplaquoll

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

52—Manzanst clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2w4nr
Elevation: 4,060 to 6,660 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Manzanst and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manzanst

Setting

Landform: Terraces, drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear, concave
Parent material: Clayey alluvium derived from shale

Typical profile

A - 0 to 3 inches: clay loam
Bt - 3 to 12 inches: clay
Btk - 12 to 37 inches: clay
Bk1 - 37 to 52 inches: clay
Bk2 - 52 to 79 inches: clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 3 percent
Maximum salinity: Slightly saline (4.0 to 7.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: C

Ecological site: R067BY037CO - Saline Overflow
Hydric soil rating: No

Minor Components

Ritoazul

Percent of map unit: 7 percent
Landform: Drainageways, interfluves
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY042CO - Clayey Plains
Hydric soil rating: No

Arvada

Percent of map unit: 6 percent
Landform: Drainageways, interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY033CO - Salt Flat
Hydric soil rating: No

Wiley

Percent of map unit: 2 percent
Landform: Interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY002CO - Loamy Plains
Hydric soil rating: No

56—Nelson-Tassel fine sandy loams, 3 to 18 percent slopes

Map Unit Setting

National map unit symbol: 3690
Elevation: 5,600 to 6,400 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Nelson and similar soils: 55 percent
Tassel and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nelson

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, crest

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from interbedded sedimentary rock

Typical profile

A - 0 to 5 inches: fine sandy loam
Ck - 5 to 23 inches: fine sandy loam
Cr - 23 to 27 inches: weathered bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R067BY045CO - Shaly Plains
Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Description of Tassel

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous slope alluvium over residuum weathered from sandstone

Typical profile

A - 0 to 4 inches: fine sandy loam
C - 4 to 10 inches: fine sandy loam
Cr - 10 to 14 inches: weathered bedrock

Properties and qualities

Slope: 3 to 18 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: R067BY045CO - Shaly Plains
Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

59—Nunn clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3693
Elevation: 5,400 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Nunn and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nunn

Setting

Landform: Fans, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

A - 0 to 12 inches: clay loam
Bt - 12 to 26 inches: clay loam
BC - 26 to 30 inches: clay loam
Bk - 30 to 58 inches: sandy clay loam

C - 58 to 72 inches: clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: R069XY042CO - Clayey Plains LRU's A and B
Other vegetative classification: CLAYEY PLAINS (069AY042CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

75—Razor-Midway complex

Map Unit Setting

National map unit symbol: 369p
Elevation: 5,300 to 6,100 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Razor and similar soils: 60 percent
Midway and similar soils: 35 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Razor

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, concave
Across-slope shape: Linear
Parent material: Clayey slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 4 inches: stony clay loam
Bw - 4 to 22 inches: cobbly clay loam
Bk - 22 to 29 inches: cobbly clay
Cr - 29 to 33 inches: weathered bedrock

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 5 percent
Maximum salinity: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R069XY047CO - Alkaline Plains LRU's A and B
Other vegetative classification: ALKALINE PLAINS (069AY047CO)
Hydric soil rating: No

Description of Midway

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 4 inches: clay loam
C - 4 to 13 inches: clay
Cr - 13 to 17 inches: weathered bedrock

Properties and qualities

Slope: 3 to 25 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Drainage class: Well drained

Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Gypsum, maximum content: 15 percent
Maximum salinity: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water supply, 0 to 60 inches: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R069XY046CO - Shaly Plains LRU's A and B
Other vegetative classification: SHALY PLAINS (069AY045CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

78—Sampson loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 369s
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Sampson and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sampson

Setting

Landform: Depressions, alluvial fans, terraces

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

Typical profile

A - 0 to 15 inches: loam
Bt - 15 to 34 inches: clay loam
Bk - 34 to 60 inches: sandy clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: R049XB202CO - Loamy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

86—Stoneham sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 36b2
Elevation: 5,100 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Stoneham and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stoneham

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous loamy alluvium

Typical profile

A - 0 to 4 inches: sandy loam
Bt - 4 to 8 inches: sandy clay loam
Btk - 8 to 11 inches: sandy clay loam
Ck - 11 to 60 inches: loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R067BY024CO - Sandy Plains
Other vegetative classification: SANDY PLAINS (069AY026CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

89—Tassel fine sandy loam, 3 to 18 percent slopes

Map Unit Setting

National map unit symbol: 36b5
Elevation: 5,600 to 6,400 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 51 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Tassel and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tassel

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous slope alluvium over residuum weathered from sandstone

Typical profile

A - 0 to 4 inches: fine sandy loam
C - 4 to 10 inches: sandy loam
Cr - 10 to 14 inches: weathered bedrock

Properties and qualities

Slope: 3 to 18 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: R067BY024CO - Sandy Plains
Other vegetative classification: SANDY PLAINS (069AY026CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 5 percent
Hydric soil rating: No

108—Wiley silt loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 367b
Elevation: 5,200 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Wiley and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wiley

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty eolian deposits

Typical profile

A - 0 to 4 inches: silt loam
Bt - 4 to 16 inches: silt loam
Bk - 16 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R067BY002CO - Loamy Plains
Other vegetative classification: LOAMY PLAINS (069AY006CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

124—Olnest sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2t51j
Elevation: 4,500 to 6,100 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Olnest and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Olnest

Setting

Landform: Sand sheets
Parent material: Eolian sands

Typical profile

A - 0 to 4 inches: sandy loam
Bt - 4 to 20 inches: sandy clay loam
Bk1 - 20 to 48 inches: sandy loam
Bk2 - 48 to 79 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 14 percent
Maximum salinity: Very slightly saline (2.0 to 3.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: B
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Minor Components

Udic haplusterts, ponded

Percent of map unit: 5 percent
Landform: Closed depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R067BY010CO - Closed Upland Depression
Hydric soil rating: No

Otero

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

Vona

Percent of map unit: 5 percent
Landform: Sand sheets
Ecological site: R067BY024CO - Sandy Plains
Hydric soil rating: No

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Appendix F

Draft Geotechnical Report

Architectural
Structural
Geotechnical

RMG
Engineers / Architects

Materials Testing
Forensic
Civil/Planning

SOILS AND GEOLOGY STUDY

Rolling Meadows
Bradley Road
El Paso County, Colorado

PREPARED FOR:

Landhuis Company
212 N. Wahsatch Ave. Ste 301
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JOB NO. 187746

August 5, 2022

Respectfully Submitted,

RMG – Rocky Mountain Group

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Reviewed by,

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TABLE OF CONTENTS

FIGURES

1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in Section 1, Section 12, the east and southeast portion of Section 2, and the northeast ¼ of Section 11 and Section 13, Township 15 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

1.2 Existing Land Use

The site is to be comprised of 18 existing parcels. The total area of the proposed site is to be approximately 1,564 acres, as denoted on the *Overall Conceptual Layout* provided by Matrix, dated October 25, 2021. The parcels included are:

- El Paso County Parcel No. 5500000385. This parcel currently consists of a total of approximately 802.42 acres and is currently undeveloped.
- El Paso County Parcel No. 5500000383. This parcel currently consists of a total of approximately of 124.76 acres and is currently undeveloped.
- El Paso County Parcel No. 5500000324. This parcel currently consists of a total of approximately 593.51 acres and is currently undeveloped.
- Power line easement and open space parcels range in order from El Paso County Parcel No. 5500000314 to 5500000323 and 5500000325 to 5500000329. These parcels consist of a total of approximately 43.31 acres and contain the existing overhead power lines that traverse the property from southeast to northwest.

The parcel is to maintain the current zoning "PUD" (Planned Unit Development), but a transition from PUD to PUDSP has been requested. It is our understanding the name of the subdivision is to be Rolling Meadows.

1.3 Project Description

The proposed site development is to consist of approximately 7,785 residential units, comprised of a mixture of single-family to multi-family structures. The lots reportedly are to range from 2,975 to 6,600 square feet. Entrance into the subdivision is to be provided from the east and west by the existing Bradley Road by extending the existing Meridian Road, and from the north by the existing Drennan Road. Additional proposed land usage includes four elementary schools, one middle school, fire station, substations, parks, detention ponds, power line and open space easements, floodplain/channel easements, and a water tank. It is our understanding the existing powerline easement is to remain an open space. The Test Boring Location Plan is presented in Figure 2.

The streets within the subdivision are to be planned as Residential Collector with 60' R.O.W, and a Non-Residential Collector with an 80' R.O.W and constructed to El Paso County standards. Drennan Road and Meridian Road are planned as Collector Roads in EPC 2040 MTCP. Bradley Road is planned as Minor Arterial in EPC 2040 MTCP. The streets are to be maintained by El Paso County.

The development is to utilize sewer and water services provided by Widefield Water and Sanitation District. Neither individual wells nor on-site wastewater treatment systems are proposed.

2.0 QUALIFICATIONS OF PREPARERS

This Soils and Geology Study was prepared by a professional geologist as defined by Colorado Revised Statures section 34-1-201(3) and by a qualified geotechnical engineer as defined by policy statement 15, "Engineering in Designated Natural Hazards Areas" of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. (Ord. 96-74; Ord. 01-42)

The principle investigators for this study are Kelli Zigler P.G., and Tony Munger, P.E. Ms. Zigler is a Professional Geologist as defined by State Statute (C.R.S 34-1-201) with over 21 years of experience in the geological and geotechnical engineering field. Ms. Kelli Zigler holds a B.S. in Geology from the University of Tulsa. Ms. Zigler has supervised and performed numerous geological and geotechnical field investigations throughout Colorado.

Tony Munger is a licensed professional engineer with over 21 years of experience in the construction engineering (residential) field. Mr. Munger and holds a Bachelor of Science in Architectural Engineering from the University of Wyoming.

3.0 STUDY OVERVIEW

The purpose of this investigation is to characterize the general geotechnical and geologic site conditions, and present our opinions of the potential effect of these conditions on the proposed development of single-family residences within the referenced site. As such, our services exclude evaluation of the environmental and/or human, health-related work products or recommendations previously prepared, by others, for this project.

Revisions to the conclusions presented in this report may be issued based upon submission of the Development Plan. This study has been prepared in accordance with the requirements outlined in the El Paso County Land Development Code (LDC) specifically Chapter 8 last updated August 27, 2019 applicable sections include 8.4.8 and 8.4.9. and the Engineering Criteria Manual (ECM), specifically Appendix C last updated July 9, 2019.

This report presents the findings of the study performed by RMG relating to the geotechnical and geologic conditions of the above-referenced site. Revisions and modifications to the conclusions and recommendations presented in this report may be issued subsequently by RMG based upon additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report.

3.1 Scope and Objective

The scope of this study is to include a physical reconnaissance of the site and a review of pertinent, publically available documents including (but not limited to) previous geologic and geotechnical reports, overhead and remote sensing imagery, published geology and/or hazard maps, design documents, etc. Our services exclude the evaluation of the environmental and/or human, health-related work products or recommendations previously prepared, by others, for this project.

The objectives of our study are to:

- Identify geologic conditions that are present on this site,
- Analyze the potential negative impacts of these conditions on the proposed site development,
- Analyze the potential negative impacts to the surrounding properties and/or public services resulting from the proposed site development as it relates to existing geologic hazards,
- Provide our opinion of suitable techniques that may be utilized to mitigate the potential negative impacts identified herein.

This report presents the findings of the study performed by RMG relating to the geologic conditions of the above-referenced site. Revisions and modifications to this report may be issued subsequently by RMG, based upon:

- Additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report,
- Review of pertinent documents (development plans, plat maps, drainage reports/plans, etc.) not available at the time of this study,
- Comments received from the governing jurisdiction and/or their consultants subsequent to submission of this document.

3.2 Site Evaluation Techniques

The information included in this report has been compiled from:

- Field reconnaissance
- Geologic and topographic maps
- Review of selected publicly available, pertinent engineering reports
- Available aerial photographs
- Exploratory soil test borings by RMG
- Laboratory testing of representative site soil and rock samples by RMG
- Geologic research and analysis
- Site development plans prepared by others

Geophysical investigations were not considered necessary for characterization of the site geology. Monitoring programs, which typically include instrumentation and/or observations for changes in groundwater, surface water flows, slope stability, subsidence, and similar conditions, are not known to exist and were not considered applicable for the scope of this report.

3.3 Additional Documents

Additional documents reviewed during the performance of this study are included in Appendix A.

4.0 SITE CONDITIONS

4.1 Existing Site Conditions

The entire site is undeveloped. Overhead power lines that traverse the property from southeast to northwest are to reside within a power line easement, which is to be designated as open space. Construction of a water tank and detention pond was observed near the northern boundary off of Drennan Road at the time of site reconnaissance.

4.2 Topography

Based on our site reconnaissance and the 2022 USGS topographic maps of the Corral Bluffs, Elsmere, Fountain, and Fountain NE quadrangles, the site topography is generally flat with rolling hills. The elevation varies by approximately 147 feet across the site, sloping generally downwards from the northwest to the southeast.

4.3 Vegetation

The majority of the site consists of native prairie grasses and weeds, and generally remains in an undisturbed (native) state.

4.4 Aerial photographs and remote-sensing imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, CGS surficial geologic mapping, and historical photos by historicaerials.com dating back to 1947. Historically, the site has remained generally undisturbed since 1947. The construction of the overhead power lines occurred prior to 1969. Since 1969, the site has remained vacant.

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

The subsurface conditions within the property were explored by drilling a total of 70 exploratory test borings to depths of approximately 20 to 35 feet below the existing ground surface. The test boring locations are presented on the Test Boring Location Plan, Figure 2.

The number of borings is in excess of the minimum one test boring per 10 acres of development up to 100 acres and one additional boring for every 25 acres of development above 100 acres as required by the ECM, Section C.3.3.

The test borings were drilled with a power-driven, continuous-flight auger drill rig. Samples were obtained during drilling of the test boring in general accordance with ASTM D-1586 and D-3550, utilizing a 2-inch O.D. Split Barrel Sampler and a 2½-inch O.D. California sampler, respectively.

Results of the penetration tests are shown on the drilling logs. The proposed lot layout is shown on the Proposed Lot Layout, Figure 3. An Explanation of Test Boring Logs is shown in Figure 4, and the Test Boring Logs are shown in Figures 5 through 39.

5.1 Laboratory Testing

Soil laboratory testing was performed as part of this investigation. The laboratory tests included moisture content, dry density, grain-size analyses, Atterberg Limits and Swell/Consolidation tests. A Summary of Laboratory Test Results is presented in Figure 40. Soils Classification Data is presented in Figures 41 through 55. Swell/Consolidation Test Results are presented in Figures 56 through 78.

6.0 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

The site is located within the western flank of the Colorado Piedmont section of the Great Plains physiographic province. The Colorado Piedmont, formed during Late Tertiary and Early Quaternary time (approximately 2,000,000 years ago), is a broad, erosional trench which separates the Southern Rocky Mountains from the High Plains. During the Late Mesozoic and Early Cenozoic Periods (approximately 70,000,000 years ago), intense tectonic activity occurred, causing the uplifting of the Front Range and associated downwarping of the Denver Basin to the east. Relatively flat uplands and broad valleys characterize the present-day topography of the Colorado Piedmont in this region.

6.1 Subsurface Soil Conditions

The subsurface materials encountered in the test borings performed for this study were classified within the laboratory using the Unified Soil Classification System (USCS). The majority of the laboratory testing focused on the Swell/Consolidation test results for the subexcavation recommendations and limited classifications (gradations and atterberg limits) were completed on the clay and claystone materials. The soils were identified and classified as clayey sand (SC) , silty sand (SM), silty to clayey sand (SM-SC), sandy clay (CL), claystone, and sandstone.

Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented on the Test Boring Logs. The classifications shown on the logs are based upon the engineer’s classification of the samples at the depths indicated. Stratification lines shown on the logs represent the approximate boundaries between material types and the actual transitions may be gradual and vary with location.

6.2 Bedrock Conditions

In general, the bedrock (as mapped by Colorado Geologic Survey - CGS) beneath the site is considered to be part of the Pierre Shale formation. Bedrock was encountered in the majority of test borings performed for this investigation. Bedrock conditions are anticipated to be encountered in the excavations and utility trenches for the proposed development.

6.3 U.S. Soil Conservation Service

The U.S. Soil Conservation Service along with United States Department of Agriculture (USDA) has identified the soils on the property as:

- 56 – Nelson-Tassel fine sandy loam, 3 to 18 percent slopes. Properties of the sandy loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and/or ponding is none, and landforms include hills.

- 108 – Wiley silt loam, 3 to 9 percent slopes. Properties of the silt loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and/or ponding is none, and landforms include hills.
- 2 – Ascalon sandy loam, 1 to 3 percent slopes. Properties of the sandy loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be low, frequency of flooding and/or ponding is none, and landforms include flats.
- 28 – Ellicott loamy coarse sand, 0 to 5 percent slopes. Properties of the loamy coarse sand include, somewhat excessively drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be very low, frequency of flooding is frequent, frequency of ponding is none, and landforms include flood plains and stream terraces.
- 43 – Kim loam, 1 to 8 percent slopes. Properties of the loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and/or ponding is none, and landforms include fans and hills.
- 52 – Manzanst clay loam, 0 to 3 percent slopes. Properties of the clay loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, frequency of flooding and/or ponding is none, and landforms include terraces and drainageways.
- 75 – Razor-Midway Complex. Properties of the complex include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and/or ponding is none, and landforms include hills.
- 78 – Sampson loam, 0 to 3 percent slopes. Properties of the loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be low, frequency of flooding and/or ponding is none, and landforms include depressions, alluvial fans, and terraces.
- 86 – Stoneham sandy loam, 3 to 8 percent slopes. Properties of the sandy loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and/or ponding is none, and landforms include hills.
- 89 – Tassel fine sandy loam, 3 to 18 percent slopes. Properties of the fine sandy loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and/or ponding is none, and landforms include hills.

- 124 – Olnest sandy loam, 0 to 3 percent slopes. Properties of the sandy loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, Runoff is anticipated to be low, frequency of flooding and/or ponding is none, and landforms include sand sheets.

The USDA Soil Survey Map is presented in Figure 82 and the FEMA Map is presented in Figure 83.

6.4 General Geologic Conditions

Based on our field observations, the USDA map, the Geologic Map of the Corral Bluffs Quadrangle, the Geologic Map of the Pueblo 1-degree by 2-degrees Quadrangle, the Geologic Map of the Elsmere Quadrangle, and the Generalized Surficial Geologic Map of the Pueblo 1-degree by 2-degree Quadrangle, an interpreted geologic map of significant surficial deposits and features was mapped for the site. The identified geologic conditions affecting the development are presented in the General Geologic Map, Figure 81.

The site generally consists of alluvial sand, silt and clay deposits underlain by claystone bedrock of the Pierre Shale formation. 14 geologic units were mapped at the site as:

- *es* – Eolian sand
- *asa* – Alluvial sand, silt, clay, and gravel (post-Piney Creek alluvium, Piney Creek Alluvium, and pre-Piney Creek alluvium of Hunt, 1954, and Scott, 1960; Broadway Alluvium)
- *xch* – Clayey, calcareous disintegration residuum
- *Qam – Middle alluvium (Late Pleistocene)* – Light-brownish-gray, pale-brown, light-yellowish-brown, and grayish-brown, poorly sorted sand and subordinate amounts of gravel. Estimated thickness is 20-50 feet.
- *Qav – Valley-side alluvium, undivided (Holocene and late Pleistocene)* – Brown to light-yellowish-brown, extremely poorly sorted sand, silty and clayey sand, and minor amounts of mostly pebble-size gravel. Unit exists primarily on valley-side slopes and alluvial fans and consists of sheetwash and re-worked wind-deposited sediment. Estimated thickness is 3-25 feet.
- *Kpc – Cone-in-cone of Lavington (1933)* - Dark-gray clayey or silty shale containing reddish-brown siderite ironstone concretions, gray iron-stained limestone concretions, thin bentonite beds, and concretions with cone-in-cone structure.
- *Kpts – Lower part of upper transition member* – yellowish-gray, medium- to coarse-grained cross-bedded sandstone with thin shale interbeds.
- *Qay2 – Young alluvium two (late and middle? Holocene)* – Includes several thin beds and lenses of dark-grayish-brown to very dark-grayish-brown sediment. The unit blankets large areas on broad valley floors. Upper surface of unit is 15-20 feet higher than stream channels

in the southern part of the quadrangle. A very weak, 6 to 18 inch thick soil is developed in this unit. Unit is subject to infrequent large floods and is estimated to be 10-20 feet thick.

- *Qs – Slocum Alluvium (Sangamon Interglaciation or Illinoian Glaciation) –* Weathered gravel on cut surface about 100 feet above modern streams.

- *Kps – Pierre Shale, Sandstone at or just above base of upper transition member –* Grayish-yellow except light-yellowish-gray to dark-yellowish-orange in about lower 30 feet, medium- coarse-grained, some thin shale interbeds and laminae, mostly crossbedded. Unit is about 160 to 190 feet thick.

- *Kp – Pierre Shale, Main part of formation –* Shale, minor siltstone and sandstone beds, and thin concretionary limestone beds; marine fossils in some beds; mostly dark to light gray and olive gray. Poorly exposed in general. Unit is about 1,200 feet exposed in Elsmere quadrangle. Total formation thickness is about 5,000 feet.

- *Qpc – Piney Creek Alluvium –* Alluvial and pond or bog deposits. Mostly clayey sandy silt and silty sand; very clayey in pond and bog deposits, gravelly along main stream and in areas of high relief; yellowish-brown and brownish-gray to dark-yellowish-brown, commonly has alternating darker and lighter colored flat even beds a few inches to a foot thick. Thickness is generally 5 to 15 feet, maximum of 50 feet possible.

- *Qal – Alluvium* - Sand, gravel, and silt mainly in present stream channels but includes deposits that form terraces as much as 4 feet high; mostly grayish yellow. Thickness generally less than 25 feet.

- *Kpt – Pierre Shale, Main part of upper transition member* - Gray to yellowish-gray shale, siltstone, and thin beds of very fone- to fine-grained sandstone; beds of concretionary limestone or limestone concretions ½- to 1-foot thick dispersed throughout; small phosphate nodules locally. The unit is poorly exposed and is about 400 feet thick.

6.5 Structural Features

Structural features such as schistocity, folds, zones of contortion or crushing, joints, shear zones or faults were not observed on the site, in the surrounding area, or in the soil samples collected for laboratory testing.

6.6 Surficial (Unconsolidated) Deposits

Lake and pond sediments, swamp accumulations, sand dunes, marine terrace deposits, talus accumulations, creep, or slope wash were not observed on the site. Slump and slide debris were also not observed on the site.

6.7 Engineering Geology

Charles Robinson and Associates (1977) have mapped 16 environmental engineering units at the site as:

- 1A – Stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%).
- 2A – Stable alluvium, colluvium and bedrock on gentle to moderate slopes (5 to 12%).
- 2D – Eolian deposits generally on flat to gentle slopes of upland areas.
- 2E – Low terraces and valleys of minor tributary streams.
- 3B – Expansive and potentially expansive soil and bedrock on flat to moderate slopes (0-12%).
- 5D – Debris fans
- 7A – Physiographic floodplain where erosion and deposition presently occur and is generally subject to recurrent flooding. Includes 100-year floodplain along major streams where floodplain studies have been conducted.
- al – Alluvium
- a Qp – Piney Creek Alluvium
- Soil Conservation Service (SCS) Floodplain
- c Kp – Colluvium, Pierre Shale (locally subdivided)
- c Kps – Colluvium, Pierre Shale (locally subdivided)
- pfp – Physiographic Floodplain
- df – Debris Fan
- Qes – Eolian Sand
- p Qs – Slocum Alluvium

The potential geologic hazards and surficial deposits as mapped by Robinson and Associates is presented in the Engineering Map of Potential Geologic Hazards and Surficial Deposits, Figure 79. The environmental and engineering conditions as mapped by Robinson and Associates is presented in the Environmental and Engineering Geologic Map for Land Use, Figure 80.

6.8 Features of Special Significance

Features of special significance such as accelerated erosion, (advancing gully head, badlands, or cliff reentrants) were not observed on the property. Features indicating settlement or subsidence such as fissures, scarplets, and offset reference features were not observed on the property or surrounding areas.

Features indicating creep, slump, or slide masses in bedrock and surficial deposits were not observed on the property.

6.9 Drainage of Water and Groundwater

The overall topography varies by approximately 147 feet across the site, sloping generally downwards from the northwest to the southeast. It is anticipated the direction of groundwater is towards Jimmy Camp Creek located to the west of the site.

Groundwater was encountered in two test borings during the field exploration, test boring TB-11 and TB-15 at depths of 17 feet and 14 feet, respectively. Based on the water contents for the samples collected at the time of drilling, moistures were not elevated and do not indicate an elevated groundwater condition.
Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels. Based on our knowledge of the area and engineering design and construction techniques commonly employed in the El Paso County area at this time, it is our opinion that there is insufficient reason to preclude full-depth basements on any of the lots in this subdivision at this time.

7.0 ECONOMIC MINERAL RESOURCES

Under the provision of House Bill 1529, it was made a policy by the State of Colorado to preserve for extraction commercial mineral resources located in a populous county. Review of the *El Paso Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction*, *Map 1* indicates the site is identified as floodplain deposits consisting of sand and gravel with minor amounts of silt and clay deposited by water along present stream courses, valley fill consisting of sand and gravel with silt and clay deposited by water in one or a series of stream valleys, eolian deposits consisting of wind blown sand and upland deposits consisting of sand, gravel with silt and clay; remnants of older streams desisted on topographic highs or bench like features. The extraction of the clay and claystone resources are not considered to be economical compared to materials available elsewhere within the county.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*, the site is mapped within the southern part of the Denver Basin Coal Region with a tract identifier of 41-59. However, the area of the site does not contain coal resources. The tract is underlain primarily by the Pierre Shale of Cretaceous age. No wells are drilled within the tract. Grand Union Oil Company drilled a well in the vicinity of the tract to a depth of 1,250 feet in 1901. No shows of hydrocarbons were recorded. The well was plugged and abandoned. The sedimentary rocks in this area appear to contain all of the essential elements; however, existing geological control is insufficient to determine the presence of a trap or reservoir. The tract is not prospective for metallic mineral resources. There are no mines in the Pierre Shale within ten miles of the tract, but the tract has some potential to contain useful clay and shale resources.

8.0 IDENTIFICATION AND MITIGATION OF POTENTIAL GEOLOGIC CONDITIONS

The El Paso County Engineering Criteria Manual recognizes and delineates the difference between hazards and constraints. A geologic hazard is one of several types of adverse geologic conditions capable of causing significant damage or loss of property and life. Geologic hazards are defined in Section C.2.2 Sub-section E.1 of the ECM. A geologic constraint is one of several types of adverse geologic conditions capable of limiting or restricting construction on a particular site. Geologic constraints are defined in Section C.2.2 Sub-section E.2 of the ECM (1.15 Definitions of Specific Terms and Phrases). The following geologic constraints were considered in the preparation of this report, and are not are not anticipated to pose a significant risk to the proposed development:

- Avalanches
- Debris Flow-Fans/Mudslides
- Ground Subsidence
- Landslides
- Rockfall
- Groundwater Springs or Seeps
- Ponding water
- Steeply Dipping Bedrock
- Unstable or Potentially Unstable Slopes
- Scour, Erosion, Accelerated Erosion Along Creek Banks and Drainageways
- History of Landfill or Uncontrolled/Undocumented Fill Placement
- Valley Fill
- Downhill/Down-Slope Creep
- Soil Slumps and Undercutting
- Corrosive Minerals

The following sections present geologic constraints that have been identified on the property:

8.1 Expansive Soils and Bedrock

Shallow foundations are anticipated for the majority of the development, and it is our understanding a mass subexcavation is proposed for mitigation of unsuitable soils. Subexcavation and replacement with moisture-conditioned structural fill is a commonly utilized method of mitigating expansive soils. Based on the test borings performed by RMG for this investigation, the on-site soils and bedrock generally possess low to very high swell potential.

<u>Mitigation</u>
Our subexcavation recommendations are presented in Section **13.0 Subexcavation and Replacement** of this report.

Note, the recommended subexcavation and replacement process does not guarantee that the swell potential will be reduced to acceptable levels. It is possible that the expansive material will retain swell potential in excess of the allowable value presented herein, even after processing and moisture-conditioning. If (at the time of the lot-specific subsurface soil investigation and/or the open excavation observation) the soil is found to possess swell potential in excess of acceptable levels for the foundation system and design parameters proposed for construction at that time, overexcavation and replacement of some or all of the previously placed fill material may be required.

Provided that appropriate mitigations and/or foundation design adjustments are implemented, the presence of expansive soils or bedrock is not considered to pose a risk to the proposed structures.

8.2 Compressible Soils

Shallow foundations are anticipated for the majority of the development, and it is our understanding a mass subexcavation is proposed for mitigation of unsuitable soils. Subexcavation and replacement with moisture-conditioned structural fill is a commonly utilized method of mitigating expansive soils. Based on the test borings performed by RMG for this investigation, the on-site soils and bedrock generally possess low to moderate compressibility potential.

Mitigation
Our subexcavation recommendations are presented in Section **13.0 Subexcavation and Replacement** of this report.

If loose soils are encountered during the Open Excavation Observation, they may require additional compaction to achieve the allowable bearing pressure indicated in this report. Fluctuations in material density may occur. In some cases, removal and recompaction of up to 2 feet of soil may be required. The removal and recompaction shall extend a minimum of the same distance beyond the building perimeter, and at least that same distance beyond the perimeter of counterfort and "T" wall footings. The use of track-mounted excavation equipment, or other low ground pressure equipment, is recommended on loose soils to reduce the likelihood of loss of stability during excavation.

8.3 Shallow Groundwater Tables

Groundwater was encountered in TB-11 and TB-15 at depths of 17 feet and 14 feet, respectively. It is anticipated that groundwater will not affect shallow foundations for the structures or shallow buried utilities proposed on the site. Groundwater may affect areas depending upon grading cuts and within deeper excavations made for installation of utilities. It should be noted that groundwater levels, other than those observed at the time of the subsurface soil investigation, could change due to season variations, changes in land runoff characteristics and future development of nearby areas.

It should be noted that in granular soils and bedrock, some subsurface water conditions might be encountered due to the variability of the soil profile. Isolated sand and gravel layers within the soil, even those of limited thickness and width, can convey subsurface water. Subsurface water may also flow atop the interface between the upper soils and the underlying bedrock. While not indicative of a "groundwater" condition, these occurrences of subsurface water migration can (especially in times of heavy rainfall or snowmelt) result in water migration into the excavation or (once construction is complete) the building envelope. Builders and planners should be cognizant of the potential for the occurrence of subsurface water conditions during on-site construction, and be prepared to evaluate and mitigate each individual occurrence as necessary.

Mitigation
Seasonal variations in groundwater conditions are expected. It is assumed groundwater beneath the subject site predominates in fractured weathered consolidated sedimentary bedrock located at depth. If shallow groundwater conditions are encountered during the site-specific Subsurface Soil Investigations and/or Open Excavation Observations, mitigations may include a combination of surface and subsurface drainage systems, vertical drainboard, etc.

In general, if groundwater was encountered within 4 to 6 feet of the proposed foundation slab elevation, an underslab drain should be anticipated in conjunction with the perimeter drain. Perimeter drains are anticipated for each individual lot to prevent the infiltration of water and to help control wetting of potentially expansive and compressible soils in the immediate vicinity of foundation elements. It must be understood that the drain is designed to intercept some types of subsurface moisture and not others. Therefore, the drain could operate properly and not mitigate all moisture problems relating to foundation performance or moisture intrusion into the basement area.

8.4 Floodplain/Floodway

Based on our review of the available Federal Emergency Management (FEMA) Community Panel No. 08041C0790G, 08041C0769G, and the online ArcGIS El Paso County Risk Map, the site lies within a 100-year floodplain (Zone AE) and regulatory floodway. The floodplain traverses the site down-gradient from the northeast to the southwest.

Mitigation
As indicated on the *Conceptual Layout 03* map prepared by Matrix Design Group, the proposed build areas of the development are to be located outside of the designated channel/floodplain as shown on the Proposed Lot Layout, Figure 3.

8.5 Faults and Seismicity

Based on review of the Earthquake and Late Cenozoic Fault and Fold Map Server provided by CGS located at http://dnrwebmapgdev.state.co.us/CGSOnline/ and the recorded information dating back to November of 1900, Colorado Springs has not experienced a recorded earthquake with a magnitude greater than 1.6 during that time period. The nearest recorded earthquakes over 1.6 occurred in December of 1995 in Manitou Springs, which experienced magnitudes ranging between 2.8 to 3.5. Additional earthquakes over 1.6 occurred between 1926 and 2001 in Woodland Park, which experienced magnitudes ranging from 2.7 to 3.3. Both of these locations are in the vicinity of the Ute Pass Fault, which is greater than 10 miles from the subject site.

Earthquakes felt at this site will most likely result from minor shifting of the granite mass within the Pikes Peak Batholith, which includes pull from minor movements along faults found in the Denver basin. It is our opinion that ground motions resulting from minor earthquakes may affect structures (and the surrounding area) at this site if minor shifting were to occur.

Mitigation
The Pikes Peak Regional Building Code, 2017 Edition, indicates maximum considered earthquake spectral response accelerations of 0.181g for a short period (S_s) and 0.055g for a 1-second period (S_1). Based on the results of our experience with similar subsurface conditions, we recommend the site be classified as Site Class B, with average shear wave velocities ranging from 2,500 to 5,000 feet per second for the materials in the upper 100 feet.

8.6 Radon

*"**Radon Act 51** passed by Congress set the natural outdoor level of radon gas (0.4 pCi/L) as the target radon level for indoor radon levels.*

Southern El Paso County and the 80929 zip code located in Rolling Meadows has an EPA assigned Radon Zone of 1. A radon zone of 1 predicts an average indoor radon screening level greater than 4 pCi/L, which is above the recommended levels assigned by the EPA. Rolling Meadows is located in a high risk area of the country. *The EPA recommends you take corrective measures to reduce your exposure to radon gas.*

Most of Colorado is generally considered to have the potential of high levels of radon gas, based on the information provided at:
https://www.elpasocountyhealth.org/sites/default/files/CDPHERadonMap.pdf. There is not believed to be unusual hazardous levels of radon from naturally occurring sources at this site.

Mitigation

Radon hazards are best mitigated at the building design and construction phases. Providing increased ventilation of basements, crawlspaces, creating slightly positive pressures within structures, and sealing of joints and cracks in the foundations and below-grade walls can help mitigate radon hazards. Radon hazards are best mitigated at the building design and construction phases. Providing increased ventilation of basements, crawlspaces, creating slightly positive pressures within structures, and sealing of joints and cracks in the foundations and below-grade walls can help mitigate radon hazards. Passive radon mitigation systems are also available.

Passive and active mitigation procedures are commonly employed in this region to effectively reduce the buildup of radon gas. Measures that can be taken after the residence is enclosed during construction include installing a blower connected to the foundation drain and sealing the joints and cracks in concrete floors and foundation walls. If the occurrence of radon is a concern, it is recommended that the residence be tested after they are enclosed and commonly utilized techniques are in place to minimize the risk.

8.7 Proposed Grading, Erosion Control, Cuts and Masses of Fill and Erosion Control

Based on the test borings for this investigation, the excavations are anticipated to encounter silty to clayey sand, claystone and sandstone. The on-site soils can generally be used as site-grading fill.

Prior to placement of overlot fill or removal and re-compaction of the existing materials, topsoil, low-density native soil, fill and organic matter should be removed from the fill area. The subgrade should be scarified, moisture conditioned to within 2% of the optimum moisture content, and recompacted to the same degree as the overlying fill to be placed. The placement and compaction of fill should be periodically observed and tested by a representative of RMG during construction.

If unsuitable fill soils are encountered at the time of construction for the single-family residences, they should be removed (overexcavated) and replaced with compacted structural fill. The zone of overexcavation shall extend to the bottom of the unsuitable fill zone and shall extend at least that same distance beyond the building perimeter (or lateral extent of any fill, if encountered first). Provided that this recommendation is implemented, the presence of this fill is not considered to pose a risk to proposed structures.

We anticipate that the deepest excavation cuts for crawlspace and garage level construction will be approximately 3 to 4 feet below the existing ground surface, and for basement level construction will be approximately 6 to 8 feet below the existing ground surface, not including subexcavation where performed.

We believe the sandy clay and claystone will classify as Type A material and the clayey sand, silty sand, silty to clayey sand, and sandstone will classify as Type C materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type A materials be laid back at ratios no steeper than 3/4:1 (horizontal to vertical) and temporary excavations made in Type C materials be laid back at ratios no steeper than 1 1/2:1 (horizontal to vertical), unless the excavation is shored and braced. Excavations deeper than 20 feet, or when water is present, should always be braced or the slope designed by a professional engineer. Long term cut slopes in the upper soil should be limited to no steeper than 3:1 (horizontal to vertical). Flatter slopes will likely be necessary should groundwater conditions occur. It is recommended that long term fill slopes be no steeper than 3:1 (horizontal to vertical).

Erosion Control

Erosion generally refers to lowering the ground surface over a wide area. The soils on-site are mildly to moderately susceptible to wind and water erosion. Temporary problems may arise due to minor wind erosion and dust during and immediately after construction. Watering of the cut areas or the use of chemical palliatives may be needed to control dust. However, once construction has been completed and vegetation reestablished, the potential for wind erosion and dust will be considerably reduced.

Loose soils are the most susceptible to water erosion. The residually weathered sands on site were encountered at medium densities and overlaid medium hard to very hard sandstone bedrock which is increasingly less susceptible to water erosion.

Cut and fill areas may be subjected to sheetwash (surface) erosion. Unchecked erosion could eventually lead to concentrated flows of water. Generally, the most effective means to control erosion is to re-vegetate the cut and fill slopes with native vegetation.

Guideline Site Grading Specifications are included in the Appendix B.

9.0 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT

Geologic hazards (as described in Section 8 of this report) were not found to be present at this site. Geologic constraints (also as described in section 8 of this report) such as: expansive soils and bedrock, compressible soils, potentially shallow groundwater, faults/seismicity, floodplain/floodways, and radon were found on the site. Where avoidance is not readily achievable, it is our opinion that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering, design, and construction practices.

10.0 BURIED UTILITIES

Based upon the conditions encountered in the test borings, we anticipate that the soils encountered in individual utility trench excavations will consist mostly of native or moisture conditioned and recompacted clayey sand, silty to clayey sand, sandstone, silty sand, sandy clay and claystone. It is anticipated the sandy clay will be encountered at medium stiff to very stiff densities, the claystone at medium hard to very hard relative densities, the sandstone at hard to very hard relative densities, and the clayey sand soils at loose to very dense densities. Bedrock conditions are anticipated within the utility trenches.

We believe the sandy clay and claystone will classify as Type A material and the clayey sand, silty sand, silty to clayey sand, and sandstone will classify as Type C materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type A materials be laid back at ratios no steeper than 3/4:1 (horizontal to vertical) and temporary excavations made in Type C materials be laid back at ratios no steeper than 1 1/2:1 (horizontal to vertical), unless the excavation is shored and braced. Excavations deeper than 20 feet, or when water is present, should always be braced or the slope designed by a professional engineer.

11.0 PRELIMINARY PAVEMENTS

The proposed roadways within this development will require a new pavement design prepared in accordance with the El Paso County regulations. The interior roadways, as indicated by the *Conceptual Layout* map prepared by Matrix Design Group are to be classified as Residential Collector with 60’ R.O.W, and Non-Residential Collector with an 80’ R.O.W.

The actual pavement section design for individual streets will be completed following overlot grading and rough cutting of the street subgrade.

The developer of the proposed site, Landhuis Company, has generally preferred to construct the roadways with a composite roadway section consisting of Hot Mix Asphalt over Cement-Treated Subgrade (CTS). For purposes of this report, we anticipate the subgrade soils will primarily have American Association of State Highway and Transportation Officials (AASHTO) Soil Classifications of A-2-4, A-2-6, A-4, A-6, A-7-6, and A-2-7, with indices ranging between 0 and 51, with estimated design subgrade "CBR-values" on the order of approximately 5 to 40.

The ECM notes that mitigation measures may be required for expansive soils, shallow ground water, subgrade instability, etc. Based on the AASHTO classification of the soils in the subdivision and laboratory swell testing, the subgrade soils are expected to encounter low to very high expansive potential. Therefore, special mitigation measures may be necessary for subgrade preparation.

Pavement materials should be selected, prepared, and placed in accordance with the El Paso County specification and the Pikes Peak Region Asphalt Paving Specifications. Tests should be performed in accordance with the applicable procedures presented in the final design.

12.0 ANTICIPATED FOUNDATION SYSTEMS

Based on the information presented previously, conventional shallow spread-footing foundation systems are anticipated to be suitable for the proposed residential structures. It is our understanding a combination of crawlspace and basement excavations is proposed for the lots. Typical foundation cuts are anticipated to be approximately 3 to 4 feet below the final ground surface for crawlspace and garage foundations and 6 to 8 feet below the final ground surface for basement foundations, not including subexcavation where performed.

Expansive soils and/or bedrock are anticipated to be encountered in a majority of the excavations at foundation and floor slab bearing levels. Removal and replacement with structural fill is anticipated. This can be accomplished through "mass" subexcavation and replacement with moisture-conditioned expansive soils/bedrock during land development operations, lot-specific overexcavation and replacement with structural fill during construction, or a combination of the two. However, it should be noted that the use of subexcavated and moisture-conditioned expansive soils as fill below foundations may result in a condition that is not suitable for all types of shallow foundations.

If loose sands are encountered, they may require additional compaction to achieve the allowable bearing pressure as indicated in a site specific subsurface soil investigation. In some cases, removal and recompaction may be required for loose soils.

It must be understood that the subexcavation and replacement process does not guarantee that the swell potential will be reduced to acceptable levels. It is possible that the expansive material will retain swell potential in excess of the allowable value presented herein, even after processing and moisture-conditioning. In such a case, the material will need to be removed, reconditioned, and replaced until the swell potential is reduced to the stated value.

If (at the time of the lot-specific subsurface soil investigation and/or the open excavation observation) the soil is found to possess swell potential in excess of acceptable levels for the foundation system and design parameters proposed for construction at that time, overexcavation and replacement of some or all of the previously placed fill material may be required.

It is also possible that material that was properly conditioned, placed, and compacted during the subexcavation process will require removal (overexcavation) and replacement at the time of construction. The swell potential of the moisture-conditioned structural fill is dependent on many factors, including (but not limited to) density/degree of compaction, moisture content (particularly changes that occur in the moisture content from the time of placement to the time of actual foundation construction), etc. Additionally, various construction processes which can adversely affect the performance of moisture-conditioned structural fill are completed at times before and after our observations, as well as between the time of land development and when the lot-specific foundation is constructed.

While the subexcavation and replacement process is generally considered suitable for use with shallow foundation types, it may result in design parameters that are not consistent with the future builder(s)' pre-existing foundation designs. In such a case, the builder would either need to obtain a foundation designed for parameters consistent with the subsurface soil conditions present at that time, or perform additional mitigation (in most cases, this consists of overexcavation and replacement with material suitable to provide the design parameters utilized in that pre-existing foundation design).

The final foundation design parameters are to be determined based on lot-specific subsurface soil investigations performed at the time of construction. However, for a structure supported atop moisture-conditioned structural fill, the maximum allowable bearing pressures are anticipated to be in the range of 2,000 to 3,000 psf with minimum dead loads in the range of 800 to 1,500 psf. For a structure supported atop granular, non-expansive structural fill, the maximum allowable bearing pressures are anticipated to range from 2,000 to 2,400 psf with no minimum dead load requirement.

The foundation designs should be prepared by a qualified Colorado Registered Professional Engineer using the recommendations presented in this report. This foundation system should be designed to span a minimum of 10 feet under the design loads. The bottoms of exterior foundations should be at least 30 inches below finished grade for frost protection.

12.1 Foundation Drains

A subsurface perimeter drain is recommended around portions of the structures which will have habitable or storage space located below the finished ground surface. This includes crawlspace areas but not the walkout trench, if applicable.

Shallow groundwater conditions were not encountered in the test boring performed for this study. Depending on the conditions encountered during the site-specific subsurface soil investigations and the conditions observed at the time of the open excavation observations, additional subsurface drainage systems may be recommended.

It must be understood that the drain systems are designed to intercept some types of subsurface moisture and not others. Therefore, the drains could operate properly and not mitigate all moisture problems relating to foundation performance or moisture intrusion into the basement area.

13.0 SUBEXCAVATION AND REPLACEMENT

The proposed lots within Rolling Meadows contain expansive soils and bedrock at depths that are anticipated to effect the performance of foundations, floor slabs, and roadways. It is our understanding that subexcavation and replacement of moisture conditioned and recompacted on-site material is the preferred alternative to reduce heave risk and enhance the performance of the foundations, roadways and flatwork. This type of subexcavation and replacement is commonly utilized throughout this region and is generally considered an acceptable alternative to the typical lot-by-lot overexcavation.

13.1 Subexcavation

Where subexcavation is to be performed, vegetation, organic and deleterious material shall be cleared and disposed of in accordance with applicable requirements prior to performing excavation and/or filling operations. Subexcavation depths are anticipated to range between 6 and 10 feet below the bottom of foundations, floor slabs, and roadways, and at least those same distances (laterally) beyond the proposed "buildable" area on each lot. Before the placement of moisture-conditioned fill, the underlying subgrade shall be scarified, moisture conditioned to within 2% of the optimum moisture content and compacted to the degree specified for the overlying fill material.

13.2 Moisture-Conditioned Structural Fill

Subexcavation and replacement with moisture-conditioned (on-site) structural fill is commonly utilized throughout the region. This approach may be combined with the use of an intermittent (voided) spread-footing foundation system or with a post-tensioned slab-on-grade foundation system.

Areas to receive moisture-conditioned expansive soils used as structural fill should have topsoil, organic material, or debris removed. After subexcavation to the recommended depth below the bottom of all foundation components, the upper 6 inches of exposed soil should be scarified and moisture-conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) prior to placing structural fill.

Moisture-conditioned structural fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment.

Replacement structural fill shall consist of a moisture-conditioned, on-site cohesive fill material. The fill material shall be moisture conditioned and replaced as follows:

- Fill shall be free of deleterious material and shall not contain rocks or cobbles greater than 6 inches in diameter.

- Claystone fill shall be thoroughly "pulverized" and shall not contain claystone chunks greater than 1 1/2 inches in diameter if being processed and/or placed by a loader, or not greater than 3 inches in diameter if being processed/placed as part of "mass" fill (scrapers and disking) operations.

- When claystone is to be incorporated using a loader, the fill materials shall be processed in a stockpile **(processing these materials in the excavations will not be permitted)**. These stockpiled fill materials shall be moisture-conditioned to a minimum of 1 percent to 4 percent above optimum moisture content (as determined by the Standard Proctor test, ASTM D-698), with an average of not less than 1 1/2 percent above optimum moisture content. These materials, once moisture conditioned and thoroughly mixed, should rest in the stockpile a minimum of 24 hours to ensure proper distribution of the moisture through the material. After resting, the materials should be re-wet and re-mixed to replace the surficial moisture lost to evaporation during the resting period.

- Fill materials not containing claystone and/or fill materials being processed/placed as part of "mass" fill (scrapers and disking) operations do not require processing in a stockpile, but shall be moisture-conditioned to a minimum of 1 percent to 4 percent above optimum moisture content (as determined by the Standard Proctor test, ASTM D-698), with an average of not less than 1 1/2 percent above optimum moisture content.

- The moisture-conditioned materials should be placed in maximum 6" compacted lifts. These materials should be compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698). Material not meeting the above requirements shall be reprocessed.

Material not meeting the above requirements shall be reprocessed.

Materials used for moisture-conditioned structural fill should be approved by RMG prior to use. Moisture-conditioned structural fill should not be placed on frozen subgrade or allowed to freeze during moisture-conditioning and placement.

To verify the condition of the compacted soils, density tests should be performed during placement. The first density tests should be conducted when 24 inches of fill have been placed.

The existing soils will require the addition of water to achieve the required moisture content. The fill soils should be thoroughly mixed or disked to provide uniform moisture content through the fill. It should be noted that clay and claystone materials compacted at the above moisture contents are likely to result in wet, slick conditions. We recommend that the excavation contractor retained to perform this work have significant experience processing subexcavated and moisture-conditioned soils.

Frequent moisture content and density tests shall be performed in the field to verify conformance with the above specifications. Furthermore, representative samples of the moisture-conditioned fill shall be obtained by personnel of RMG on a daily basis for follow-up swell testing to demonstrate that the swell potential has been reduced to not more than 1 percent swell when saturated under a 1,000 psf surcharge pressure. Areas where the follow-up swell tests indicate swells higher than that value shall have the fill material removed, reprocessed, recompacted, and retested.

RMG should be contacted a minimum of 3 days prior to initiation of subexcavation and moisture conditioning processes in order to schedule appropriate field services. Fill shall not be placed on frozen subgrade or allowed to freeze during processing. The time of the year when night temperatures are above freezing are the most optimal period for a subexcavation operation.

Following completion of the subexcavation and moisture conditioning process, it is imperative that the "as-compacted" moisture content be maintained prior to construction and establishment of landscape irrigation. This may require reprocessing of materials and addition of supplemental water to prevent remobilization of swell potential within the fill.

13.3 Granular Structural Fill

Areas to receive granular (non-expansive) structural fill should have topsoil, organic material, or debris removed. The upper 6 inches of the exposed surface soils should be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) prior to placing structural fill.

Structural fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment.

Structural fill shall consist of granular, non-expansive material. It should be placed in loose lifts not exceeding 8 to 12 inches, moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test, ASTM D-1557. The materials should be compacted by mechanical means.

Materials used for structural fill should be approved by RMG prior to use. Structural fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement.

14.0 DETENTION STORAGE CRITERIA

This section has been prepared in accordance with the requirements outlined in the El Paso County Land Development Code (LDC), the Engineering Criteria Manual (ECM) Section 2.2.6 and Appendix C.3.2.B, and the El Paso County (EPC) Drainage Criteria Manual, Volume 1 Section 11.3.3.

14.1 Soil and Rock Design Parameters

It is unknown at this time if detention ponds, retention ponds or a combination of both are proposed for the Rolling Meadows development. A site grading plan with retention/retention pond specifications has not been provided to RMG by Landhuis Company.

RMG has performed laboratory tests of soil from across the proposed development. Based upon field and laboratory testing, the following soil and rock parameters are typical for the soils likely to be encountered, and are recommended for use in detention/retention pond embankment design.

Soil Description	Unit Weight (lb/ft^3)	Friction Angle (degree)	Active Earth Pressure, Ka	Passive Earth Pressure, Kp	At Rest Earth Pressure, Ko
Clay to Sandy Clay	115	17	0.548	1.826	0.708
Claystone	125	17	0.548	1.826	0.708
Silty to Clayey Sand	120	28	0.361	2.770	0.531
Sandstone	130	30	0.333	3.000	0.500

14.2 Detention Pond Considerations

It is uncertain if above-ground embankment construction is anticipated. All pond side slopes are to be constructed with a maximum 3:1 (horizontal:vertical) slope. Side slopes should be constructed in accordance with applicable sections of the El Paso County Engineering Criteria Manual, the El Paso County Drainage Criteria Manual, and the El Paso County Land Development Code.

15.0 ADDITIONAL STUDIES

The findings, conclusions and recommendations presented in this report were provided to evaluate the suitability of the site for future development. Unless indicated otherwise, the test borings, laboratory test results, conclusions and recommendations presented in this report are not intended for use for design and construction. **We recommend that a *lot-specific* subsurface soil investigation be performed for the proposed structures.** The extent of any fill soils encountered during the lot-specific investigation(s) should be evaluated for suitability to support the proposed structures prior to construction.

Additionally, the groundwater conditions encountered in the lot-specific investigation should be evaluated to determine the feasibility of basement construction on that lot.

The lot-specific subsurface soil investigations should consider the proposed structure type, anticipated foundation loading conditions, location within the property, and local construction methods. Recommendations resulting from the investigations should be used for design and confirmed by on-site observation and testing during development and construction.

16.0 CONCLUSIONS

Based upon our evaluation of the geologic conditions, it is our opinion that the proposed development is feasible. The geologic conditions identified (expansive soils and bedrock, compressible soils, potentially shallow groundwater, faults/seismicity, floodplain/floodways, and radon) are not considered unusual for the Front Range region of Colorado. Mitigation of geologic conditions is most effectively accomplished by avoidance. However, where avoidance is not a practical or acceptable alternative, geologic conditions should be mitigated by implementing appropriate planning, engineering, and local construction practices.

In addition to the previously identified mitigation alternatives, surface and subsurface drainage systems should be implemented. Exterior, perimeter foundation drains should be installed around below-grade habitable or storage spaces. Surface water should be efficiently removed from the building area to prevent ponding and infiltration into the subsurface soil.

The foundation systems for the proposed single-family structures should be designed and constructed based upon recommendations developed in a site-specific subsurface soil investigation.

Foundation selection and design should consider the potential for subsurface expansive soil-related movements. Mitigation techniques commonly used in the El Paso County area include overexcavation and replacement with structural fill, subexcavation and replacement with on-site moisture-conditioned soils, and/or the installation of deep foundation systems all of which are considered common construction practices for this area.

The foundation and floor slabs of each structure should be designed using the recommendations provided in the lot-specific subsurface soil investigation performed for each lot. In addition, appropriate surface drainage should be established during construction and maintained by the homeowner.

Irrigation devices should not be placed within 5 feet of the foundation. Irrigation should be limited to the amount sufficient to maintain vegetation. Application of more water will increase the likelihood of slab and foundation movements.

Additionally, the ground surface should be sloped from the building with a minimum gradient of 10 percent for the first 10 feet. This is equivalent to 12 inches of fall across this 10-foot zone. If a 10-foot zone is not possible on the upslope side of the structure, then a well-defined swale should be created a minimum 5 feet from the foundation and sloped parallel with the wall with a minimum slope of 2 percent to intercept the surface water and transport it around and away from the structure. Roof drains should extend across backfill zones and landscaped areas to a region that is graded to direct flow away from the structure. Owners should maintain the surface grading and drainage recommended in this report to help prevent water from being directed toward and/or ponding near the foundations.

Landscaping should be selected to reduce irrigation requirements. Plants used close to foundation walls should be limited to those with low moisture requirements and irrigated grass should not be located within 5 feet of the foundation. To help control weed growth, geotextiles should be used below landscaped areas adjacent to foundations. Impervious plastic membranes are not recommended.

The recommendations listed in this report are intended to address normal surface drainage conditions, assuming the presence of groundcover (established vegetation, paved surfaces, and/or structures) throughout the regions upslope from this structure. However, groundcover may not be present due to a variety of factors (ongoing construction/development, wildfires, etc.). During periods when groundcover is not present in the "upslope" regions, higher than normal surface drainage conditions may occur, resulting in perched water tables, excess runoff, flash floods, etc. In these cases, the surface drainage recommendations presented herein (even if properly maintained) may not mitigate all groundwater problems or moisture intrusion into the structure. We recommend that the site plan be prepared with consideration of increased runoff during periods when groundcover is not present on the upslope areas.

We believe the sandy clay and claystone will classify as Type A material and the clayey sand, silty sand, silty to clayey sand, and sandstone will classify as Type C materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type A materials be laid back at ratios no steeper than 3/4:1 (horizontal to vertical) and temporary excavations made in Type C materials be laid back at ratios no steeper than 1 1/2:1 (horizontal to vertical), unless the excavation is shored and braced. Flatter slopes will likely be necessary should groundwater conditions occur.

Long term cut slopes in the upper soil should be limited to no steeper than 3:1 (horizontal to vertical). Flatter slopes will likely be necessary should groundwater conditions occur. It is recommended that long term fill slopes be no steeper than 3:1 (horizontal to vertical).

Revisions and modifications to the conclusions and recommendations presented in this report may be issued subsequently by RMG based upon additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report.

It is important for the Owner(s) of these properties read and understand this report, as well as the previous reports referenced above, and too carefully familiarize themselves with the geologic constraints associated with construction in this area. This report only addresses the geologic constraints contained within the boundaries of the site referenced above.

17.0 CLOSING

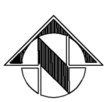
This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by implication, evaluation of wild fire hazards, environmental assessment of the site, or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to, biological or toxicological issues, are beyond the scope of this report. If the owner is concerned about the potential for such contamination or conditions, other studies should be undertaken.

This report has been prepared for **Landhuis Company** in accordance with generally accepted geotechnical engineering and engineering geology practices. The conclusions and recommendations in this report are based in part upon data obtained from review of available topographic and geologic maps, review of available reports of previous studies conducted in the site vicinity, a site reconnaissance, and research of available published information, soil test borings, soil laboratory testing, and engineering analyses. The nature and extent of variations may not become evident until construction activities begin. If variations then become evident, RMG should be retained to re-evaluate the recommendations of this report, if necessary.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers and engineering geologists practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied, is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

If we can be of further assistance in discussing the contents of this report or analysis of the proposed development, from a geotechnical engineering point-of-view, please feel free to contact us.

FIGURES



NOT TO SCALE

Architecture
Structural
Geotechnical

RMG

Materials Testing
Forensics
Civil / Planning

Engineers / Architects

SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

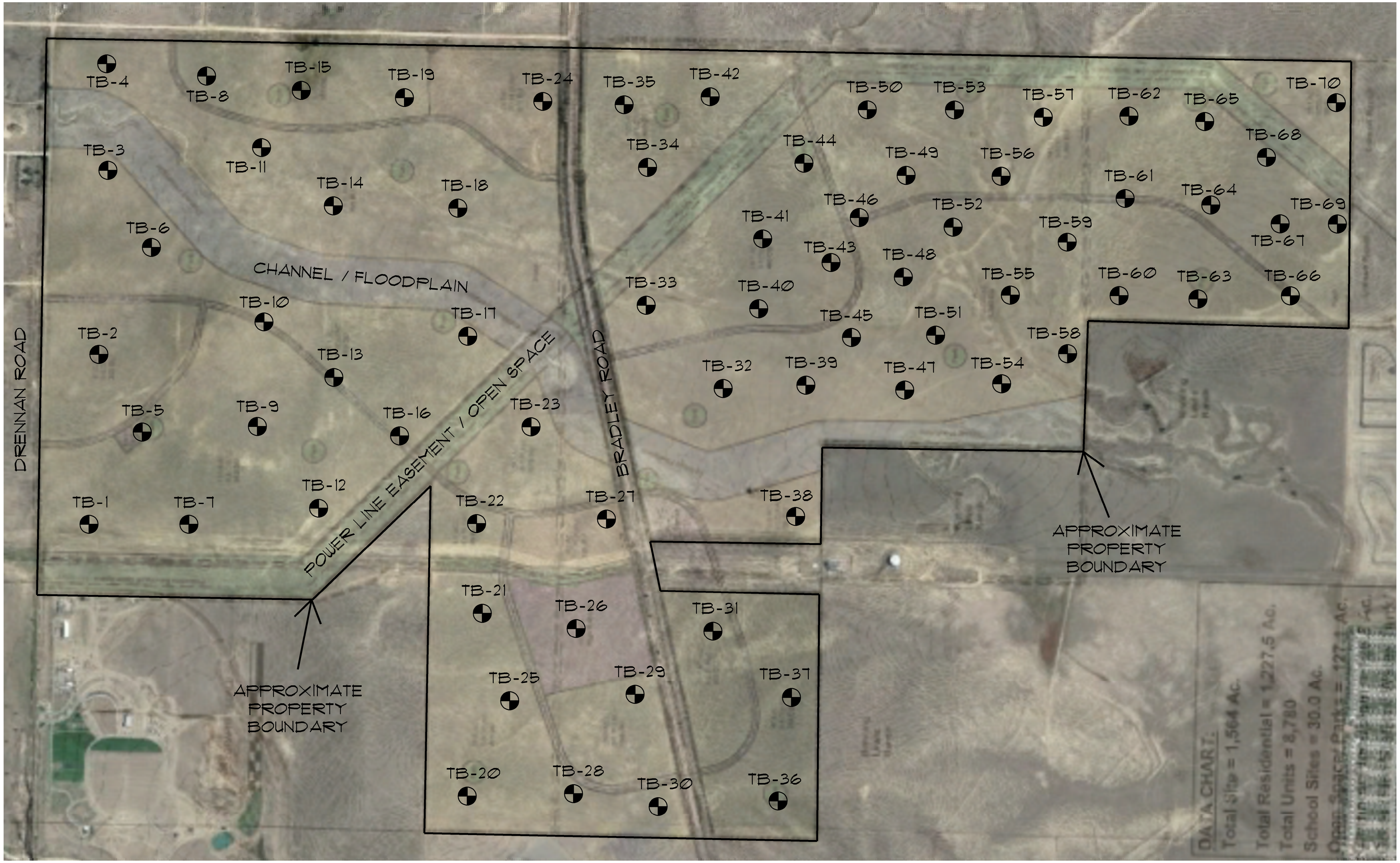
SITE VICINITY MAP

ROLLING MEADOWS
BRADLEY ROAD
EL PASO COUNTY, COLORADO
LANDHUIS COMPANY

JOB No. 187746

FIG No. 1

DATE 8-5-2022



NOT TO SCALE

DENOTES APPROXIMATE LOCATION OF TEST BORINGS

JOB No. 187746

RMG
Engineers / Architects
Materials Testing / Forensics / Civil / Planning
Architecture / Structural / Geotechnical
SOUTHERN COLORADO OFFICE
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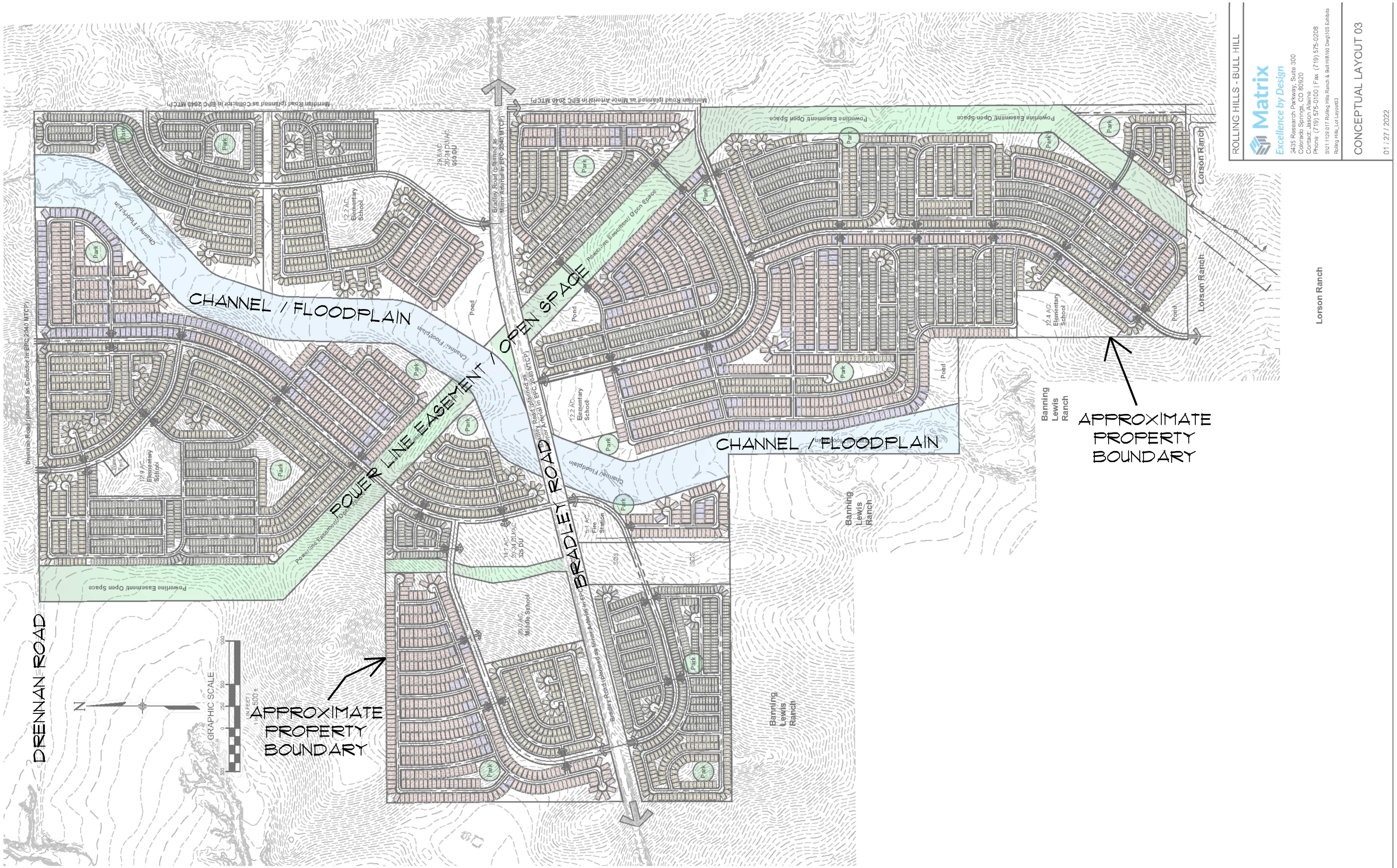
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

ROLLING MEADOWS
BRADLEY ROAD
EL PASO COUNTY, COLORADO
LANDUIS COMPANY

ENGINEER:	TPM
DRAWN BY:	KCR
CHECKED BY:	TPM
ISSUED:	8-5-2022

TEST BORING LOCATION PLAN

SHEET No.
FIG-2



NOT TO SCALE

JOB No. 187746

RMG

Materials Testing
Forensics
Civil / Planning

Architecture
Structural
Geotechnical

Engineers / Architects

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ROLLING MEADOWS
BRADLEY ROAD
EL PASO COUNTY, COLORADO
LANDUIS COMPANY

ENGINEER:	TPM
DRAWN BY:	KCR
CHECKED BY:	TPM
ISSUED:	8-5-2022

PROPOSED LOT LAYOUT

SHEET No.
FIG-3

SOILS DESCRIPTION

CLAYEY SAND

CLAYSTONE

SANDSTONE

SANDY CLAY

SILTY SAND

SILTY TO CLAYEY SAND

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
RMG - ROCKY MOUNTAIN GROUP
2910 AUSTIN BLUFFS PARKWAY
COLORADO SPRINGS, COLORADO

SYMBOLS AND NOTES

XX STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

XX UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

FREE WATER TABLE

DEPTH AT WHICH BORING CAVED

BULK DISTURBED BULK SAMPLE

AUG AUGER "CUTTINGS"

4.5 WATER CONTENT (%)

ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

RMG
Engineers / Architects

Geotechnical
Materials Testing
Civil, Planning

Colorado Springs: (Corporate Office)
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EXPLANATION OF TEST BORING LOGS

JOB No. 187746

FIGURE No. 4

DATE Aug/05/2022

TEST BORING: **1**	DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22			
SAND, CLAYEY, light brown to brown, medium dense, moist	5	20	5.3
	10	20	6.8
CLAY, SANDY, brown, stiff to very stiff, moist	15	20	8.4
	20	16	11.5
	25	23	12.4
SAND, CLAYEY, tan, medium dense, moist	30	20	11.1

TEST BORING: **2**	DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22			
CLAY, SANDY, tan to brown, very stiff, moist	5	30	6.5
SANDSTONE, CLAYEY, tan to brown and olive, very hard, moist	10	50/5"	13.6
CLAYSTONE, SANDY, reddish brown to gray, hard to very hard, moist	15	50/8"	13.1
	20	50/3"	9.8

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TEST BORING LOG

JOB No. 187746

FIGURE No. 5

DATE Aug/05/2022

TEST BORING: **3** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, CLAYEY, with interbedded claystone, tan to gray, hard to very hard, moist	5			50/6"	3.4
	10			50/6"	10.9
	15			10/0"	6.8
AUGER REFUSAL AT 17 FEET DUE TO VERY HARD BEDROCK	20				

TEST BORING: **4** DATE DRILLED: 2/11/22 NO GROUNDWATER ON 2/11/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff, moist	5			15	7.7
	10			15	9.3
SANDSTONE, CLAYEY, with interbedded claystone seams, brown to olive, medium hard to very hard, moist	15			50/9"	12.7
	20			50/7"	15.4
				10/0"	10.2
	25				

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TEST BORING LOG

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FIGURE No. 6

DATE Aug/05/2022

TEST BORING: **5** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, CLAYEY, light brown, loose to medium dense, moist	5			17	7.4
	10			15	7.9
	15			16	8.6
	20			17	6.1

TEST BORING: **6** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, CLAYEY, brown, loose to medium dense, moist	5			13	5.7
	10			15	6.1
	15			13	8.4
	20			13	9.5

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TEST BORING LOG

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FIGURE No. 7

DATE Aug/05/2022

TEST BORING: **7** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, brown to olive, loose to medium dense, moist	5			18	--
	10			16	4.2
	15			19	5.1
CLAY, SANDY, dark brown, very stiff, moist	20			34	14.1

TEST BORING: **8** DATE DRILLED: 2/11/22 NO GROUNDWATER ON 2/11/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, CLAYEY, with gravel, tan, dense, moist	5			50/10"	6.2
CLAYSTONE, SANDY, brown, hard to very hard, moist	10			50/4"	8.8
	15			50/4"	14.7
	20			50/6"	19.1

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TEST BORING LOG

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FIGURE No. 8

DATE Aug/05/2022

TEST BORING: **9** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, tan to brown, stiff, moist	5			16	6.2
	10			15	10.7
CLAYSTONE, SANDY, tan to brown and olive, hard to very hard, moist	15			50/6"	13.3
	20			50/4"	11.8

TEST BORING: **10** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, tan to olive, very stiff, moist	5			25	7.7
CLAYSTONE, SANDY, tan to olive, medium hard to very hard, moist	10			50/10"	12.1
	15			50/6"	15.9
	20			50/4"	13.7

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FIGURE No. 9

DATE Aug/05/2022

TEST BORING: **11**

DATE DRILLED: 2/11/22

GROUNDWATER @ 17.0 ' 2/11/22

CLAY, SANDY, brown to dark brown, soft to stiff, moist to wet

DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5	◢	14	5.9
10	◢	8	11.0
15	◢	6	16.7
20	◢	4	29.0

TEST BORING: **12**

DATE DRILLED: 2/9/22

NO GROUNDWATER ON 2/9/22

CLAYSTONE, SANDY, brown, with rust staining, medium hard to very hard, moist

DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5	◢	50	12.2
10	◢	50/8"	12.7
15	◢	50/6"	12.7
20	◢	50/5"	11.6

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TEST BORING LOG

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FIGURE No. 10

DATE Aug/05/2022

TEST BORING: **13**

DATE DRILLED: 2/14/22

NO GROUNDWATER ON 2/14/22

Description	Depth (FT)	Blows per ft.	Water content %
SAND, CLAYEY, tan, moist	0–4		
CLAY, SANDY, light brown to brown, stiff to very stiff, moist	4	15	8.4
	9	16	9.5
	14	21	9.7
	19	21	10.2
	24	26	9.5
CLAYSTONE, SANDY, brown to olive, very hard, moist	29	50/4"	10.7

TEST BORING: **14**

DATE DRILLED: 2/11/22

NO GROUNDWATER ON 2/11/22

Description	Depth (FT)	Blows per ft.	Water content %
CLAY, SANDY, brown, stiff, moist	4	17	5.3
SAND, CLAYEY, with gravel, brown, loose, moist	9	9	0.9
CLAY, SANDY, brown, moist			
SAND, CLAYEY, with gravel, tan, loose to medium dense, moist	14	13	2.9
	19	10	3.6

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FIGURE No. 11

DATE Aug/05/2022

TEST BORING: **15** DATE DRILLED: 2/11/22 GROUNDWATER @ 14.0 ' 2/11/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, CLAYEY, with gravel, brown to dark brown, loose to medium dense, moist to wet	5			32	7.8
	10			18	10.2
	15			9	24.8
	20			25	12.4

TEST BORING: **16** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown to brown, stiff to very stiff, moist	5			13	5.8
	10			20	8.7
CLAYSTONE, SANDY, brown to olive, firm to very hard, moist	15			34	10.8
	20			50/4"	11.8

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TEST BORING LOG

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FIGURE No. 12

DATE Aug/05/2022

TEST BORING: **17**

DATE DRILLED: 2/11/22
NO GROUNDWATER ON 2/11/22

DESCRIPTION	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown, moist (0–4 ft)	4		10/0"	11.3
CLAYSTONE, SANDY, olive to gray, medium hard to very hard, moist (4–19.5 ft)	9	◢	50/9"	16.0
	14	◢	50/8"	17.1
	19	◢	50/7"	17.8

TEST BORING: **18**

DATE DRILLED: 2/11/22
NO GROUNDWATER ON 2/11/22

DESCRIPTION	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, tan to dark brown and olive, stiff, moist (0–20 ft)	4	◢	14	8.7
	9	◢	14	14.6
	14	◢	17	7.4
	19	◢	12	14.0

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FIGURE No. 13

DATE Aug/05/2022

TEST BORING: **19** DATE DRILLED: 2/11/22 NO GROUNDWATER ON 2/11/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff to very stiff, moist					
	5			17	4.7
	10			15	7.9
	15			21	10.8
	20			17	8.5
	25			20	7.0
SAND, CLAYEY, tan to olive, moist					
CLAY, SANDY, brown, very stiff, moist	30			25	12.3

TEST BORING: **20** DATE DRILLED: 2/9/22 NO GROUNDWATER ON 2/9/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown to tan, medium stiff to very stiff, moist					
	5			7	8.4
	10			17	7.3
SAND, CLAYEY, brown, medium dense, moist	15			16	5.2
CLAY, SANDY, brown, very stiff, moist	20			20	16.3

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FIGURE No. 14

DATE Aug/05/2022

TEST BORING: **21** DATE DRILLED: 2/9/22 NO GROUNDWATER ON 2/9/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, CLAYEY, tan, moist					
CLAY, SANDY, tan to olive, stiff to very stiff, moist	5			22	11.1
	10			18	9.3
	15			16	6.3
	20			15	8.9

TEST BORING: **22** DATE DRILLED: 2/9/22 NO GROUNDWATER ON 2/9/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, tan, with rust staining, stiff to very stiff, moist	5			18	4.8
	10			20	9.7
	15			28	14.5
CLAYSTONE, SANDY, light brown, weathered, moist	20			16	10.0

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FIGURE No. 15

DATE Aug/05/2022

TEST BORING: **23** DATE DRILLED: 2/9/22 NO GROUNDWATER ON 2/9/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, tan, stiff to very stiff, moist					
	5			12	7.8
	10			24	7.7
	15			34	8.1
	20			28	9.6

TEST BORING: **24** DATE DRILLED: 2/11/22 NO GROUNDWATER ON 2/11/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff to very stiff, moist					
	5			18	7.2
	10			25	8.5
	15			27	8.6
CLAYSTONE, SANDY, olive to gray, medium hard, moist					
	20			40	12.6

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TEST BORING LOG

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FIGURE No. 16

DATE Aug/05/2022

TEST BORING: **25** DATE DRILLED: 2/9/22 NO GROUNDWATER ON 2/9/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, tan, stiff to very stiff, moist	5			9	7.8
	10			10	9.6
	15			20	7.7
	20			24	7.9
	25			20	7.0
CLAYSTONE, SANDY, tan, medium hard, moist	30			31	8.2

TEST BORING: **26** DATE DRILLED: 2/9/22 NO GROUNDWATER ON 2/9/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown, with rust staining, very stiff to hard, moist	5			18	8.3
	10			30	9.3
	15			38	9.0
CLAYSTONE, SANDY, brown, hard, moist	20			50/10"	9.1

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FIGURE No. 17

DATE Aug/05/2022

TEST BORING: **27** DATE DRILLED: 2/9/22 NO GROUNDWATER ON 2/9/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, very stiff, moist					
	5			21	7.3
	10			31	14.0
	15			33	12.4
	20			27	8.9

TEST BORING: **28** DATE DRILLED: 2/9/22 NO GROUNDWATER ON 2/9/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, tan, very stiff, moist					
	5			18	8.5
	10			22	9.4
	15			32	9.8
CLAYSTONE, SANDY, tan to olive, hard, moist	20			50	13.0

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FIGURE No. 18

DATE Aug/05/2022

TEST BORING: **29** DATE DRILLED: 2/9/22 NO GROUNDWATER ON 2/9/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, brown, with rust staining, medium hard to hard, moist					
	5			50	14.3
	10			50/11"	12.9
	15			50/10"	13.2
	20			50/11"	11.3

TEST BORING: **30** DATE DRILLED: 2/9/22 NO GROUNDWATER ON 2/9/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown, stiff to very stiff, moist					
	5			13	7.6
	10			20	8.0
	15			21	6.9
CLAYSTONE, SANDY, brown to olive, firm, moist					
	20			37	14.5

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TEST BORING LOG

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FIGURE No. 19

DATE Aug/05/2022

TEST BORING: **31** DATE DRILLED: 3/14/22 NO GROUNDWATER ON 3/14/22	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, brown and olive to gray, firm to hard, moist	5	◣	40	10.2
	10	◣	40	11.6
	15	◣	50/8"	12.5
	20	■	50/9"	14.4

TEST BORING: **32** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, very stiff, moist	5	◣	19	13.4
SAND, SILTY, with gravel, tan to brown, loose, moist	10	■	9	4.7
	15	■	9	7.0
	20	■	6	6.8

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TEST BORING LOG

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FIGURE No. 20

DATE Aug/05/2022

TEST BORING: **33**

DATE DRILLED:
2/14/22
NO GROUNDWATER ON
2/14/22

DESCRIPTION	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY, with gravel, tan to brown, medium dense, moist	0–20			
	5	■	11	5.6
	10	■	10	3.4
	15	■	11	1.5
	20	■	14	1.8

TEST BORING: **34**

DATE DRILLED:
2/14/22
NO GROUNDWATER ON
2/14/22

DESCRIPTION	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, brown, medium dense, moist	0–5			
	5	■	12	5.5
CLAY, SANDY, brown, stiff to very stiff, moist	5–20			
	10	■	9	14.6
	15	◢	10	16.0
	20	■	21	13.5

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FIGURE No. 21

DATE Aug/05/2022

TEST BORING: **35** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, medium stiff, moist	5			8	9.7
CLAYSTONE, SANDY, brown, medium hard to hard, moist	10			40	12.5
	15			50/6"	11.2
SANDSTONE, SILTY, brown, hard, moist	20			50/6"	10.8
CLAYSTONE, SANDY, brown, hard, moist	25				
	30			50/10"	19.2

TEST BORING: **36** DATE DRILLED: 3/14/22 NO GROUNDWATER ON 3/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown, stiff to very stiff, moist	5			15	6.0
	10			21	6.3
	15			20	6.8
CLAYSTONE, SANDY, olive to gray, hard, moist	20			50/8"	10.1

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FIGURE No. 22

DATE Aug/05/2022

TEST BORING: **37** DATE DRILLED: 3/14/22 NO GROUNDWATER ON 3/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown to brown and olive, stiff to very stiff, moist					
	5			15	7.3
	10			18	6.0
	15			25	10.2
	20			20	10.9
	25			25	13.1
SAND, CLAYEY, brown, dense, moist	30			35	13.7

TEST BORING: **38** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY, brown, moist					
CLAY, SANDY, brown, stiff to hard, moist	5			38	11.0
	10			35	20.4
	15			19	17.6
SAND, CLAYEY, brown, medium dense, moist	20			13	16.6
CLAYSTONE, SANDY, brown, medium hard, moist	25				
	30			50/11"	17.5

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FIGURE No. 23

DATE Aug/05/2022

TEST BORING: **39** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, with gravel, light brown to tan, loose to medium dense, moist					
	5		■	12	10.6
	10		■	10	3.3
	15		■	9	5.2
	20		■	19	2.6

TEST BORING: **40** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY, with gravel, tan to brown, medium dense, moist					
	5		■	12	6.3
CLAY, SANDY, brown, very stiff, moist					
	10		■	16	20.0
SAND, SILTY, with gravel, brown, loose to medium dense, moist					
	15		■	6	4.1
	20		■	19	2.6

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TEST BORING LOG

JOB No. 187746

FIGURE No. 24

DATE Aug/05/2022

TEST BORING: **41** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff to very stiff, moist	5			9	7.4
	10			23	12.2
CLAYSTONE, SANDY, brown, medium hard to very hard, moist	15			50/7"	12.8
AUGER REFUSAL AT 18 FEET DUE TO VERY HARD BEDROCK	20				

TEST BORING: **42** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, very stiff, moist	5			19	18.2
CLAYSTONE, SANDY, gray, medium hard to hard, moist	10			50/8"	13.0
	15			50/8"	14.5
	20			50/8"	14.3

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TEST BORING LOG

JOB No. 187746

FIGURE No. 25

DATE Aug/05/2022

TEST BORING: **43**

DATE DRILLED: 3/12/22

NO GROUNDWATER ON 3/12/22

Description	Depth (ft)	Blows per ft.	Water content %
SAND, SILTY, light brown, moist	0–1		
CLAY, SANDY, light brown to dark brown, stiff to very stiff, moist	1–15		
	4	39	12.9
	9	16	10.2
	14	17	15.5
CLAYSTONE, SANDY, brown, firm, moist	15–20		
	19	48	18.6

TEST BORING: **44**

DATE DRILLED: 3/12/22

NO GROUNDWATER ON 3/12/22

Description	Depth (ft)	Blows per ft.	Water content %
CLAY, SANDY, brown, very stiff, moist	0–12		
	4	33	12.6
	9	41	13.2
CLAYSTONE, SANDY, brown, medium hard, moist	12–20		
	14	50/9"	11.9
	19	50/9"	12.6

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TEST BORING LOG

JOB No. 187746

FIGURE No. 26

DATE Aug/05/2022

TEST BORING: **45** DATE DRILLED: 3/12/22 NO GROUNDWATER ON 3/12/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY, brown, loose to medium dense, moist	5			9	3.8
	10			25	7.7
CLAYSTONE, SANDY, brown, medium hard to hard, moist	15			50/9"	13.6
	20			50/6"	13.9

TEST BORING: **46** DATE DRILLED: 3/12/22 NO GROUNDWATER ON 3/12/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, very stiff, moist	5			21	8.9
CLAYSTONE, SANDY, brown, firm, moist	10			41	9.2
	15			45	9.6
	20			46	9.3

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TEST BORING LOG

JOB No. 187746

FIGURE No. 27

DATE Aug/05/2022

TEST BORING: **47** DATE DRILLED: 3/12/22 NO GROUNDWATER ON 3/12/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, tan to brown, loose, moist	5			10	3.9
	10			10	6.2
	15			9	11.7
	20			6	18.1

TEST BORING: **48** DATE DRILLED: 3/12/22 NO GROUNDWATER ON 3/12/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff to very stiff, moist	5			12	9.4
	10			18	10.8
	15			16	9.5
	20			25	13.6
CLAYSTONE, SANDY, brown, medium hard, moist	25				
	30			50/7"	13.7

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TEST BORING LOG

JOB No. 187746

FIGURE No. 28

DATE Aug/05/2022

TEST BORING: **49** DATE DRILLED: 3/12/22 NO GROUNDWATER ON 3/12/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, brown, firm to medium hard, moist					
	5			33	14.8
	10			50/10"	13.3
	15			50/7"	14.5
	20				16.0

TEST BORING: **50** DATE DRILLED: 3/12/22 NO GROUNDWATER ON 3/12/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff to very stiff, moist					
	5			13	7.1
	10			21	10.3
CLAYSTONE, SANDY, brown, firm to medium hard, moist	15			45	11.0
	20			50/8"	12.6

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TEST BORING LOG

JOB No. 187746

FIGURE No. 29

DATE Aug/05/2022

TEST BORING: **51**

DATE DRILLED: 3/12/22

NO GROUNDWATER ON 3/12/22

DESCRIPTION	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown to dark brown and olive, stiff, moist	5			13	3.8
	10			16	15.9
	15			12	6.0
	20			7	18.9

TEST BORING: **52**

DATE DRILLED: 3/12/22

NO GROUNDWATER ON 3/12/22

DESCRIPTION	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, with gravel , light brown to dark brown and olive to gray, stiff, moist	5			18	6.2
SAND, CLAYEY, with gravel, brown, loose, moist	10			14	2.9
CLAY, SANDY, brown, very stiff, moist	15			20	10.0
	20			20	18.9

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TEST BORING LOG

JOB No. 187746

FIGURE No. 30

DATE Aug/05/2022

TEST BORING: **53** DATE DRILLED: 3/12/22 NO GROUNDWATER ON 3/12/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown to dark brown, stiff to very stiff, moist	5			15	6.2
	10			32	17.4
	15			14	8.2
SAND, CLAYEY, brown, loose to medium dense, moist	20			11	5.6
	25			7	13.0
CLAY, SANDY, brown to olive, stiff, moist	30			15	18.4

TEST BORING: **54** DATE DRILLED: 3/12/22 NO GROUNDWATER ON 3/12/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff, moist	5			13	12.9
	10			14	11.1
	15			17	16.2
SAND, CLAYEY, light brown, loose, moist	20			8	4.4

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TEST BORING LOG

JOB No. 187746

FIGURE No. 31

DATE Aug/05/2022

TEST BORING: **55**

DATE DRILLED:
3/12/22
NO GROUNDWATER ON
3/12/22

DEPTH (FT)	SOIL DESCRIPTION	BLOWS PER FT.	WATER CONTENT %
0–18	SAND, CLAYEY, brown to dark brown, loose, moist		
5		10	5.4
10		13	7.5
15		10	5.5
18–20	CLAY, SANDY, dark brown, stiff, moist		
20		14	15.4

TEST BORING: **56**

DATE DRILLED:
3/12/22
NO GROUNDWATER ON
3/12/22

DEPTH (FT)	SOIL DESCRIPTION	BLOWS PER FT.	WATER CONTENT %
0–20	SAND, CLAYEY, brown, loose, moist		
5		8	5.3
10		8	8.6
15		8	9.1
20		5	12.6

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TEST BORING LOG

JOB No. 187746

FIGURE No. 32

DATE Aug/05/2022

TEST BORING: **57** DATE DRILLED: 3/12/22 NO GROUNDWATER ON 3/12/22	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, olive to gray, medium hard to hard, moist	5		50/6"	13.5
	10		50/6"	13.7
	15		50/7"	14.5
	20		50	13.4

TEST BORING: **58** DATE DRILLED: 3/12/22 NO GROUNDWATER ON 3/12/22	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, light brown to brown, medium dense, moist	5		19	6.0
	10		22	5.9
	15		27	6.5
CLAY, SANDY, olive, medium stiff to stiff, moist	20		10	9.4
	25		7	11.8
	30		9	19.7

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TEST BORING LOG

JOB No. 187746

FIGURE No. 33

DATE Aug/05/2022

TEST BORING: 59

DATE DRILLED: 3/12/22
NO GROUNDWATER ON 3/12/22

Description	Depth (ft)	Sample	Blows per ft.	Water content %
CLAY, SANDY, brown, moist	0–4			
CLAYSTONE, SANDY, brown and olive to gray, firm to hard, moist	4		35	11.4
	9		50/7"	11.9
	14		50/6"	13.2
	19		50/8"	12.5

TEST BORING: 60

DATE DRILLED: 3/12/22
NO GROUNDWATER ON 3/12/22

Description	Depth (ft)	Sample	Blows per ft.	Water content %
CLAY, SANDY, brown to olive, stiff, moist	4		11	9.1
	9		13	13.8
	14		14	15.9
	19		13	15.7

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TEST BORING LOG

JOB No. 187746

FIGURE No. 34

DATE Aug/05/2022

TEST BORING: **61** DATE DRILLED: 3/8/22 NO GROUNDWATER ON 3/8/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, very stiff, moist	5			29	8.4
CLAYSTONE, SANDY, brown to dark brown and olive, medium hard to very hard, moist	10			50/8"	12.2
	15			50/6"	12.6
	20			50/7"	11.5
	25			50/6"	20.6

TEST BORING: **62** DATE DRILLED: 3/8/22 NO GROUNDWATER ON 3/8/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown to olive, very stiff, moist	5			26	9.4
	10			32	10.9
CLAYSTONE, SANDY, brown to olive, medium hard to very hard, moist	15			50/8"	11.9
	20			50/5"	11.7

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TEST BORING LOG

JOB No. 187746

FIGURE No. 35

DATE Aug/05/2022

TEST BORING: **63**

DATE DRILLED: 3/12/22

NO GROUNDWATER ON 3/12/22

DESCRIPTION	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown to olive, stiff to hard, moist	5		24	10.9
	10		50/9"	13.4
	15		50/8"	14.5
	20		12	16.5

TEST BORING: **64**

DATE DRILLED: 3/12/22

NO GROUNDWATER ON 3/12/22

DESCRIPTION	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, olive, very stiff, moist	5		40	12.2
	10		42	14.5
CLAYSTONE, SANDY, brown to olive, hard to very hard, moist	15		50/6"	10.7
	20		50/7"	11.6

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TEST BORING LOG

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FIGURE No. 36

DATE Aug/05/2022

TEST BORING: **65** DATE DRILLED: 3/8/22 NO GROUNDWATER ON 3/8/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, brown to olive, medium hard to very hard, moist	5			50/11"	11.0
	10			50/7"	10.8
	15			50/6"	10.4
	20			50/7"	13.2

TEST BORING: **66** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, brown and olive to dark gray, firm to very hard, moist	5			41	12.6
	10			50/6"	12.3
	15			50/6"	12.4
	20			50/6"	13.4
	25			50/5"	12.3

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TEST BORING LOG

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FIGURE No. 37

DATE Aug/05/2022

TEST BORING: **67** DATE DRILLED: 3/8/22 NO GROUNDWATER ON 3/8/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff, moist	5			12	13.4
CLAYSTONE, SANDY, brown to dark brown and olive, firm to hard, moist	10			45	13.8
	15			50/9"	10.7
	20			50/10"	10.5

TEST BORING: **68** DATE DRILLED: 3/8/22 NO GROUNDWATER ON 3/8/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, very stiff, moist	5			22	8.4
	10			35	10.0
CLAYSTONE, SANDY, dark brown, medium hard, moist	15			50	14.9
	20			49	14.4

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TEST BORING LOG

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FIGURE No. 38

DATE Aug/05/2022

TEST BORING: **69** DATE DRILLED: 2/14/22 NO GROUNDWATER ON 2/14/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown to olive, very stiff, moist	5			25	8.9
CLAYSTONE, SANDY, brown to olive, firm to hard, moist	10			33	10.1
	15			50/9"	12.0
	20			50/6"	10.5

TEST BORING: **70** DATE DRILLED: 3/8/22 NO GROUNDWATER ON 3/8/22	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, very stiff, moist	5			25	13.8
CLAYSTONE, SANDY, brown to dark brown and olive, medium hard to very hard, moist	10			50/8"	15.3
	15			50/9"	14.6
	20			38	12.0
	25				
	30			50/4"	11.4

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TEST BORING LOG

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FIGURE No. 39

DATE Aug/05/2022

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
1	4.0	5.3	103.2	23	8	0.0	25.8		- 1.3	SC
1	9.0	6.8								
1	14.0	8.4								
1	19.0	11.5								
1	24.0	12.4	110.1	25	10				- 0.9	
1	29.0	11.1				0.3	21.7			
2	4.0	6.5								
2	9.0	13.6	107.4			1.9	32.3		- 0.7	
2	14.0	13.1								
2	19.0	9.8								
3	4.0	3.4				0.0	7.9			
3	9.0	10.9								
3	14.0	6.8								
3	19.0	5.5								
4	4.0	7.7								
4	9.0	9.3								
4	14.0	12.7		30	13	0.4	28.9			SC
4	19.0	15.4								
4	24.0	10.2								
5	4.0	7.4								
5	9.0	7.9	102.1				32.7		- 2.4	
5	14.0	8.6								
5	19.0	6.1								
6	4.0	5.7								
6	9.0	6.1								
6	14.0	8.4	102.5	24	10		38.8		- 2.3	SC
6	19.0	9.5								
7	9.0	4.2		NP	NP	0.0	22.6			SM
7	14.0	5.1								
7	19.0	14.1								
8	4.0	6.2				0.5	14.3			
8	9.0	8.8								
8	14.0	14.7								
8	19.0	19.1								

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
9	4.0	6.2		30	19	0.0	54.6			CL
9	9.0	10.7								
9	14.0	13.3								
9	19.0	11.8								
10	4.0	7.7								
10	9.0	12.1	118.5	42	25	0.0	67.9		0.9	CL
10	14.0	15.9								
10	19.0	13.7								
11	4.0	5.9								
11	9.0	11.0	103.7	29	18	0.0	54.6		- 0.7	CL
11	14.0	16.7								
11	19.0	29.0								
12	4.0	12.2	115.8				74.4		6.8	
12	9.0	12.7								
12	14.0	12.7								
12	19.0	11.6								
13	4.0	8.4								
13	9.0	9.5	107.5				57.3		1.6	
13	14.0	9.7								
13	19.0	10.2								
13	24.0	9.5	99.5	38	24		77.8		0.0	CL
13	29.0	10.7								
14	4.0	5.3								
14	9.0	0.9				0.2	3.0			SP
14	14.0	2.9								
14	19.0	3.6								
15	4.0	7.8	111.2	32	21		41.6		1.9	SC
15	9.0	10.2								
15	14.0	24.8								
15	19.0	12.4								
16	4.0	5.8		27	8	0.0	54.8			CL
16	9.0	8.7								
16	14.0	10.8								
16	19.0	11.8								

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SUMMARY OF LABORATORY TEST RESULTS

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FIGURE No. 40
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Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
17	4.0	11.3								
17	9.0	16.0	115.3	73	54				4.1	
17	14.0	17.1								
17	19.0	17.8								
18	4.0	8.7	91.3	36	22				- 1.8	
18	9.0	14.6								
18	14.0	7.4								
18	19.0	14.0								
19	4.0	4.7								
19	9.0	7.9								
19	14.0	10.8								
19	19.0	8.5					61.1			
19	24.0	7.0	99.4						- 3.7	
19	29.0	12.3	109.9	32	17		64.5		- 0.7	CL
20	4.0	8.4		35	25		76.7			CL
20	9.0	7.3								
20	14.0	5.2								
20	19.0	16.3								
21	4.0	11.1								
21	9.0	9.3		33	19	0.0	65.6			CL
21	14.0	6.3								
21	19.0	8.9								
22	4.0	4.8					60.2			
22	9.0	9.7								
22	14.0	14.5								
22	19.0	10.0								
23	4.0	7.8								
23	9.0	7.7	103.1	36	25		70.1		0.8	CL
23	14.0	8.1								
23	19.0	9.6								
24	4.0	7.2								
24	9.0	8.5								
24	14.0	8.6	113.3	34	19				2.3	
24	19.0	12.6								

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SUMMARY OF LABORATORY TEST RESULTS

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
25	4.0	7.8								
25	9.0	9.6								
25	14.0	7.7	106.0	32	17				0.7	
25	19.0	7.9								
25	24.0	7.0		32	17		61.7			CL
25	29.0	8.2		35	22		61.0			CL
26	4.0	8.3								
26	9.0	9.3	114.8	33	22		71.9		0.8	CL
26	14.0	9.0								
26	19.0	9.1								
27	4.0	7.3	85.0				58.2		4.3	
27	9.0	14.0								
27	14.0	12.4								
27	19.0	8.9								
28	4.0	8.5								
28	9.0	9.4				0.0	82.4			
28	14.0	9.8								
28	19.0	13.0								
29	4.0	14.3	117.0				98.1		4.9	
29	9.0	12.9								
29	14.0	13.2								
29	19.0	11.3								
30	4.0	7.6								
30	9.0	8.0		31	14		70.0			CL
30	14.0	6.9								
30	19.0	14.5								
31	4.0	10.2								
31	9.0	11.6	127.4	49	32		87.5		4.8	CL
31	14.0	12.5								
31	19.0	14.4								
32	4.0	13.4	96.4	49	30	0.0	86.6		- 0.4	CL
32	9.0	4.7								
32	14.0	7.0								
32	19.0	6.8								

SUMMARY OF LABORATORY TEST RESULTS

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
33	4.0	5.6								
33	9.0	3.4				2.1	26.4			
33	14.0	1.5								
33	19.0	1.8								
34	4.0	5.5								
34	9.0	14.6		33	19		89.3			CL
34	14.0	16.0								
34	19.0	13.5								
35	4.0	9.7		38	23		73.0			CL
35	9.0	12.5								
35	14.0	11.2								
35	19.0	10.8								
35	29.0	19.2		59	39	0.0	92.2			CH
36	4.0	6.0	101.6	27	9		53.4		- 1.5	CL
36	9.0	6.3								
36	14.0	6.8								
36	19.0	10.1								
37	4.0	7.3								
37	9.0	6.0								
37	14.0	10.2	106.2				84.2		1.2	
37	19.0	10.9								
37	24.0	13.1								
37	29.0	13.7		45	30		79.3			CL
38	4.0	11.0								
38	9.0	20.4	102.5				98.0		2.2	
38	14.0	17.6								
38	19.0	16.6								
38	29.0	17.5	108.9				97.4		- 0.8	
39	4.0	10.6								
39	9.0	3.3		59	36	0.5	24.9			SC
39	14.0	5.2								
39	19.0	2.6								
40	4.0	6.3								
40	9.0	20.0		40	24	0.0	85.3			CL

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
40	14.0	4.1								
40	19.0	2.6								
41	4.0	7.4		29	10	0.0	64.2			CL
41	9.0	12.2								
41	14.0	12.8								
42	4.0	18.2	111.8	48	32	0.0	71.7		4.7	CL
42	9.0	13.0								
42	14.0	14.5								
42	19.0	14.3								
43	4.0	12.9	112.0	48	32		82.0		5.6	CL
43	9.0	10.2								
43	14.0	15.5								
43	19.0	18.6								
44	4.0	12.6								
44	9.0	13.2	118.6				90.7		6.2	
44	14.0	11.9								
44	19.0	12.6								
45	4.0	3.8				0.5	31.4			
45	9.0	7.7								
45	14.0	13.6								
45	19.0	13.9								
46	4.0	8.9								
46	9.0	9.2								
46	14.0	9.6	118.9			0.0	80.6		4.3	
46	19.0	9.3								
47	4.0	3.9				0.1	25.4			
47	9.0	6.2								
47	14.0	11.7								
47	19.0	18.1								
48	4.0	9.4								
48	9.0	10.8		36	22		73.4			CL
48	14.0	9.5								
48	19.0	13.6								
48	29.0	13.7	121.2	47	31		92.8		4.9	CL

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
49	4.0	14.8		54	35		82.7			CH
49	9.0	13.3								
49	14.0	14.5								
49	19.0	16.0								
50	4.0	7.1								
50	9.0	10.3	111.1	36	24				1.6	
50	14.0	11.0								
50	19.0	12.6								
51	4.0	3.8								
51	9.0	15.9	119.2	46	31		50.3		0.8	CL
51	14.0	6.0								
51	19.0	18.9								
52	4.0	6.2				0.0	39.7			
52	9.0	2.9								
52	14.0	10.0								
52	19.0	18.9								
53	4.0	6.2								
53	9.0	17.4	106.6	58	39	0.0	97.7		3.3	CH
53	14.0	8.2								
53	19.0	5.6								
53	24.0	13.0				2.0	48.1			
53	29.0	18.4								
54	4.0	12.9	89.0				84.9		- 0.4	
54	9.0	11.1								
54	14.0	16.2								
54	19.0	4.4								
55	4.0	5.4								
55	9.0	7.5				0.0	38.1			
55	14.0	5.5								
55	19.0	15.4								
56	4.0	5.3								
56	9.0	8.6				0.0	42.0			
56	14.0	9.1								
56	19.0	12.6								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 187746
FIGURE No. 40

DATE Aug/05/2022

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
57	4.0	13.5								
57	9.0	13.7								
57	14.0	14.5	116.4	49	34				2.1	
57	19.0	13.4								
58	4.0	6.0								
58	9.0	5.9								
58	14.0	6.5	99.6	19	7	0.0	40.1		- 5.5	SC-SM
58	19.0	9.4								
58	24.0	11.8								
58	29.0	19.7								
59	4.0	11.4								
59	9.0	11.9	116.6	46	32		89.5		6.1	CL
59	14.0	13.2								
59	19.0	12.5								
60	4.0	9.1				0.0	69.2			
60	9.0	13.8								
60	14.0	15.9								
60	19.0	15.7								
61	4.0	8.4								
61	9.0	12.2	124.4	42	28	0.0	97.5		3.6	CL
61	14.0	12.6								
61	19.0	11.5								
61	24.0	20.6								
62	4.0	9.4								
62	9.0	10.9	117.2	38	26	1.9	84.6		2.5	CL
62	14.0	11.9								
62	19.0	11.7								
63	4.0	10.9	111.1	37	22				3.3	
63	9.0	13.4								
63	14.0	14.5								
63	19.0	16.5								
64	4.0	12.2								
64	9.0	14.5		47	34		76.0			CL
64	14.0	10.7								

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
64	19.0	11.6								
65	4.0	11.0								
65	9.0	10.8								
65	14.0	10.4	118.5			0.0	91.9		5.4	
65	19.0	13.2								
66	4.0	12.6								
66	9.0	12.3	122.2	48	32		90.4		2.3	CL
66	14.0	12.4								
66	19.0	13.4								
66	24.0	12.3								
67	4.0	13.4								
67	9.0	13.8		44	31	0.0	95.6			CL
67	14.0	10.7								
67	19.0	10.5								
68	4.0	8.4		33	20	0.0	85.3			CL
68	9.0	10.0								
68	14.0	14.9								
68	19.0	14.4								
69	4.0	8.9								
69	9.0	10.1	102.4				80.9		1.2	
69	14.0	12.0								
69	19.0	10.5								
70	4.0	13.8								
70	9.0	15.3		62	47	0.0	99.0			CH
70	14.0	14.6								
70	19.0	12.0								
70	29.0	11.4								

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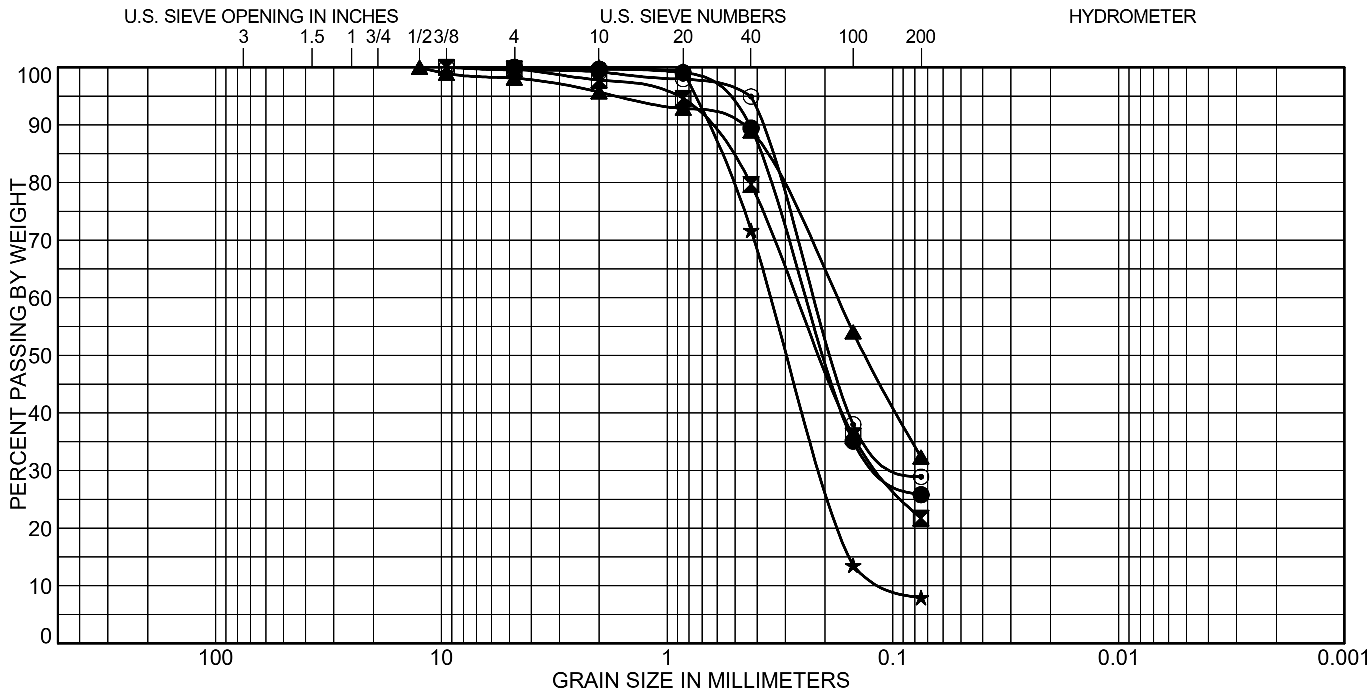
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 187746
FIGURE No. 40

DATE Aug/05/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	1	4.0	**CLAYEY SAND(SC)**	23	15	8
⧗	1	29.0				
▲	2	9.0				
★	3	4.0				
⊙	4	14.0	**CLAYEY SAND(SC)**	30	17	13

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	4.0	0.0	74.2	25.8	
⧗	1	29.0	0.3	78.0	21.7	
▲	2	9.0	1.9	65.8	32.3	
★	3	4.0	0.0	92.1	7.9	
⊙	4	14.0	0.4	70.7	28.9	

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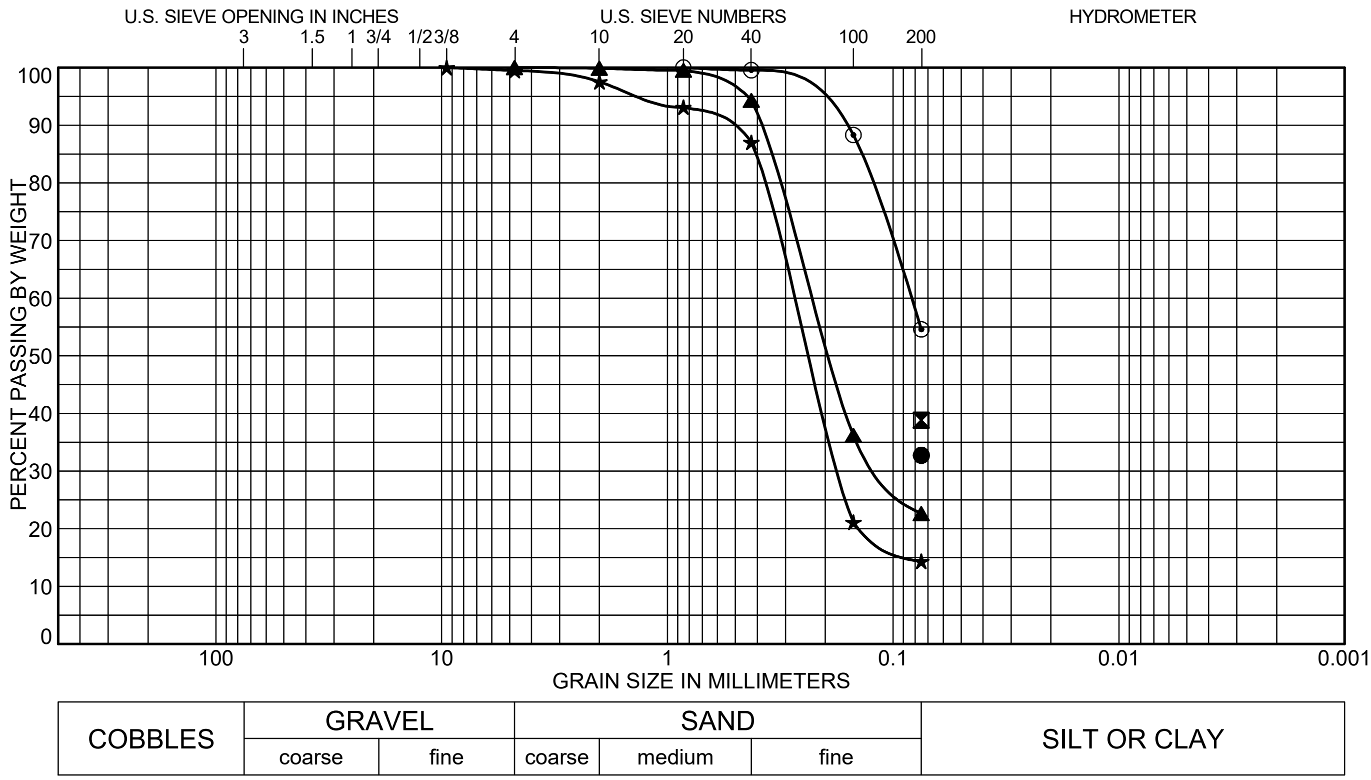
SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 41

DATE Aug/05/2022



	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**5**	**9.0**				
⧗	**6**	**14.0**	**CLAYEY SAND(SC)**	**24**	**14**	**10**
▲	**7**	**9.0**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**
★	**8**	**4.0**				
⊙	**9**	**4.0**	**SANDY LEAN CLAY(CL)**	**30**	**11**	**19**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**5**	**9.0**			**32.7**	
⧗	**6**	**14.0**			**38.8**	
▲	**7**	**9.0**	**0.0**	**77.4**	**22.6**	
★	**8**	**4.0**	**0.5**	**85.2**	**14.3**	
⊙	**9**	**4.0**	**0.0**	**45.4**	**54.6**	

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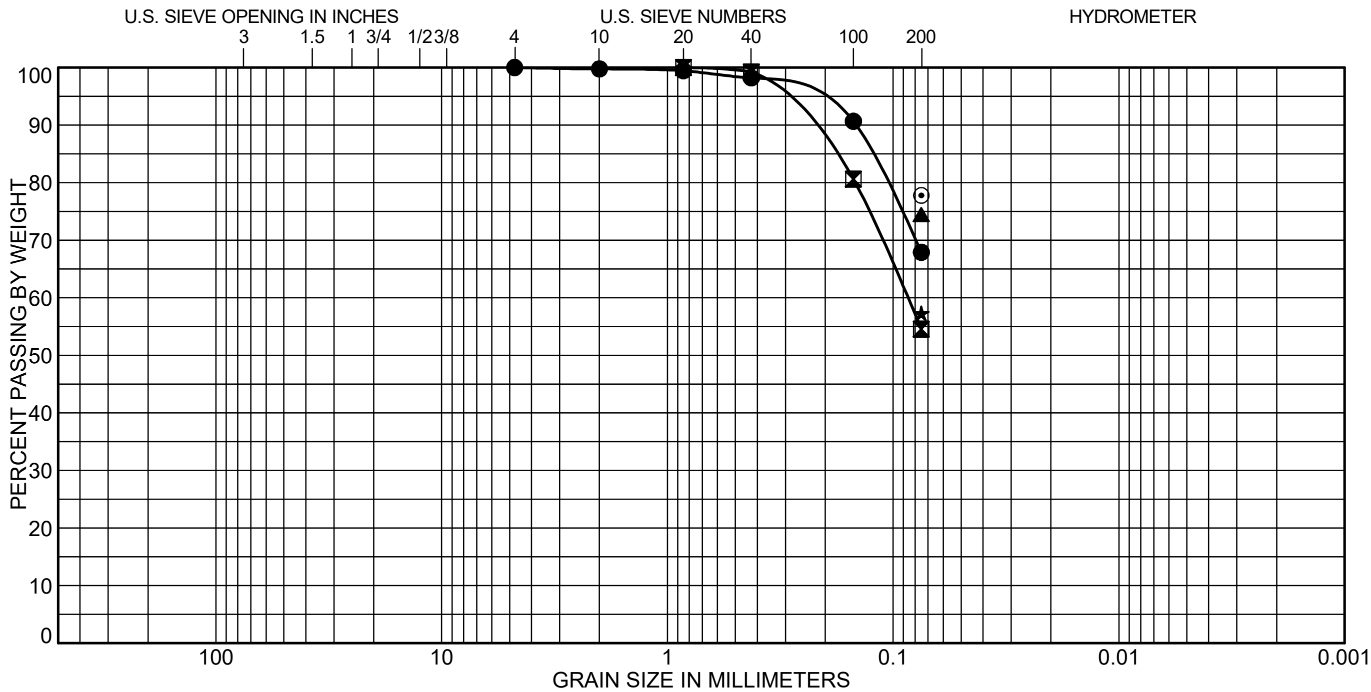
SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 42

DATE Aug/05/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**10**	**9.0**	**SANDY LEAN CLAY(CL)**	**42**	**17**	**25**
⊠	**11**	**9.0**	**SANDY LEAN CLAY(CL)**	**29**	**11**	**18**
▲	**12**	**4.0**				
★	**13**	**9.0**				
⊙	**13**	**24.0**	**LEAN CLAY with SAND(CL)**	**38**	**14**	**24**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**10**	**9.0**	**0.0**	**32.1**	**67.9**	
⊠	**11**	**9.0**	**0.0**	**45.4**	**54.6**	
▲	**12**	**4.0**			**74.4**	
★	**13**	**9.0**			**57.3**	
⊙	**13**	**24.0**			**77.8**	

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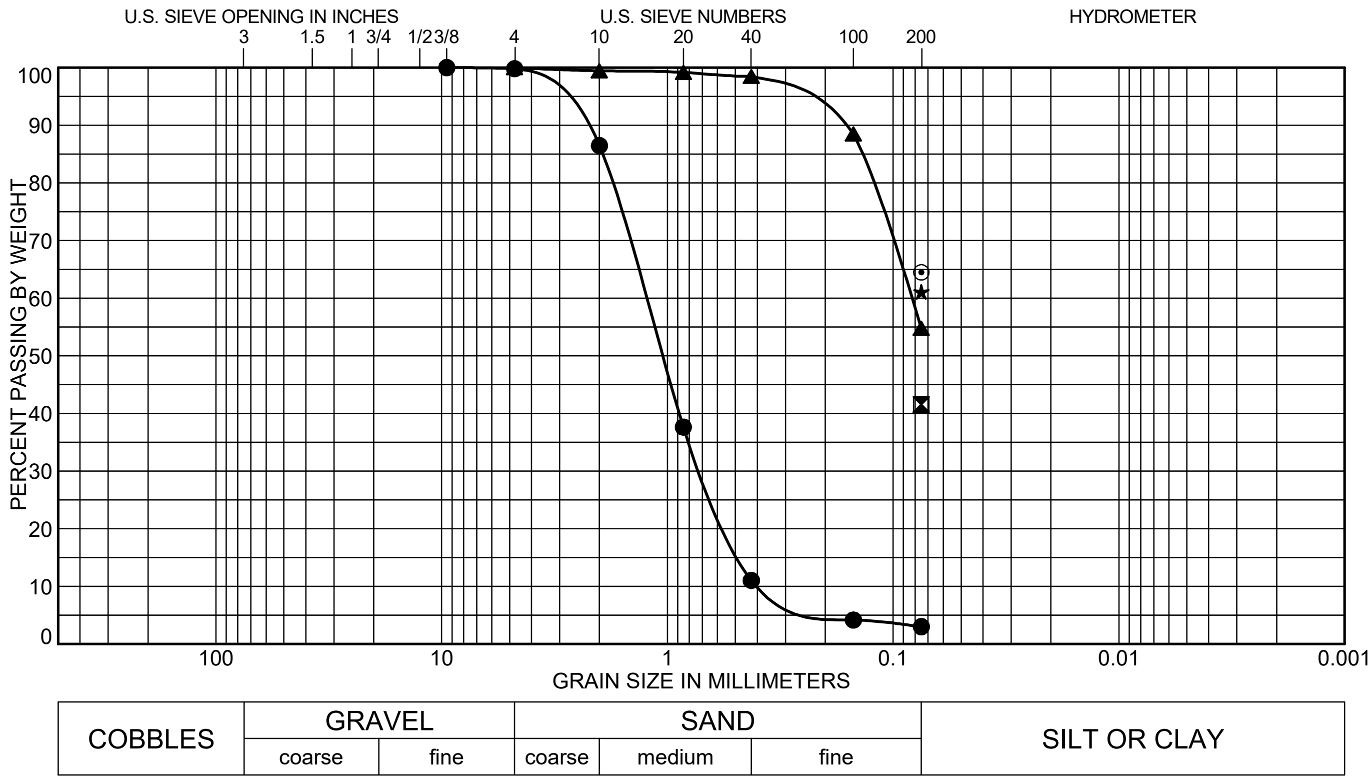
SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 43

DATE Aug/05/2022



	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**14**	**9.0**	**POORLY GRADED SAND(SP)**			
⧗	**15**	**4.0**	**CLAYEY SAND(SC)**	**32**	**11**	**21**
▲	**16**	**4.0**	**SANDY LEAN CLAY(CL)**	**27**	**19**	**8**
★	**19**	**19.0**				
⊙	**19**	**29.0**	**SANDY LEAN CLAY(CL)**	**32**	**15**	**17**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**14**	**9.0**	**0.2**	**96.8**	**3.0**	
⧗	**15**	**4.0**			**41.6**	
▲	**16**	**4.0**	**0.0**	**45.2**	**54.8**	
★	**19**	**19.0**			**61.1**	
⊙	**19**	**29.0**			**64.5**	

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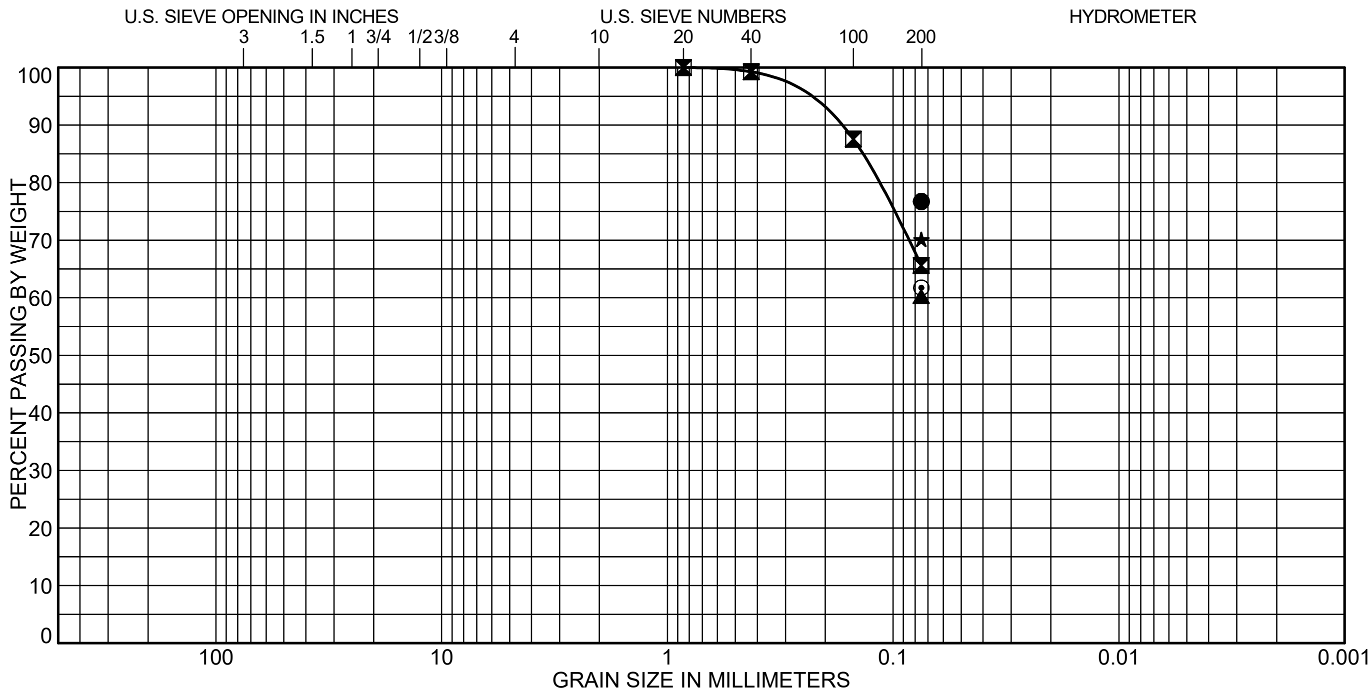
SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 44

DATE Aug/05/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**20**	**4.0**	**LEAN CLAY with SAND(CL)**	**35**	**10**	**25**
⧗	**21**	**9.0**	**SANDY LEAN CLAY(CL)**	**33**	**14**	**19**
▲	**22**	**4.0**				
★	**23**	**9.0**	**LEAN CLAY with SAND(CL)**	**36**	**11**	**25**
⊙	**25**	**24.0**	**SANDY LEAN CLAY(CL)**	**32**	**15**	**17**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**20**	**4.0**			**76.7**	
⧗	**21**	**9.0**	**0.0**	**34.4**	**65.6**	
▲	**22**	**4.0**			**60.2**	
★	**23**	**9.0**			**70.1**	
⊙	**25**	**24.0**			**61.7**	

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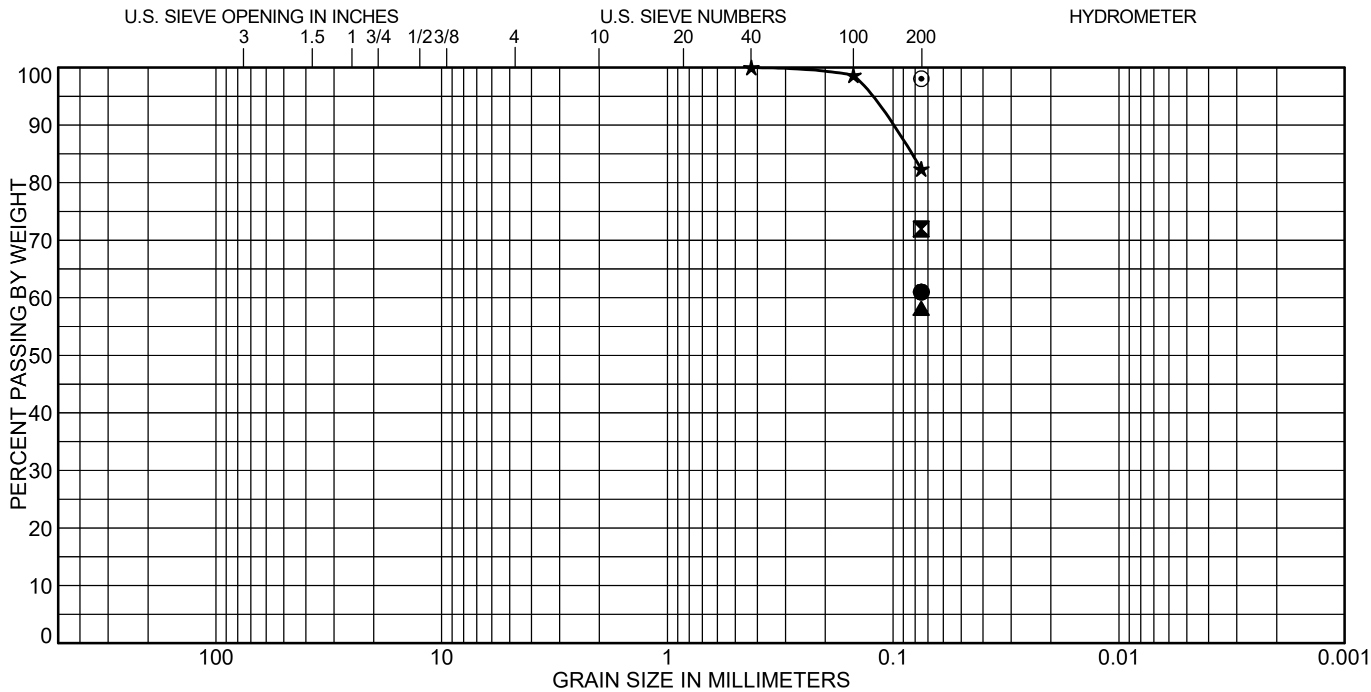
FIGURE No. 45

DATE Aug/05/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**25**	**29.0**	**SANDY LEAN CLAY(CL)**	**35**	**13**	**22**
⊠	**26**	**9.0**	**LEAN CLAY with SAND(CL)**	**33**	**11**	**22**
▲	**27**	**4.0**				
★	**28**	**9.0**				
⊙	**29**	**4.0**				

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**25**	**29.0**			**61.0**	
⊠	**26**	**9.0**			**71.9**	
▲	**27**	**4.0**			**58.2**	
★	**28**	**9.0**	**0.0**	**17.6**	**82.4**	
⊙	**29**	**4.0**			**98.1**	

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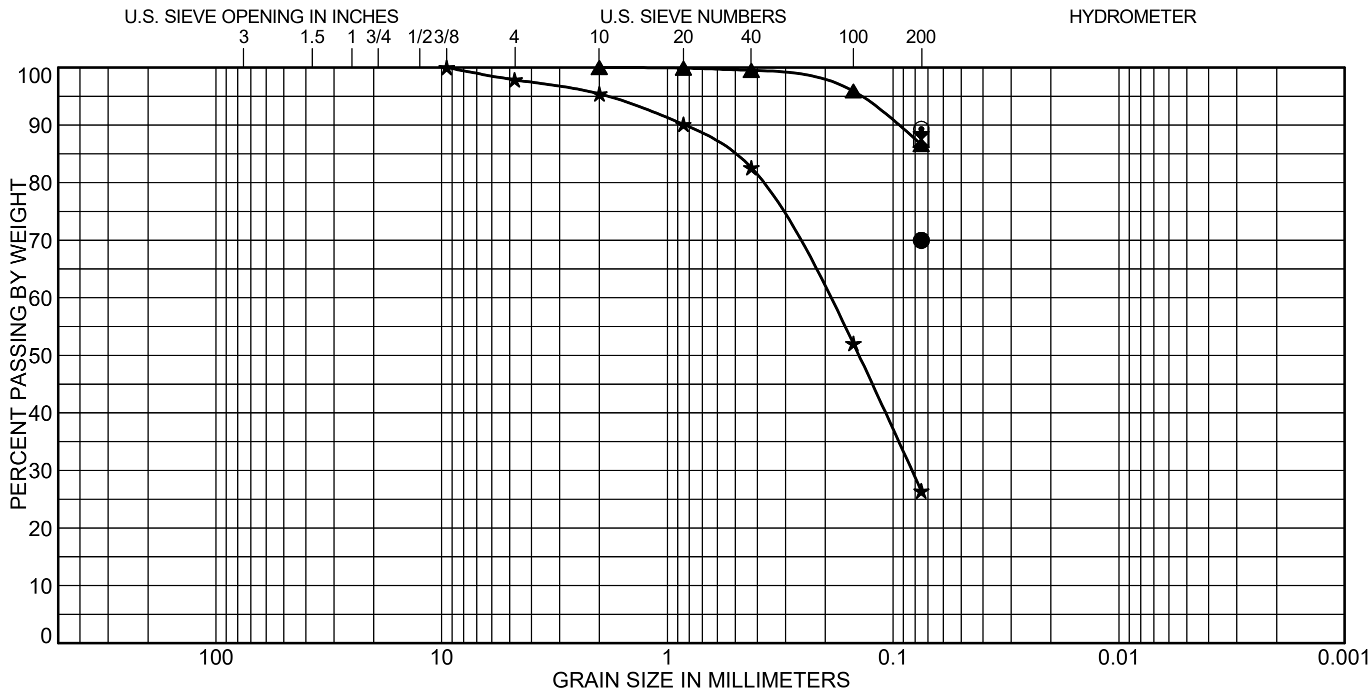
FIGURE No. 46

DATE Aug/05/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**30**	**9.0**	**SANDY LEAN CLAY(CL)**	**31**	**17**	**14**
⊠	**31**	**9.0**	**LEAN CLAY(CL)**	**49**	**17**	**32**
▲	**32**	**4.0**	**LEAN CLAY(CL)**	**49**	**19**	**30**
★	**33**	**9.0**				
⊙	**34**	**9.0**	**LEAN CLAY(CL)**	**33**	**14**	**19**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**30**	**9.0**			**70.0**	
⊠	**31**	**9.0**			**87.5**	
▲	**32**	**4.0**	**0.0**	**13.4**	**86.6**	
★	**33**	**9.0**	**2.1**	**71.4**	**26.4**	
⊙	**34**	**9.0**			**89.3**	

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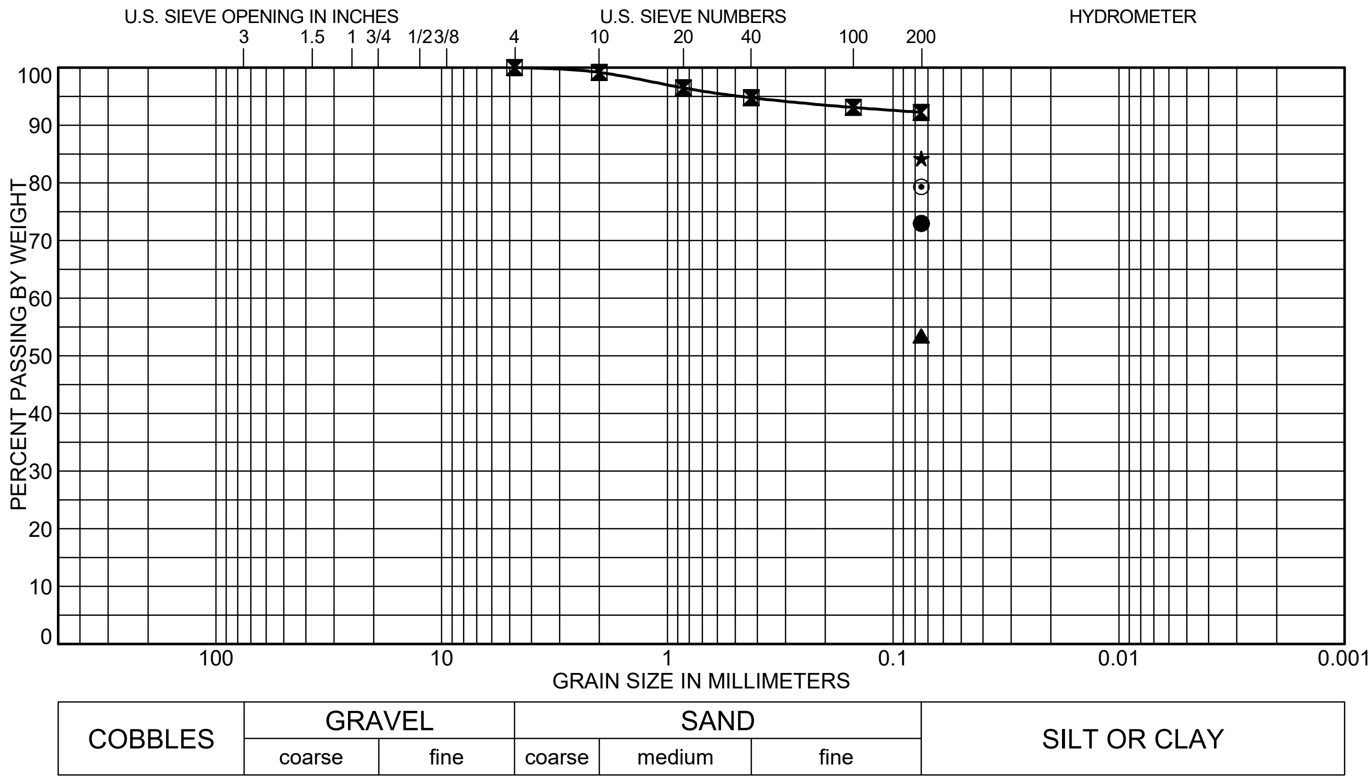
SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 47

DATE Aug/05/2022



	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**35**	**4.0**	**LEAN CLAY with SAND(CL)**	**38**	**15**	**23**
⧗	**35**	**29.0**	**FAT CLAY(CH)**	**59**	**20**	**39**
▲	**36**	**4.0**	**SANDY LEAN CLAY(CL)**	**27**	**18**	**9**
★	**37**	**14.0**				
⊙	**37**	**29.0**	**LEAN CLAY with SAND(CL)**	**45**	**15**	**30**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**35**	**4.0**			**73.0**	
⧗	**35**	**29.0**	**0.0**	**7.8**	**92.2**	
▲	**36**	**4.0**			**53.4**	
★	**37**	**14.0**			**84.2**	
⊙	**37**	**29.0**			**79.3**	

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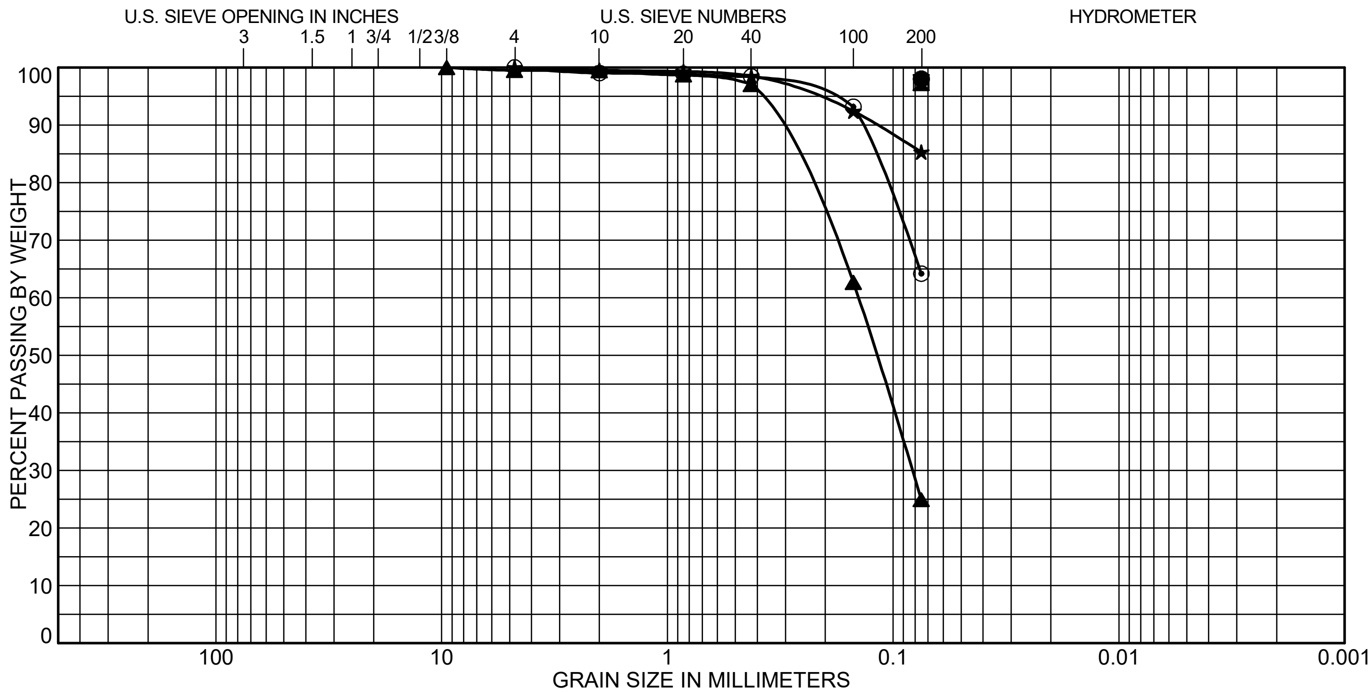
SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 48

DATE Aug/05/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**38**	**9.0**				
⧗	**38**	**29.0**				
▲	**39**	**9.0**	**CLAYEY SAND(SC)**	**59**	**23**	**36**
★	**40**	**9.0**	**LEAN CLAY(CL)**	**40**	**16**	**24**
⊙	**41**	**4.0**	**SANDY LEAN CLAY(CL)**	**29**	**19**	**10**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**38**	**9.0**			**98.0**	
⧗	**38**	**29.0**			**97.4**	
▲	**39**	**9.0**	**0.5**	**74.6**	**24.9**	
★	**40**	**9.0**	**0.0**	**14.7**	**85.3**	
⊙	**41**	**4.0**	**0.0**	**35.8**	**64.2**	

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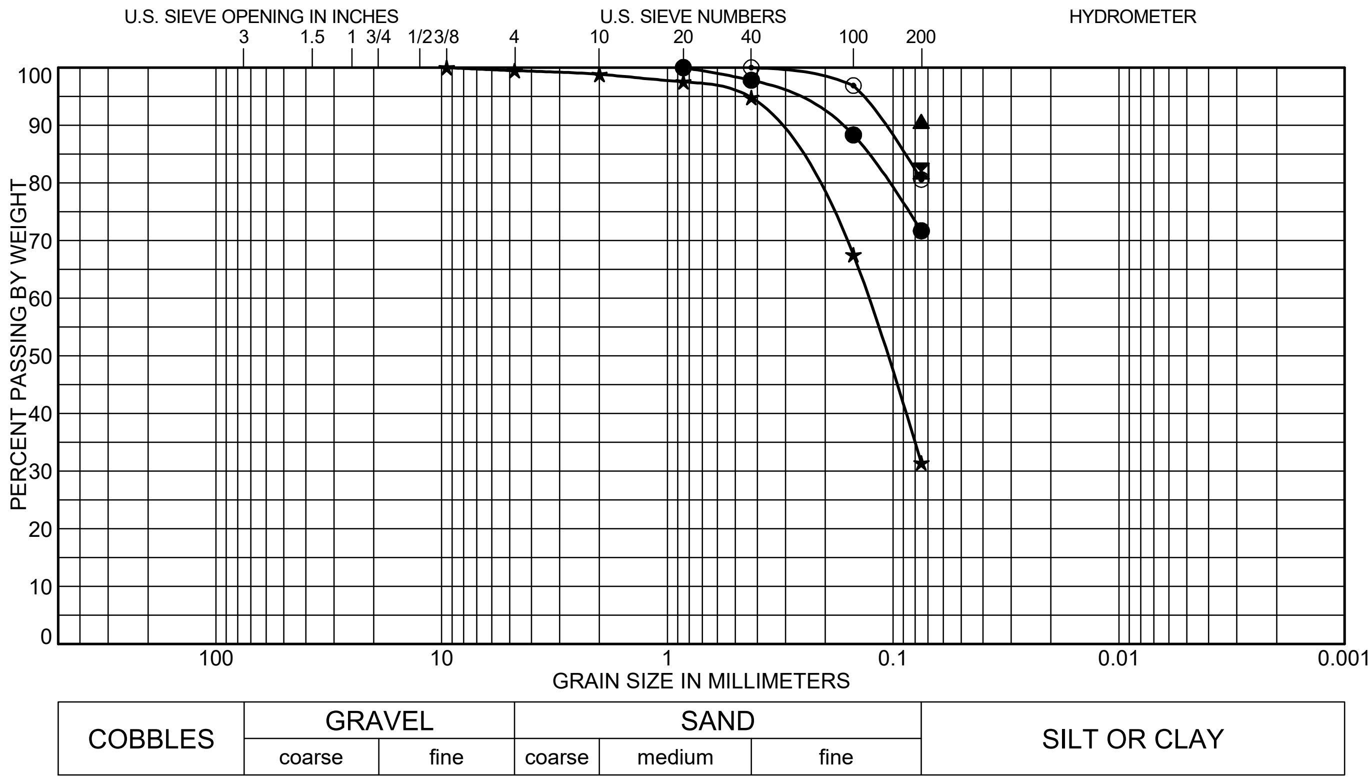
SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 49

DATE Aug/05/2022



	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**42**	**4.0**	**LEAN CLAY with SAND(CL)**	**48**	**16**	**32**
⧗	**43**	**4.0**	**LEAN CLAY with SAND(CL)**	**48**	**16**	**32**
▲	**44**	**9.0**				
★	**45**	**4.0**				
⦿	**46**	**14.0**				

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**42**	**4.0**	**0.0**	**28.3**	**71.7**	
⧗	**43**	**4.0**			**82.0**	
▲	**44**	**9.0**			**90.7**	
★	**45**	**4.0**	**0.5**	**68.1**	**31.4**	
⦿	**46**	**14.0**	**0.0**	**19.4**	**80.6**	

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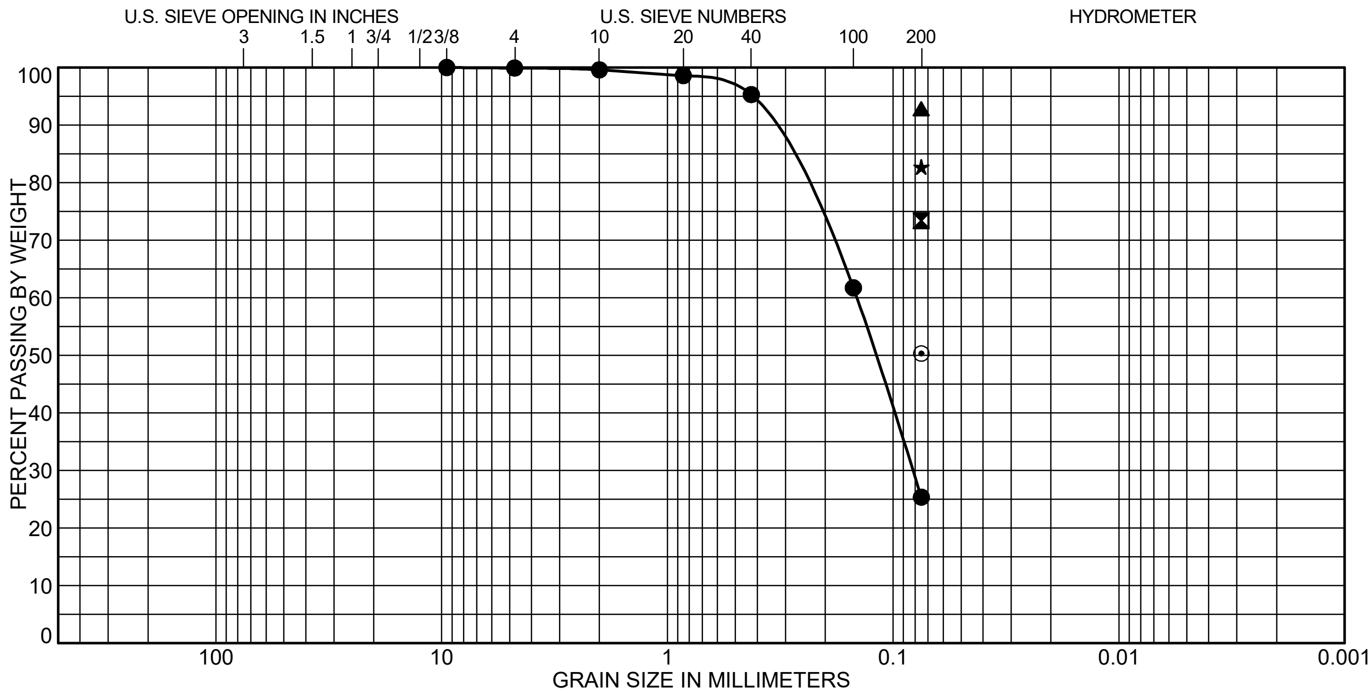
SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 50

DATE Aug/05/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**47**	**4.0**				
⧗	**48**	**9.0**	**LEAN CLAY with SAND(CL)**	**36**	**14**	**22**
▲	**48**	**29.0**	**LEAN CLAY(CL)**	**47**	**16**	**31**
★	**49**	**4.0**	**FAT CLAY with SAND(CH)**	**54**	**19**	**35**
⊙	**51**	**9.0**	**SANDY LEAN CLAY(CL)**	**46**	**15**	**31**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**47**	**4.0**	**0.1**	**74.5**	**25.4**	
⧗	**48**	**9.0**			**73.4**	
▲	**48**	**29.0**			**92.8**	
★	**49**	**4.0**			**82.7**	
⊙	**51**	**9.0**			**50.3**	

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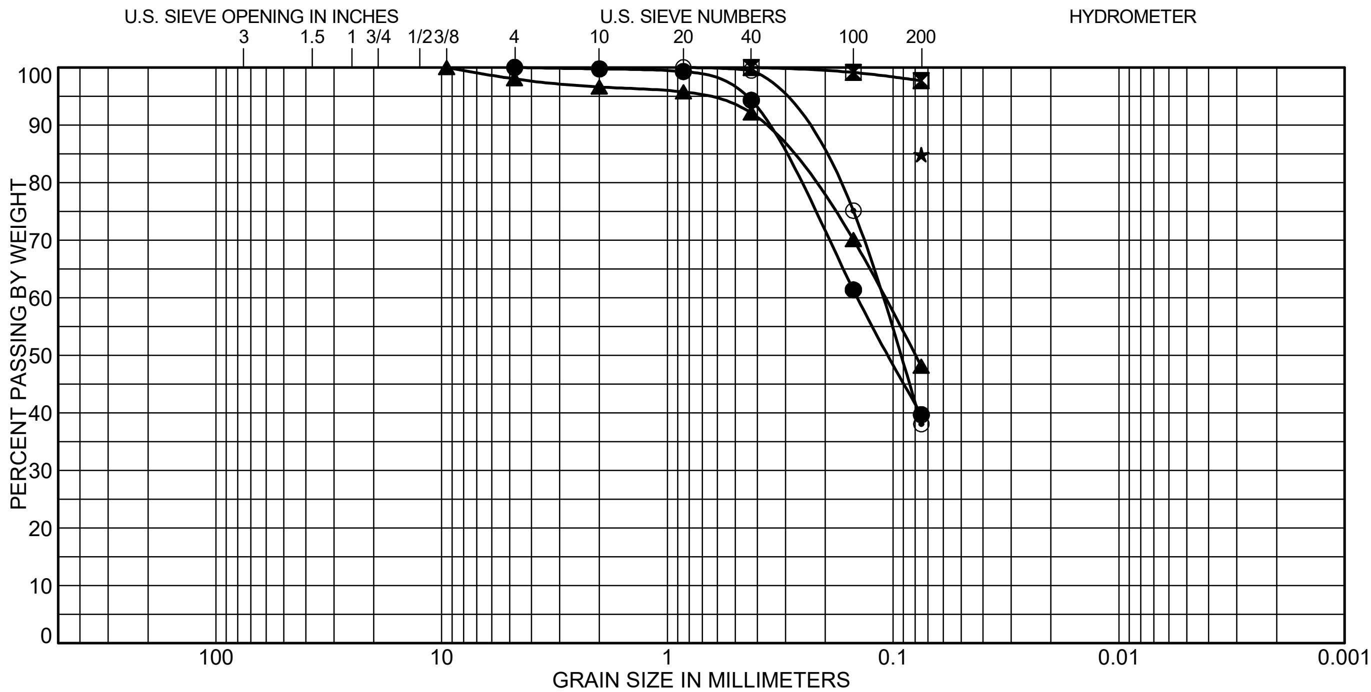
SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 51

DATE Aug/05/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	**52**	**4.0**				
⧗	**53**	**9.0**	**FAT CLAY(CH)**	**58**	**19**	**39**
▲	**53**	**24.0**				
★	**54**	**4.0**				
⊙	**55**	**9.0**				

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**52**	**4.0**	**0.0**	**60.3**	**39.7**	
⧗	**53**	**9.0**	**0.0**	**2.3**	**97.7**	
▲	**53**	**24.0**	**2.0**	**49.9**	**48.1**	
★	**54**	**4.0**			**84.9**	
⊙	**55**	**9.0**	**0.0**	**61.9**	**38.1**	

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SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 52

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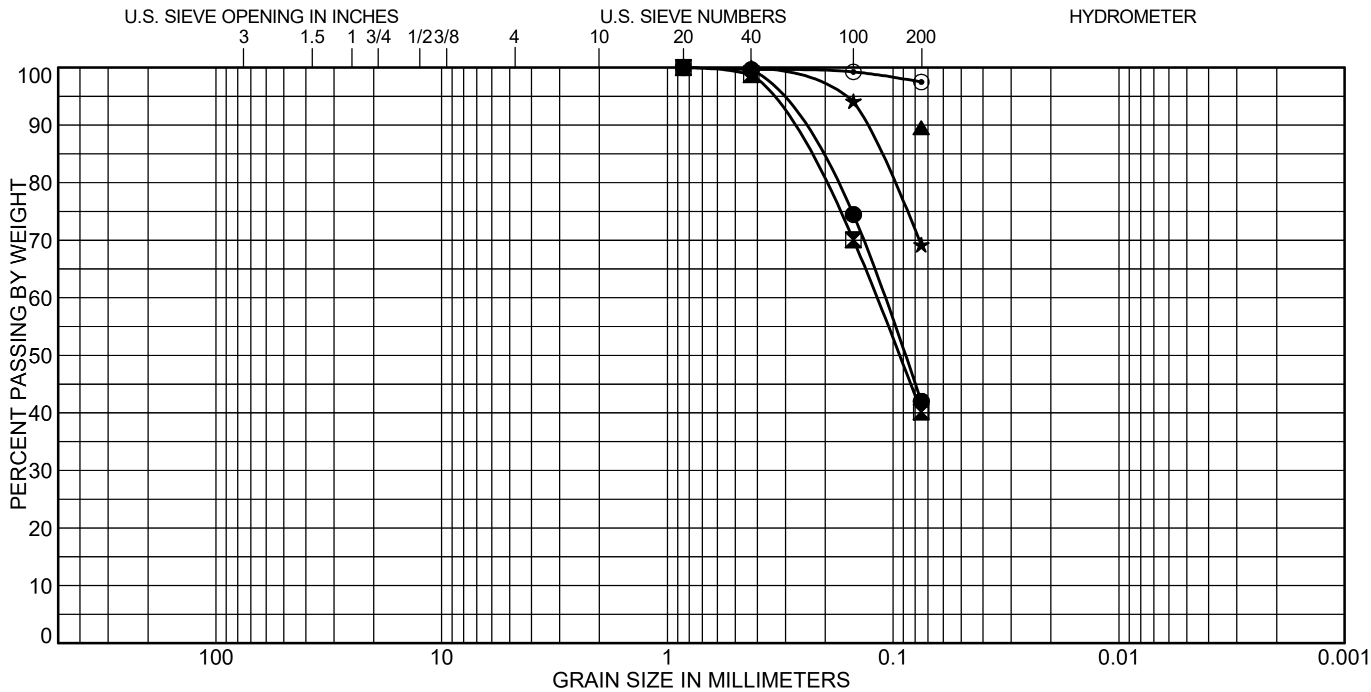

<table>
<tr><td rowspan="2">COBBLES</td><td colspan="2">GRAVEL</td><td colspan="3">SAND</td><td rowspan="2">SILT OR CLAY</td></tr>
<tr><td>coarse</td><td>fine</td><td>coarse</td><td>medium</td><td>fine</td></tr>
</table>

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**56**	**9.0**				
⧗	**58**	**14.0**	**SILTY, CLAYEY SAND(SC-SM)**	**19**	**12**	**7**
▲	**59**	**9.0**	**LEAN CLAY(CL)**	**46**	**14**	**32**
★	**60**	**4.0**			**14**	
⊙	**61**	**9.0**	**LEAN CLAY(CL)**	**42**	**14**	**28**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**56**	**9.0**	**0.0**	**58.0**	**42.0**	
⧗	**58**	**14.0**	**0.0**	**59.9**	**40.1**	
▲	**59**	**9.0**			**89.5**	
★	**60**	**4.0**	**0.0**	**30.8**	**69.2**	
⊙	**61**	**9.0**	**0.0**	**2.5**	**97.5**	

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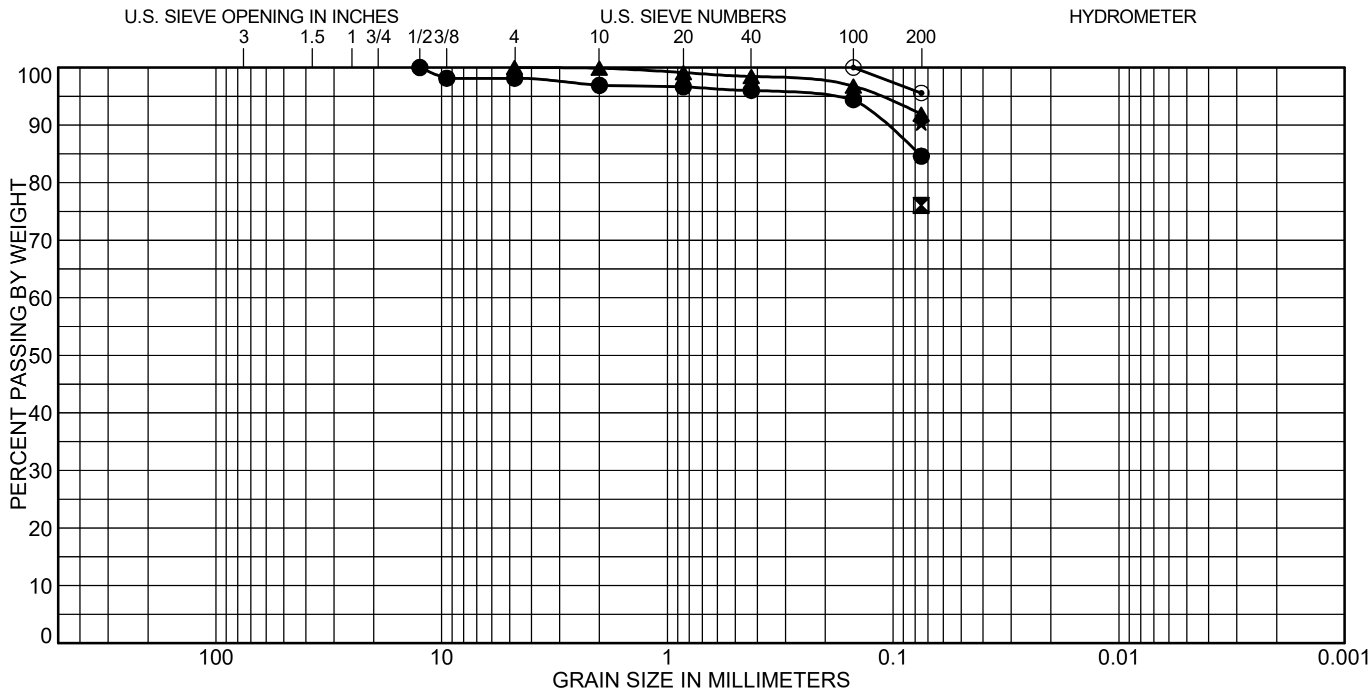
JOB No. 187746

FIGURE No. 53

DATE Aug/05/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**62**	**9.0**	**LEAN CLAY with SAND(CL)**	**38**	**12**	**26**
⧗	**64**	**9.0**	**LEAN CLAY with SAND(CL)**	**47**	**13**	**34**
▲	**65**	**14.0**				
★	**66**	**9.0**	**LEAN CLAY(CL)**	**48**	**16**	**32**
⊙	**67**	**9.0**	**LEAN CLAY(CL)**	**44**	**13**	**31**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**62**	**9.0**	**1.9**	**13.5**	**84.6**	
⧗	**64**	**9.0**			**76.0**	
▲	**65**	**14.0**	**0.0**	**8.1**	**91.9**	
★	**66**	**9.0**			**90.4**	
⊙	**67**	**9.0**	**0.0**	**4.4**	**95.6**	

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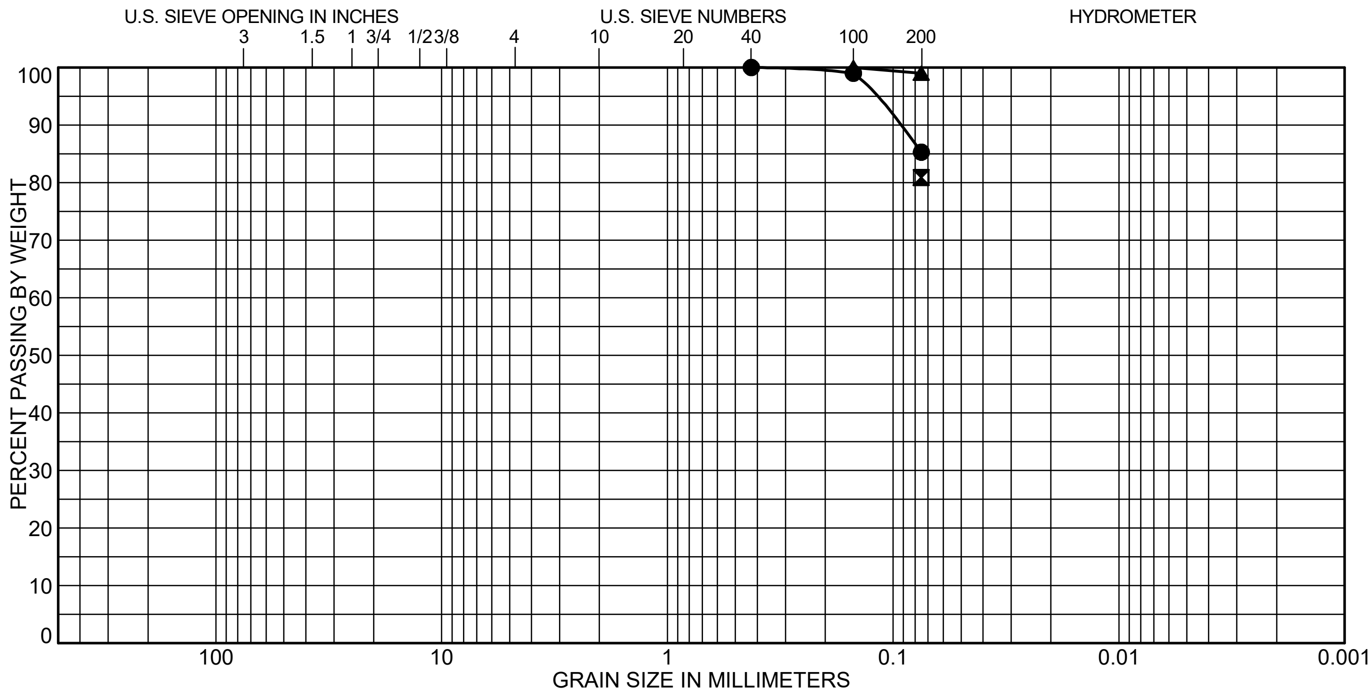
SOIL CLASSIFICATION DATA

JOB No. 187746

FIGURE No. 54

DATE Aug/05/2022



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**68**	**4.0**	**LEAN CLAY(CL)**	**33**	**13**	**20**
⧗	**69**	**9.0**				
▲	**70**	**9.0**	**FAT CLAY(CH)**	**62**	**15**	**47**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**68**	**4.0**	**0.0**	**14.7**	**85.3**	
⧗	**69**	**9.0**			**80.9**	
▲	**70**	**9.0**	**0.0**	**1.0**	**99.0**	

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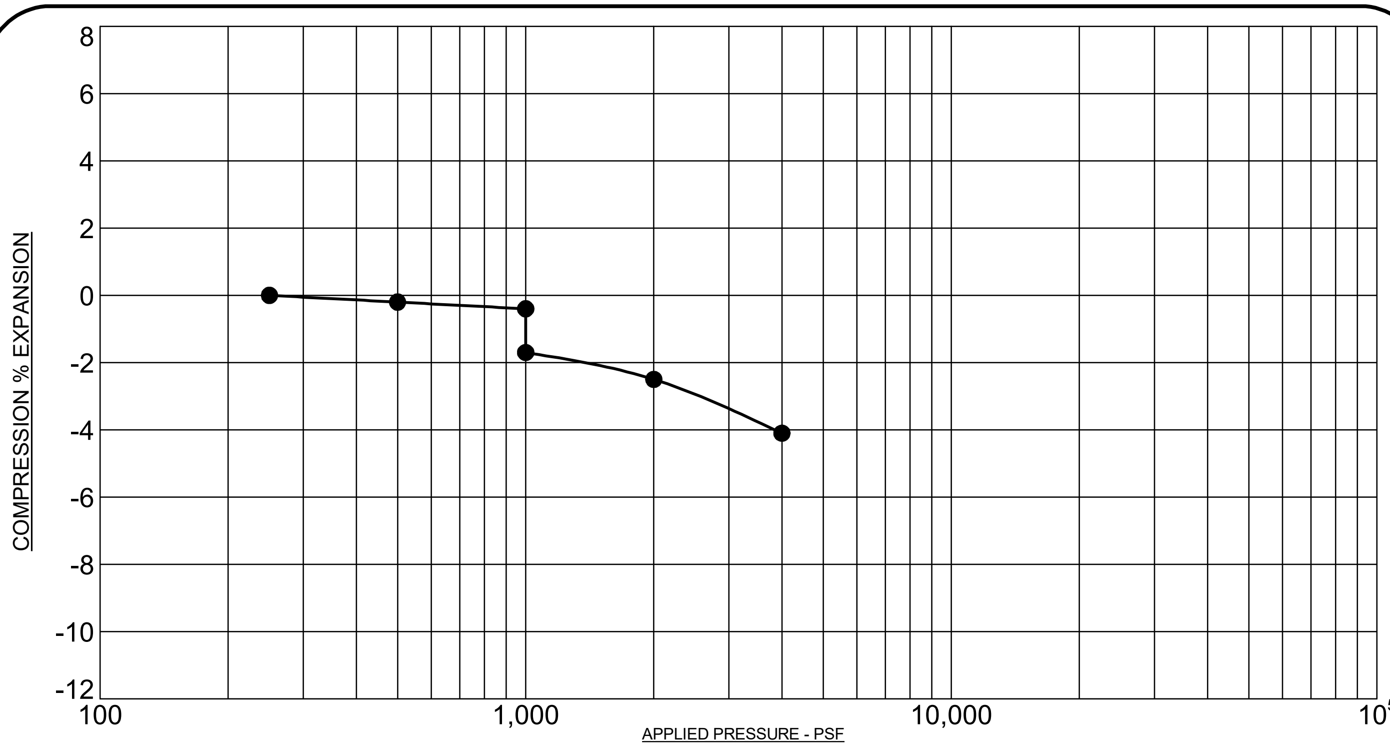
SOIL CLASSIFICATION DATA

JOB No. 187746

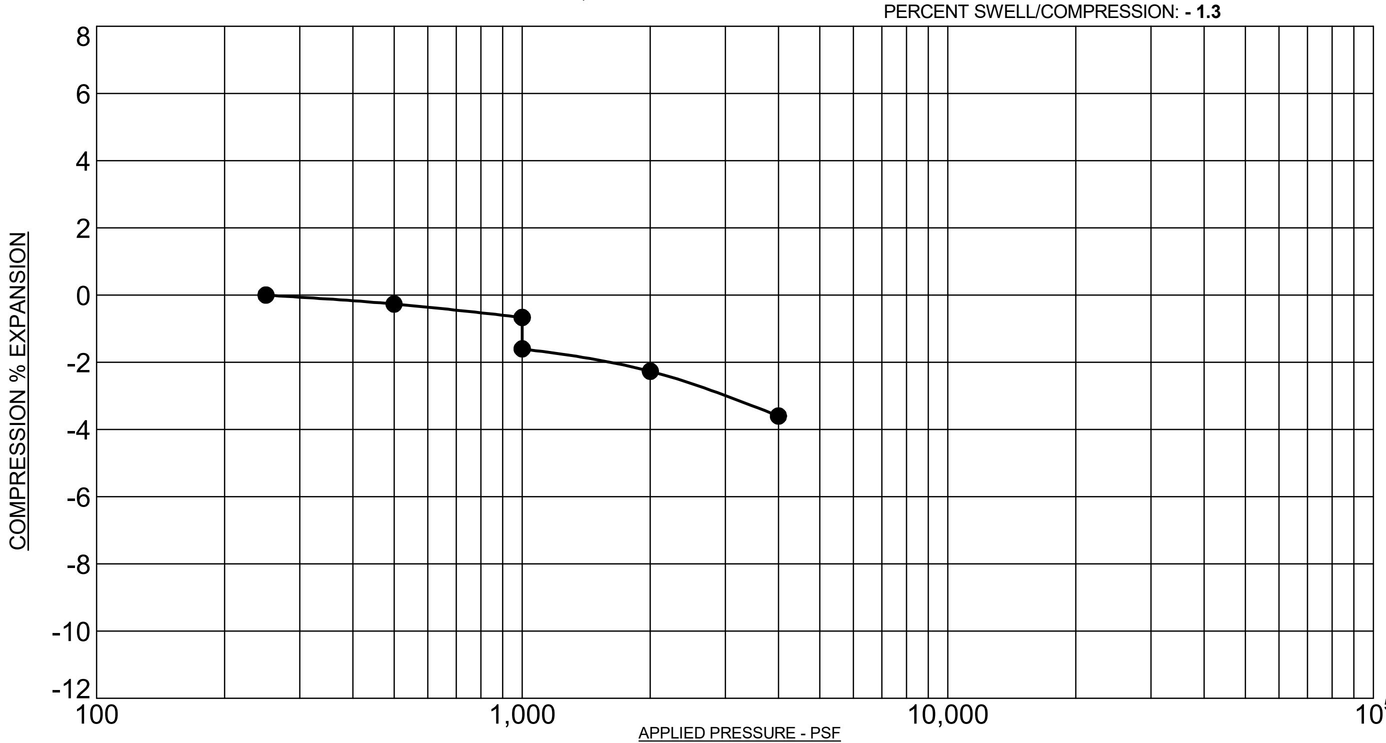
FIGURE No. 55

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **1 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **103.2 PCF**
NATURAL MOISTURE CONTENT: **5.3%**
PERCENT SWELL/COMPRESSION: **- 1.3**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **1 @ 24 FT**
NATURAL DRY UNIT WEIGHT: **110.1 PCF**
NATURAL MOISTURE CONTENT: **12.4%**
PERCENT SWELL/COMPRESSION: **- 0.9**

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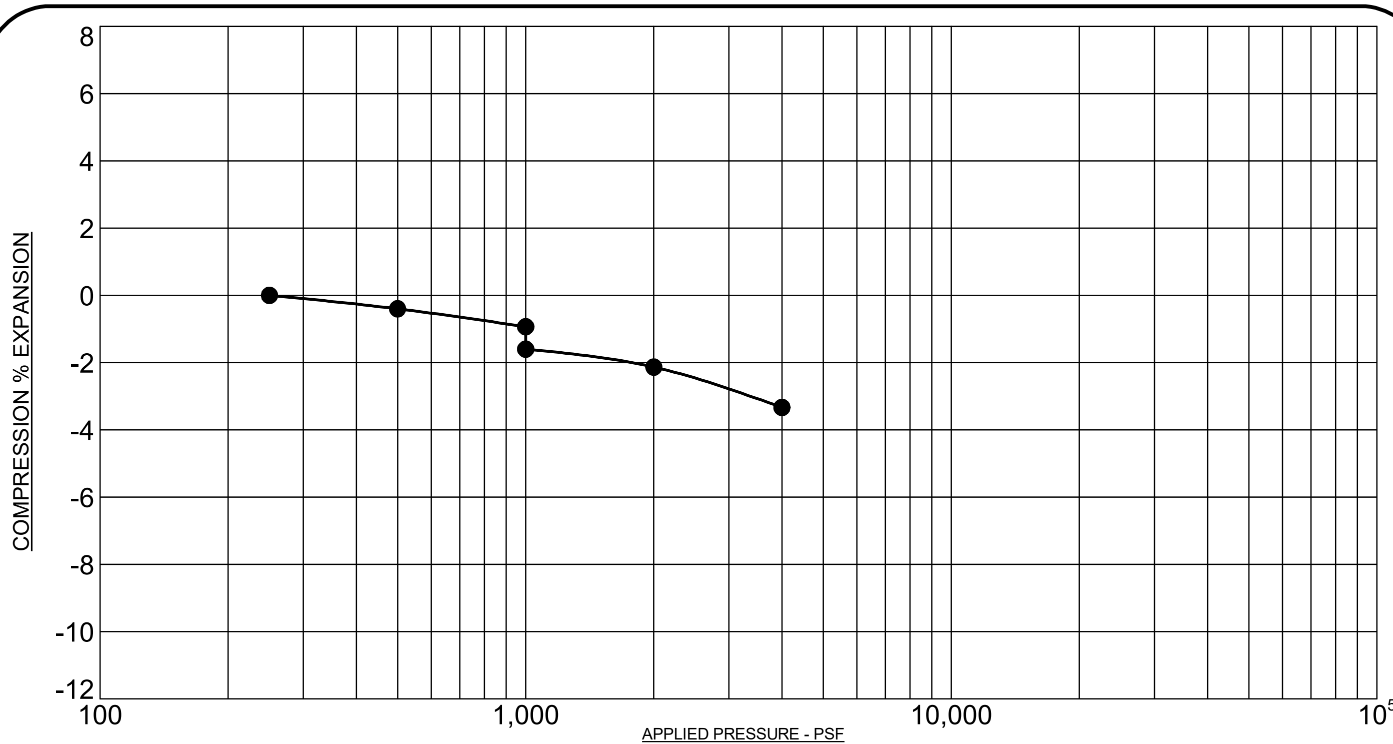
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

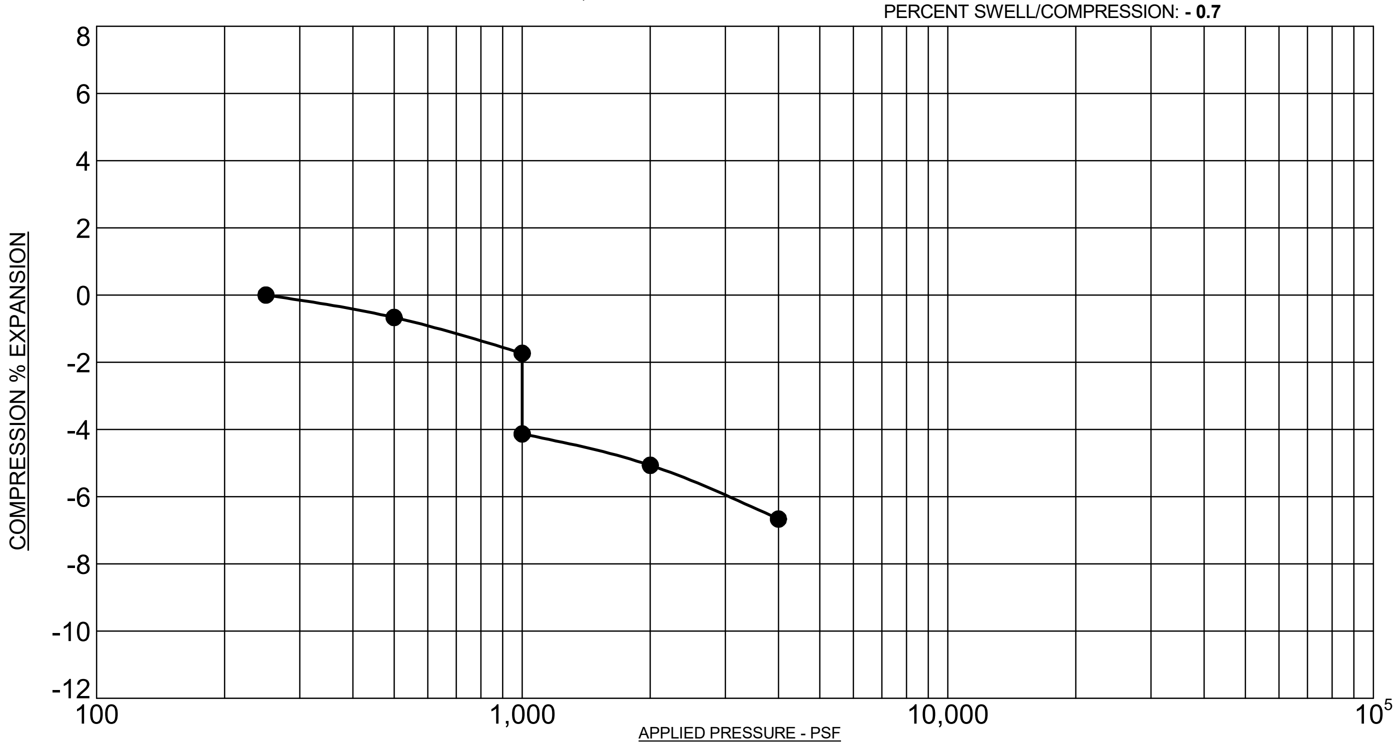
FIGURE No. 56

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **SANDSTONE, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **2 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **107.4 PCF**
NATURAL MOISTURE CONTENT: **13.6%**
PERCENT SWELL/COMPRESSION: **- 0.7**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **5 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **102.1 PCF**
NATURAL MOISTURE CONTENT: **7.9%**
PERCENT SWELL/COMPRESSION: **- 2.4**

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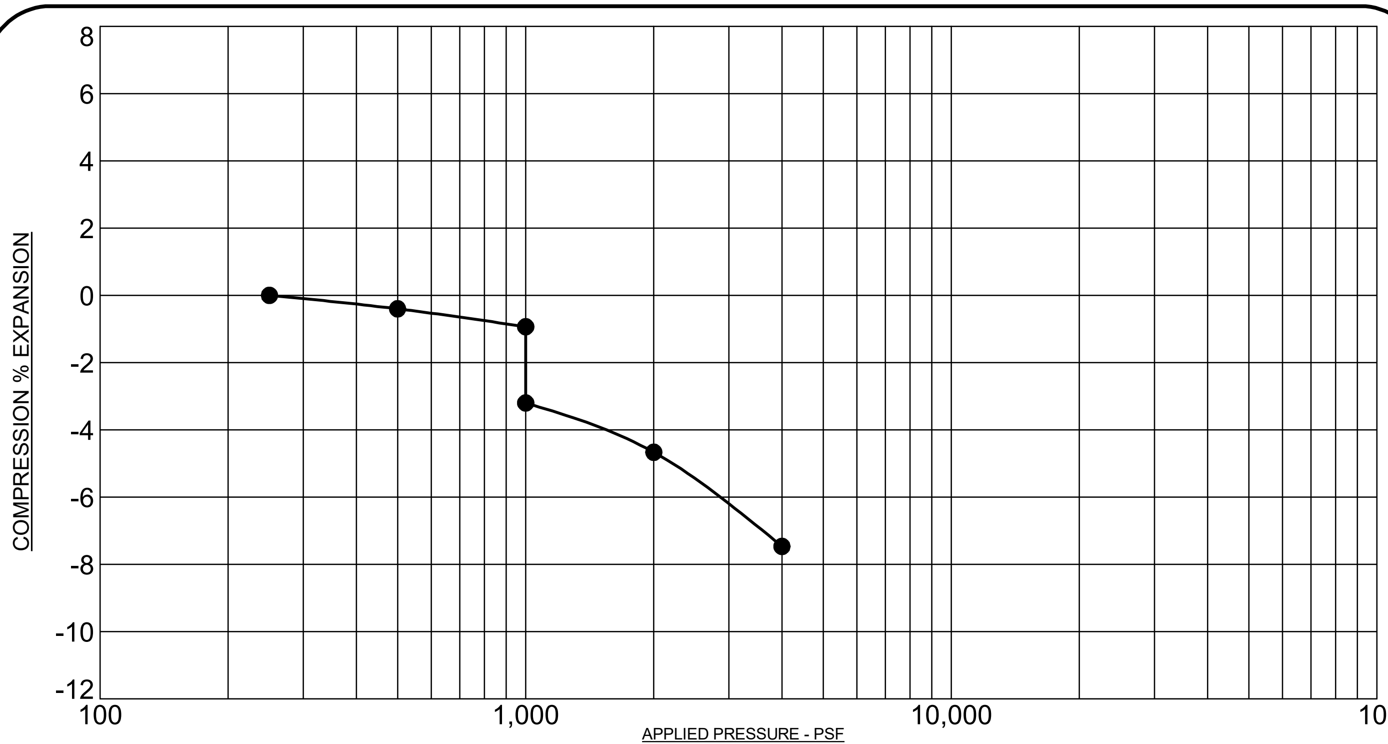
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

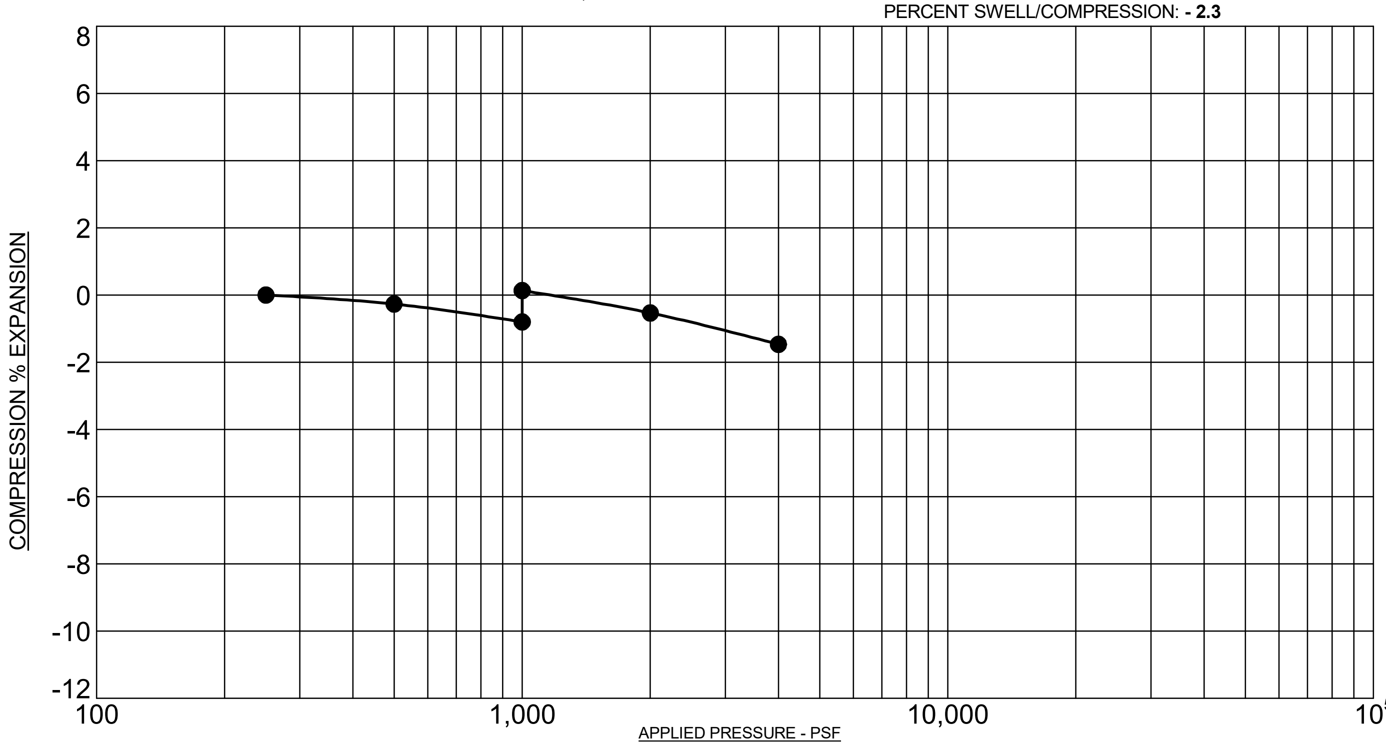
FIGURE No. 57

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **6 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **102.5 PCF**
NATURAL MOISTURE CONTENT: **8.4%**
PERCENT SWELL/COMPRESSION: **- 2.3**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **10 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **118.5 PCF**
NATURAL MOISTURE CONTENT: **12.1%**
PERCENT SWELL/COMPRESSION: **0.9**

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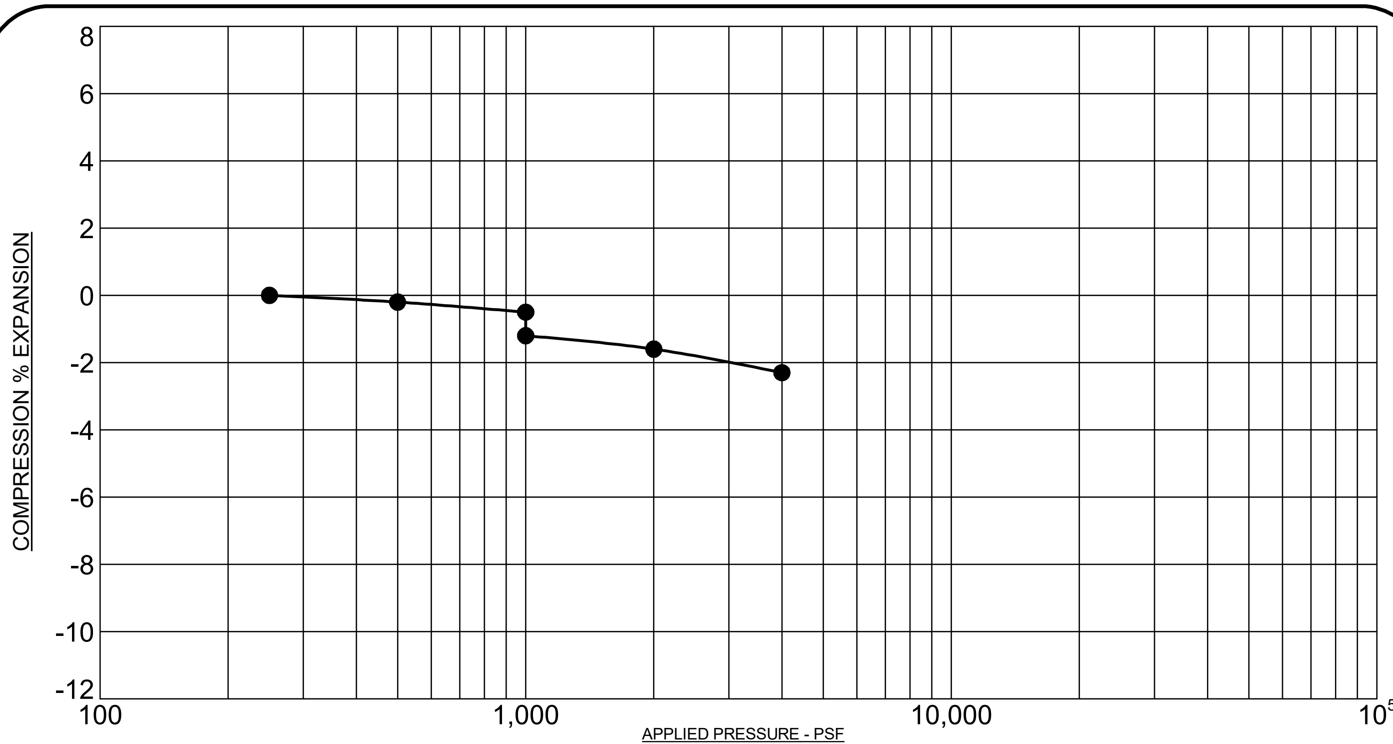
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

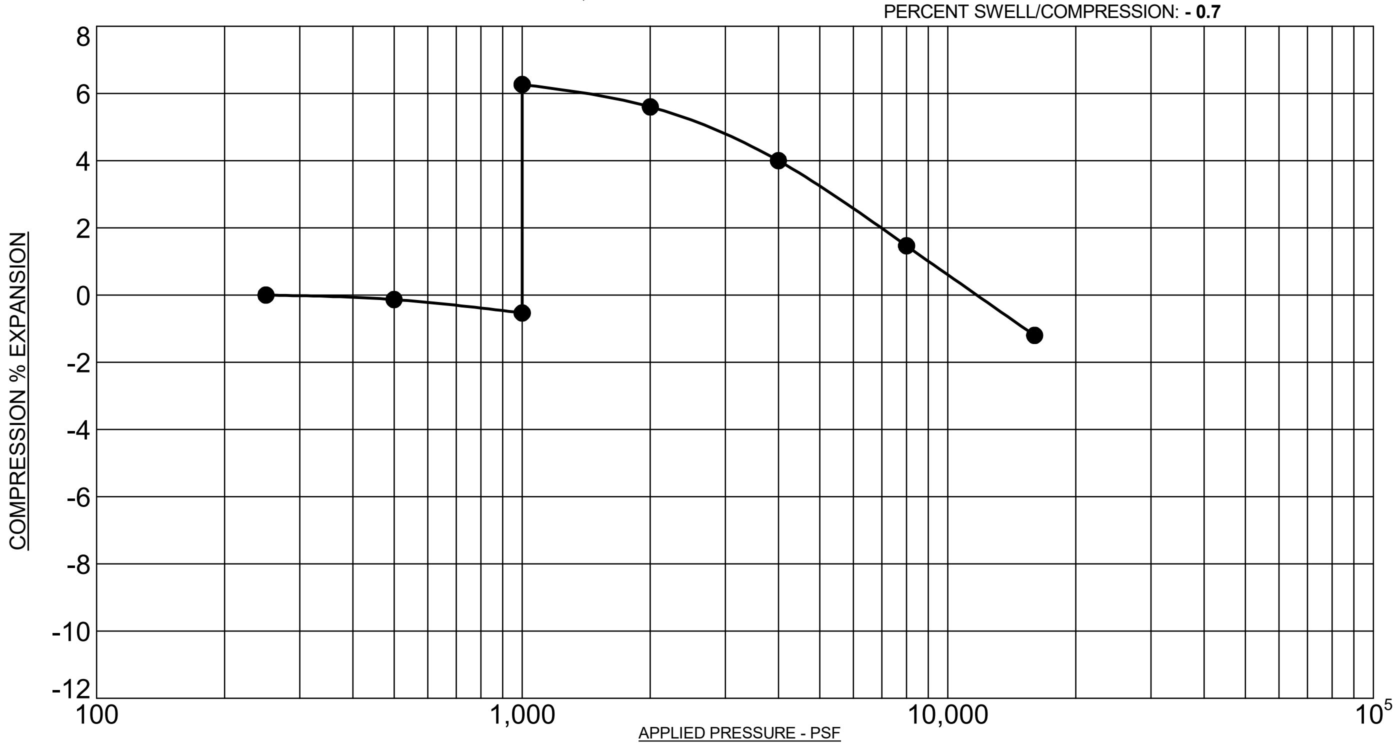
FIGURE No. 58

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **11 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **103.7 PCF**
NATURAL MOISTURE CONTENT: **11.5%**
PERCENT SWELL/COMPRESSION: **- 0.7**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **12 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **115.8 PCF**
NATURAL MOISTURE CONTENT: **12.4%**
PERCENT SWELL/COMPRESSION: **6.8**

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SWELL/CONSOLIDATION TEST RESULTS

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FIGURE No. 59

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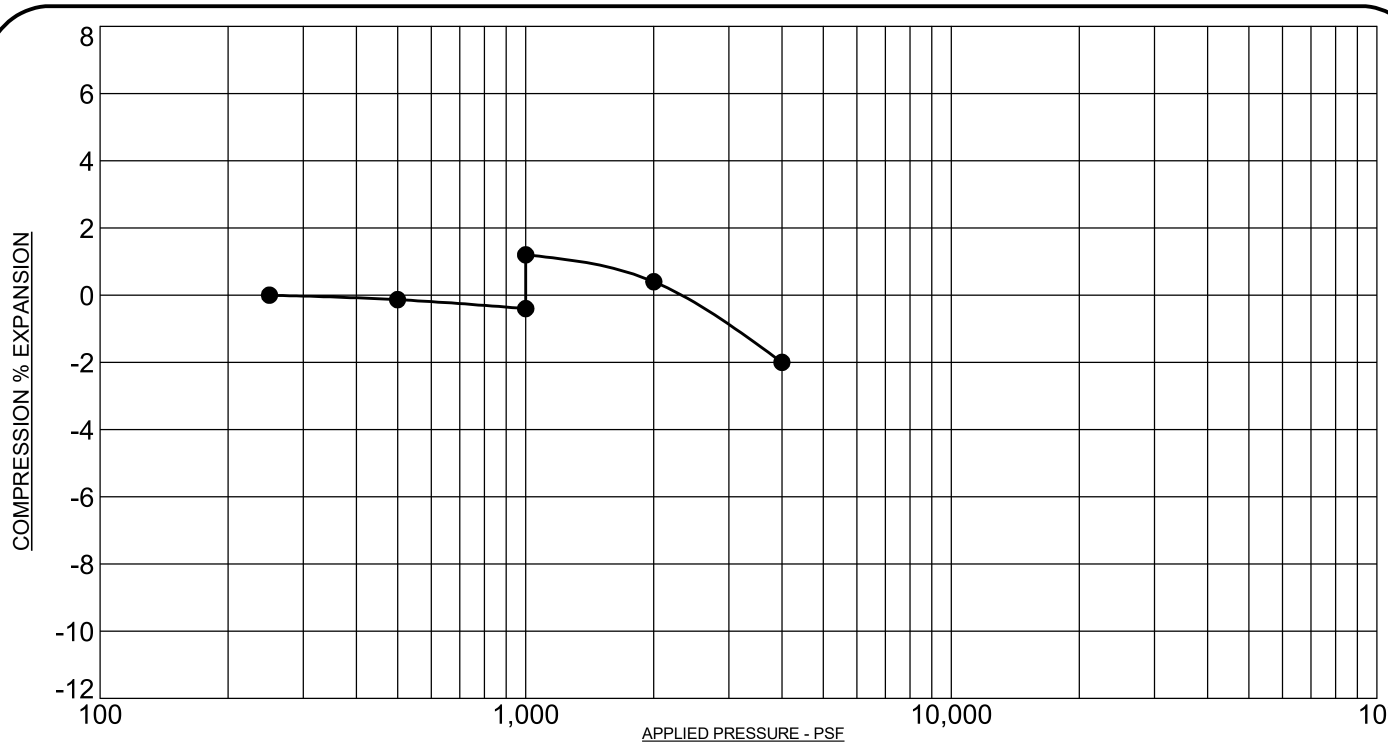

PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **13 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **107.5 PCF**
NATURAL MOISTURE CONTENT: **9.5%**
PERCENT SWELL/COMPRESSION: **1.6**

PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **13 @ 24 FT**
NATURAL DRY UNIT WEIGHT: **99.5 PCF**
NATURAL MOISTURE CONTENT: **9.5%**
PERCENT SWELL/COMPRESSION: **0.0**

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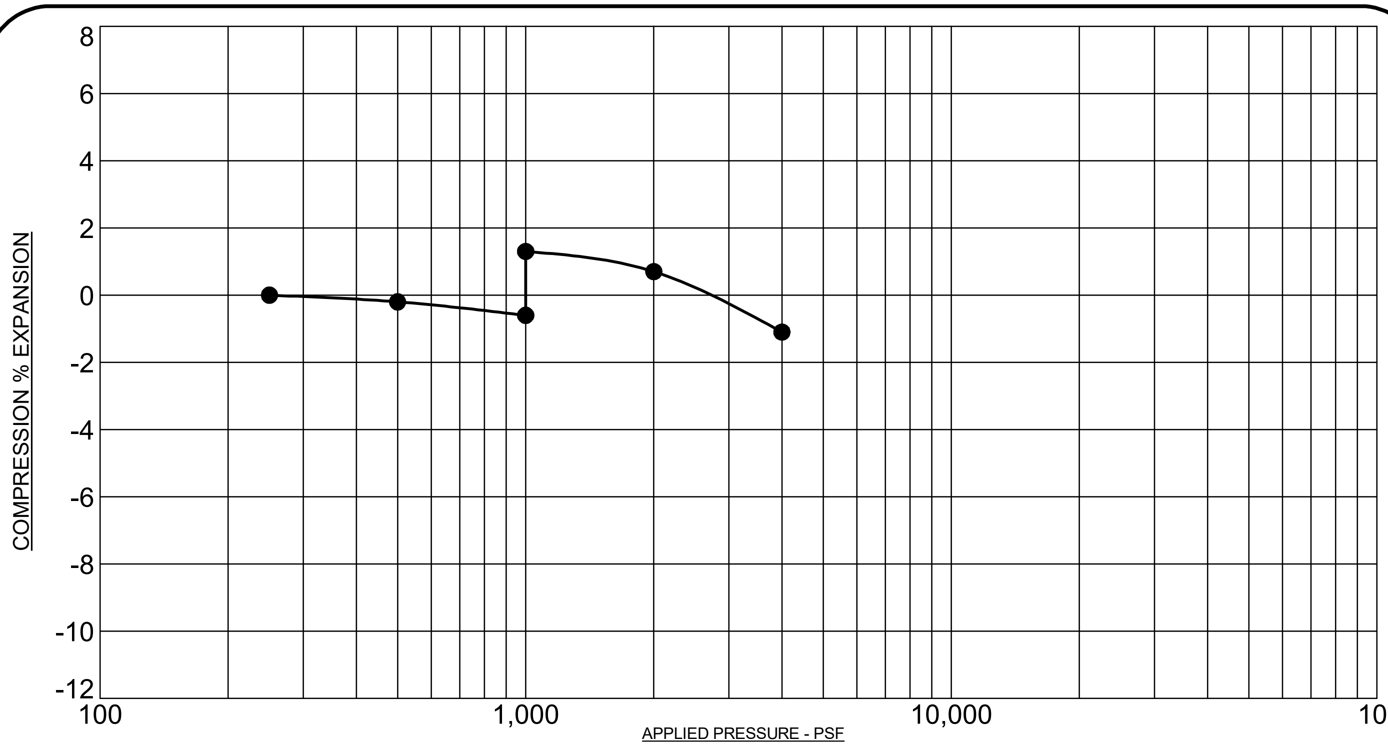
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

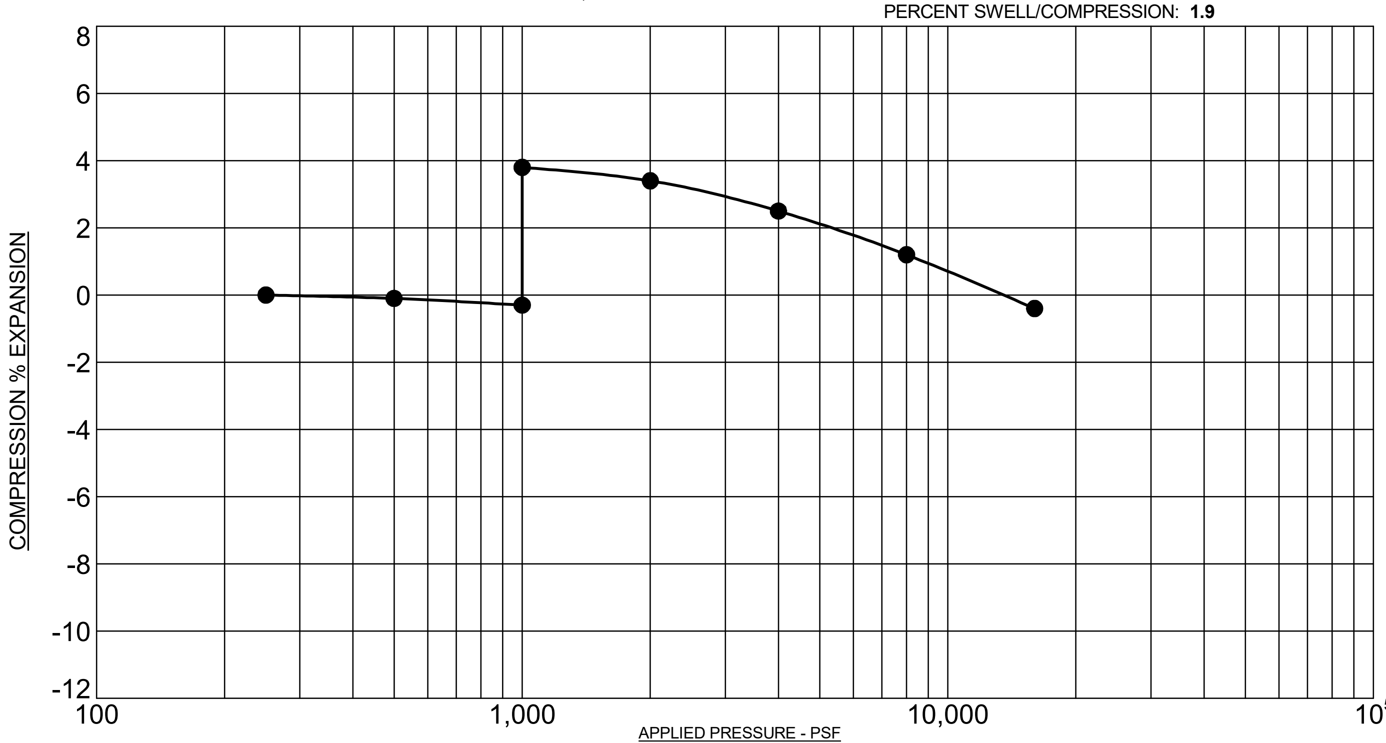
FIGURE No. 60

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **15 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **111.2 PCF**
NATURAL MOISTURE CONTENT: **7.8%**
PERCENT SWELL/COMPRESSION: **1.9**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **17 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **115.3 PCF**
NATURAL MOISTURE CONTENT: **16.0%**
PERCENT SWELL/COMPRESSION: **4.1**

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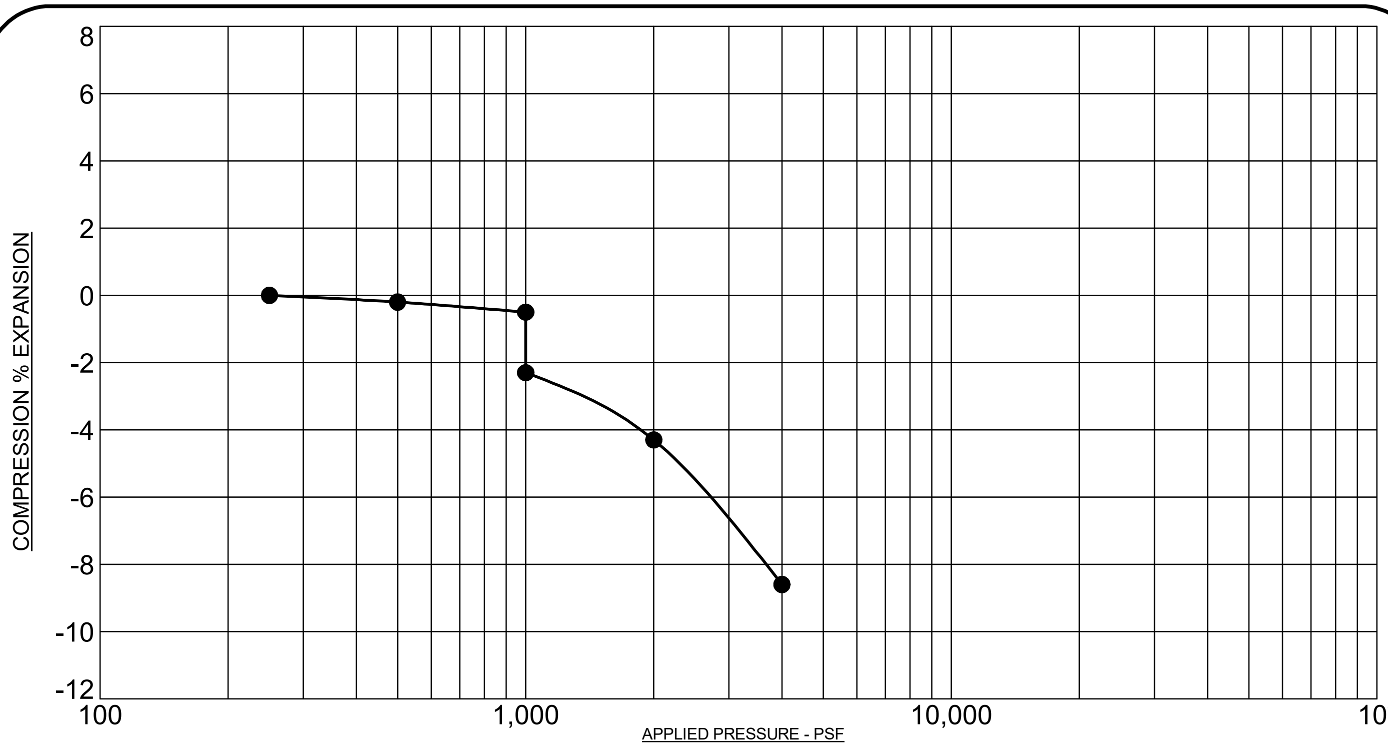
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

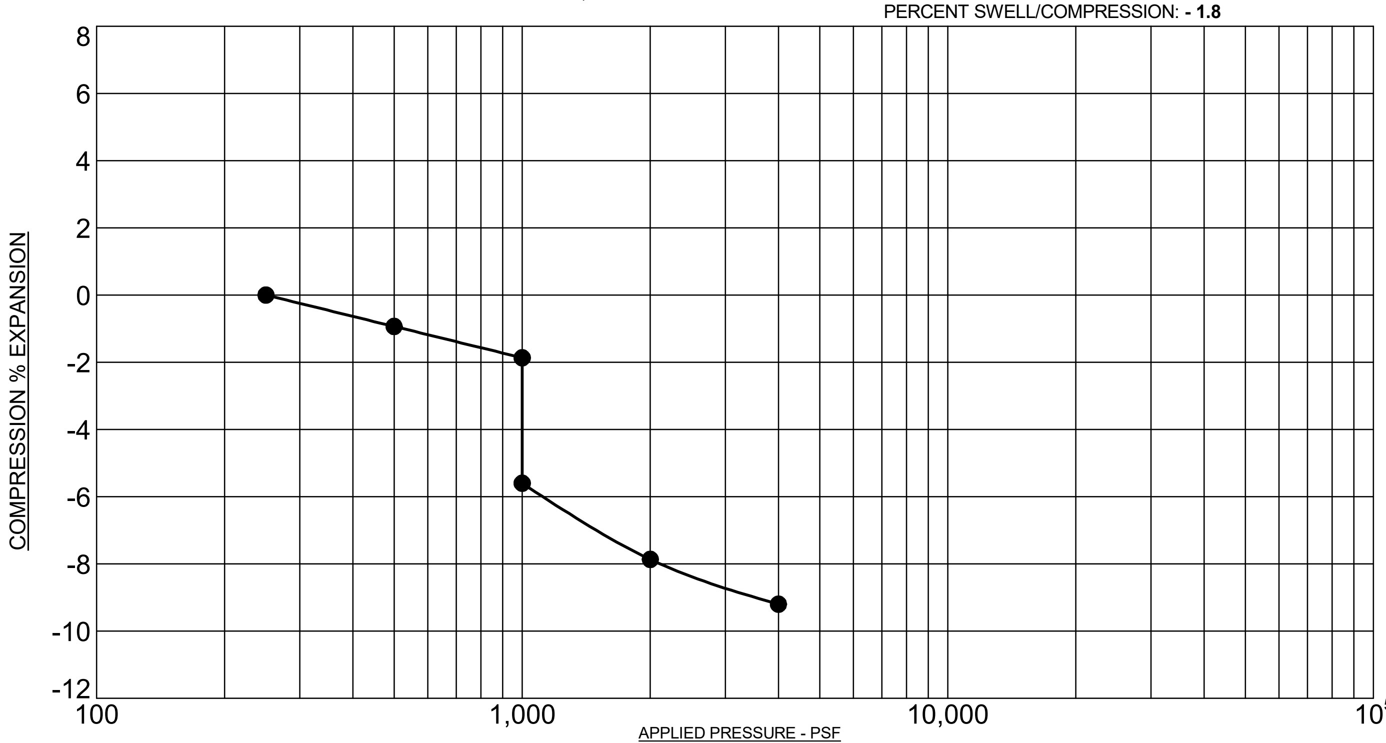
FIGURE No. 61

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **18 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **91.3 PCF**
NATURAL MOISTURE CONTENT: **8.7%**
PERCENT SWELL/COMPRESSION: **- 1.8**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **19 @ 24 FT**
NATURAL DRY UNIT WEIGHT: **99.4 PCF**
NATURAL MOISTURE CONTENT: **7.0%**
PERCENT SWELL/COMPRESSION: **- 3.7**

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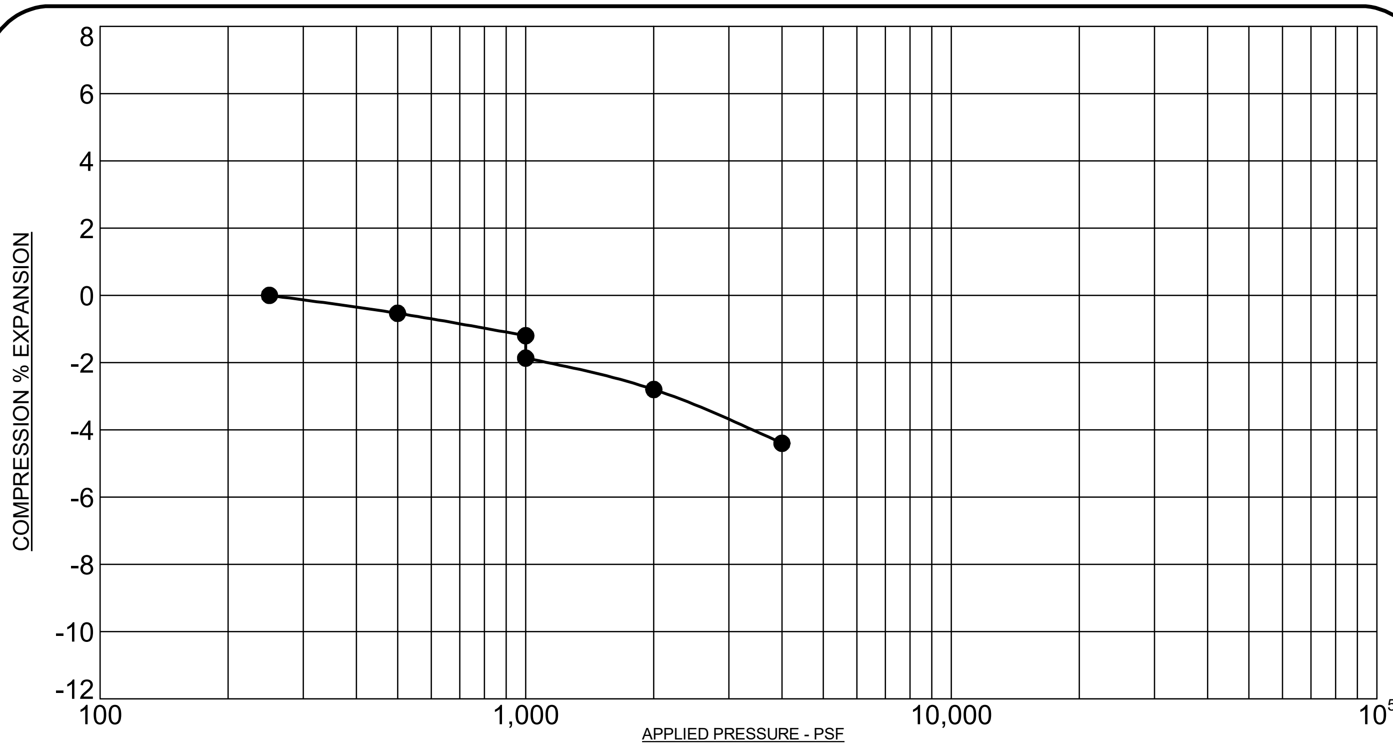
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

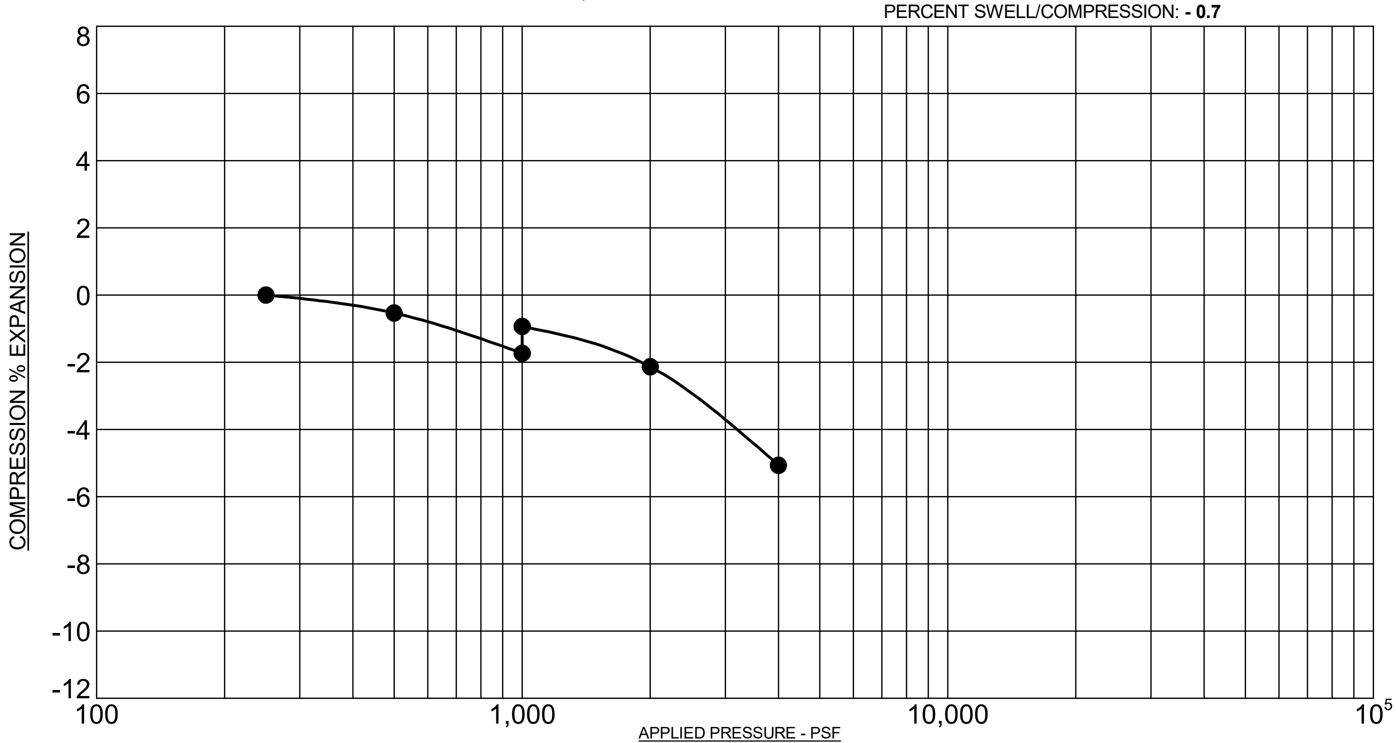
FIGURE No. 62

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **19 @ 29 FT**
NATURAL DRY UNIT WEIGHT: **109.9 PCF**
NATURAL MOISTURE CONTENT: **12.3%**
PERCENT SWELL/COMPRESSION: **- 0.7**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **23 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **103.1 PCF**
NATURAL MOISTURE CONTENT: **7.7%**
PERCENT SWELL/COMPRESSION: **0.8**

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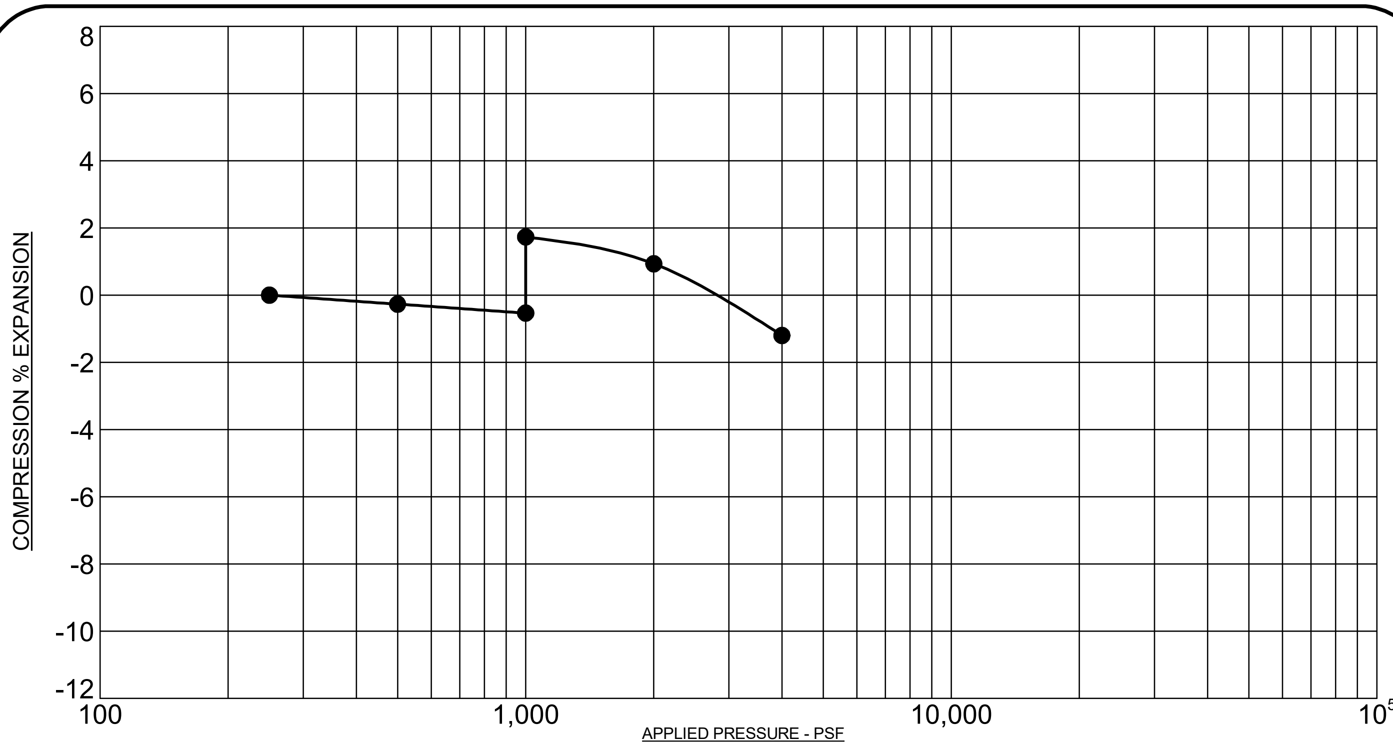
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

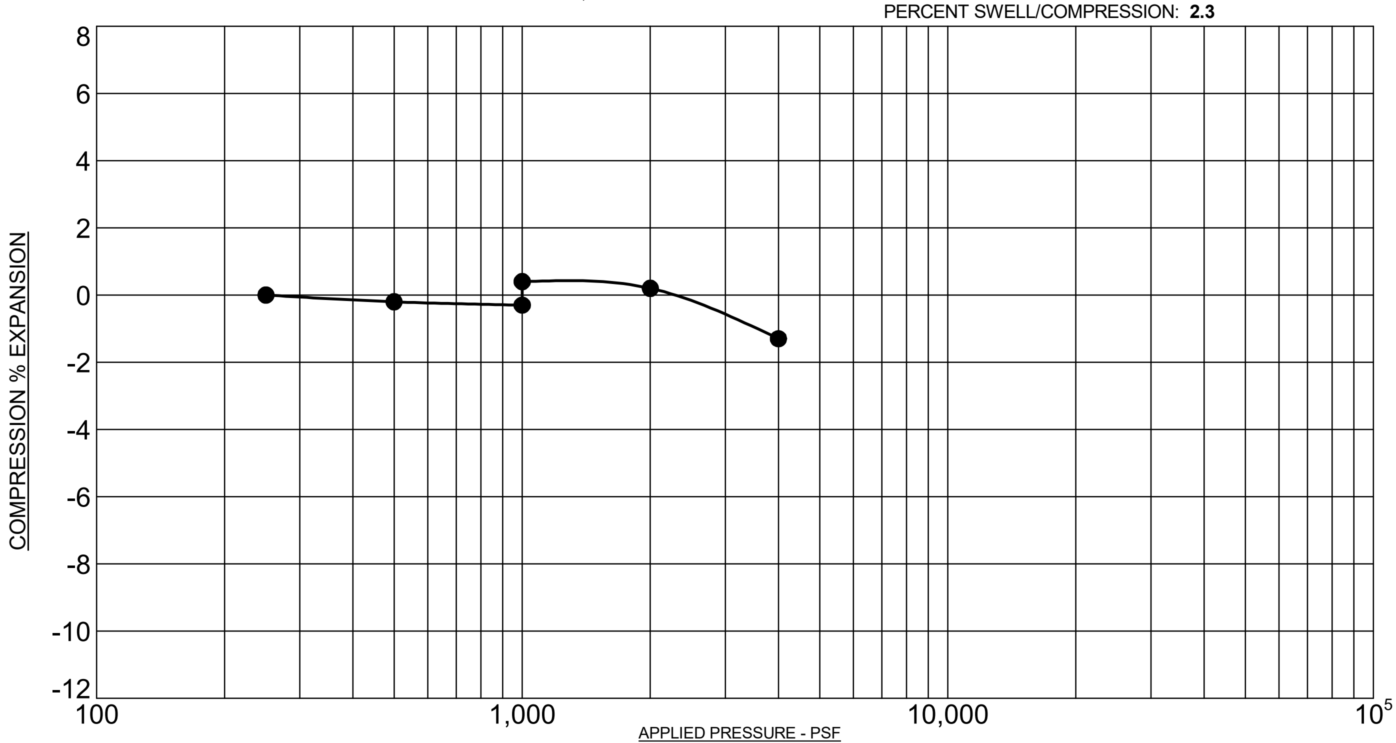
FIGURE No. 63

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **24 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **113.3 PCF**
NATURAL MOISTURE CONTENT: **8.6%**
PERCENT SWELL/COMPRESSION: **2.3**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY,**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **25 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **106.0 PCF**
NATURAL MOISTURE CONTENT: **7.7%**
PERCENT SWELL/COMPRESSION: **0.7**

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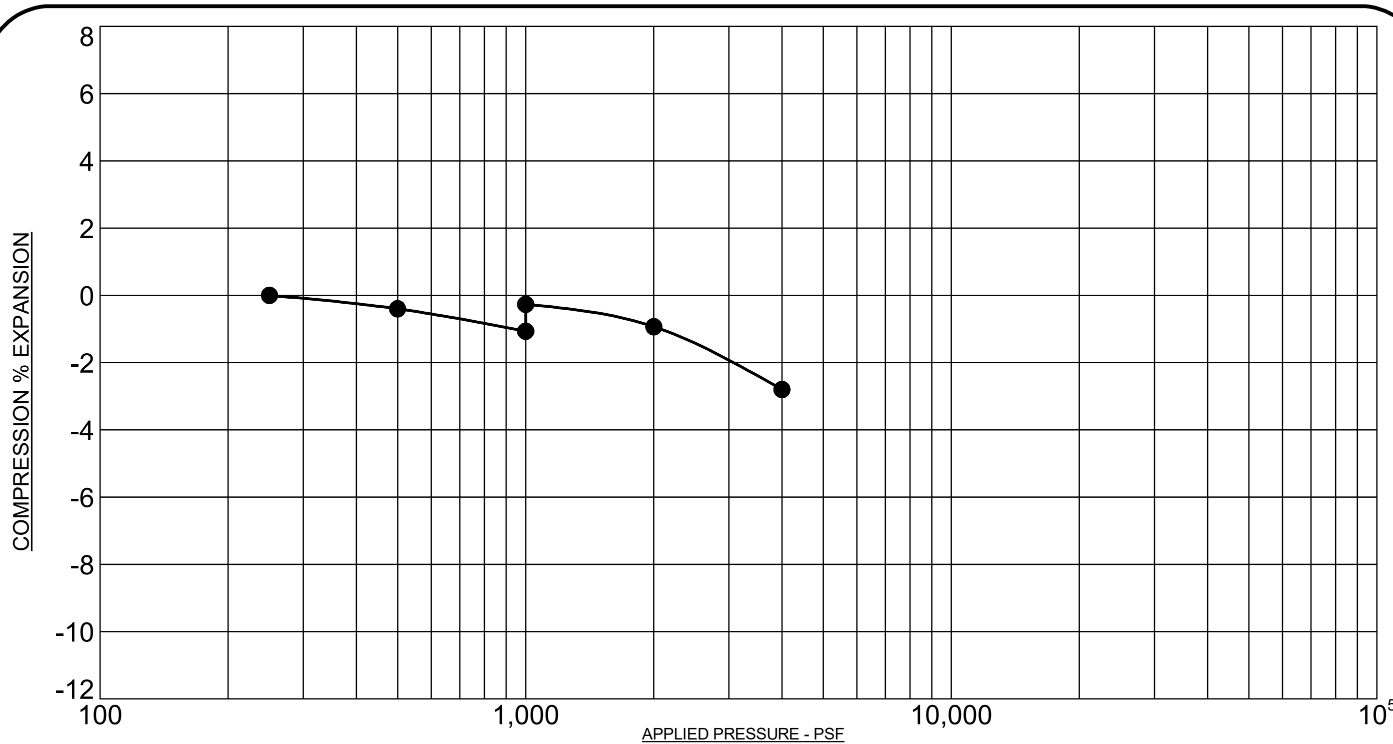
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

FIGURE No. 64

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **26 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **114.8 PCF**
NATURAL MOISTURE CONTENT: **9.3%**
PERCENT SWELL/COMPRESSION: **0.8**

PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **27 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **85.0 PCF**
NATURAL MOISTURE CONTENT: **7.3%**
PERCENT SWELL/COMPRESSION: **4.3**

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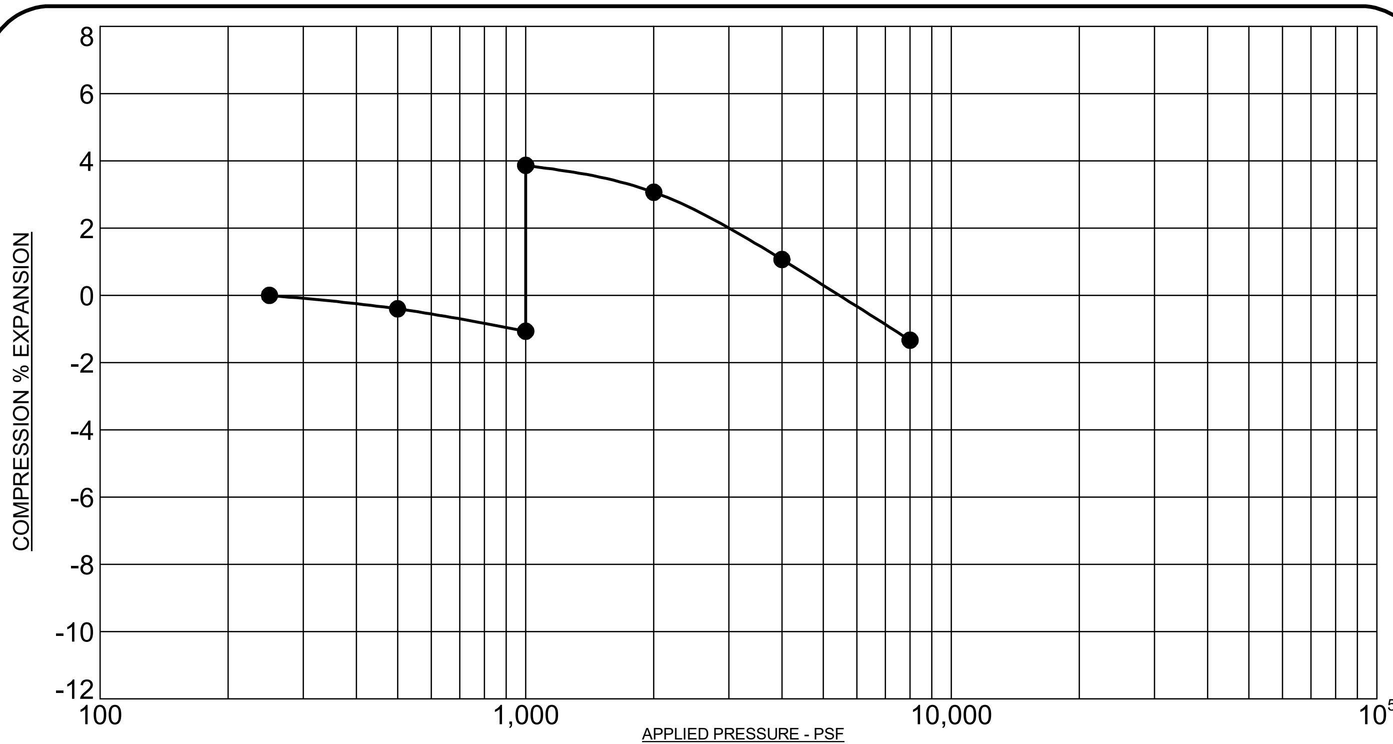
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

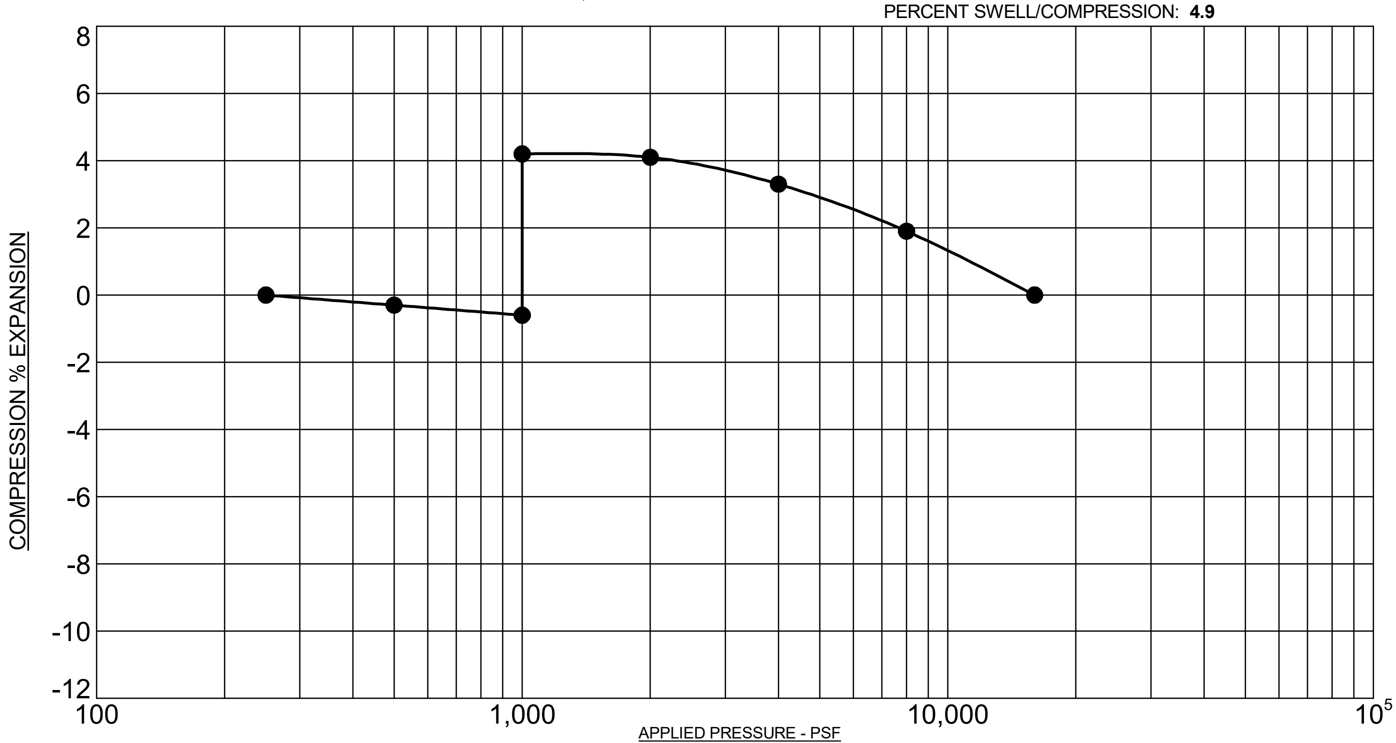
FIGURE No. 65

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **29 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **117.0 PCF**
NATURAL MOISTURE CONTENT: **14.3%**
PERCENT SWELL/COMPRESSION: **4.9**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **31 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **127.4 PCF**
NATURAL MOISTURE CONTENT: **5.5%**
PERCENT SWELL/COMPRESSION: **4.8**

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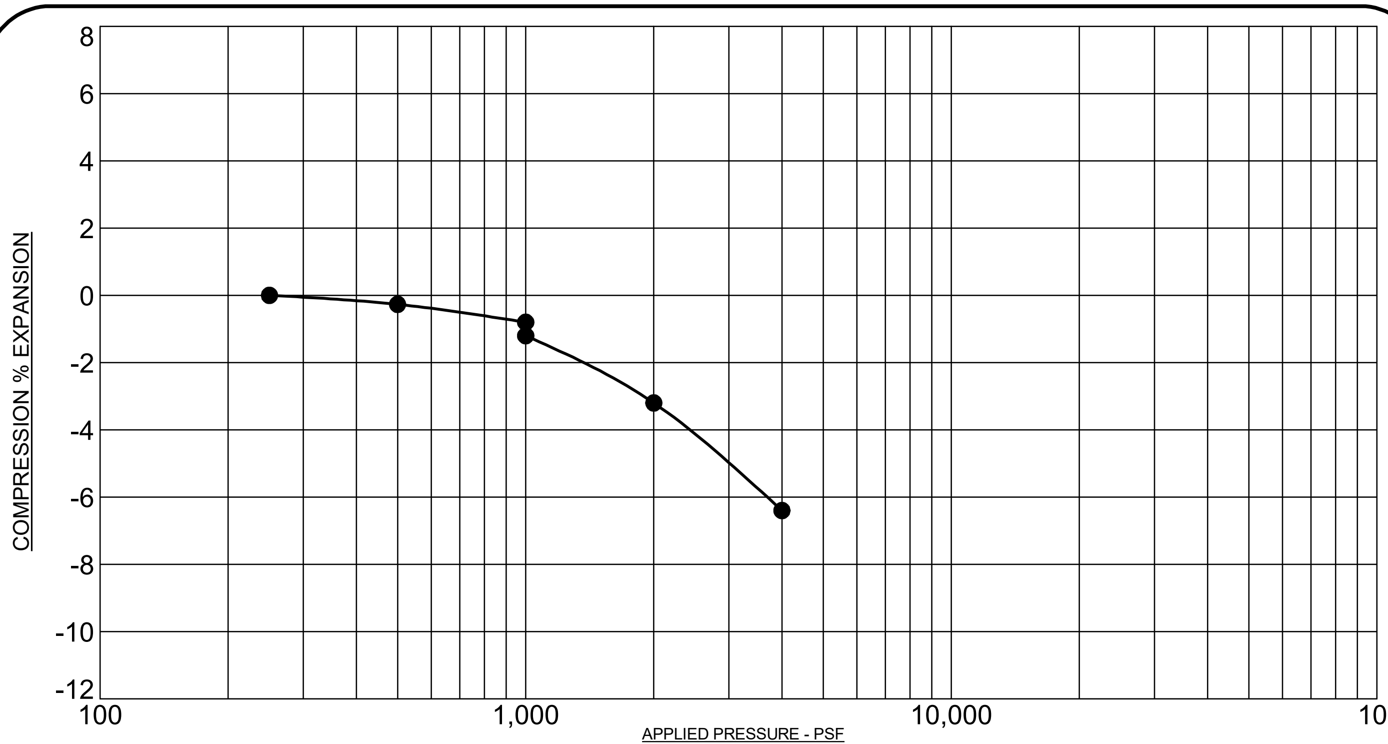
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

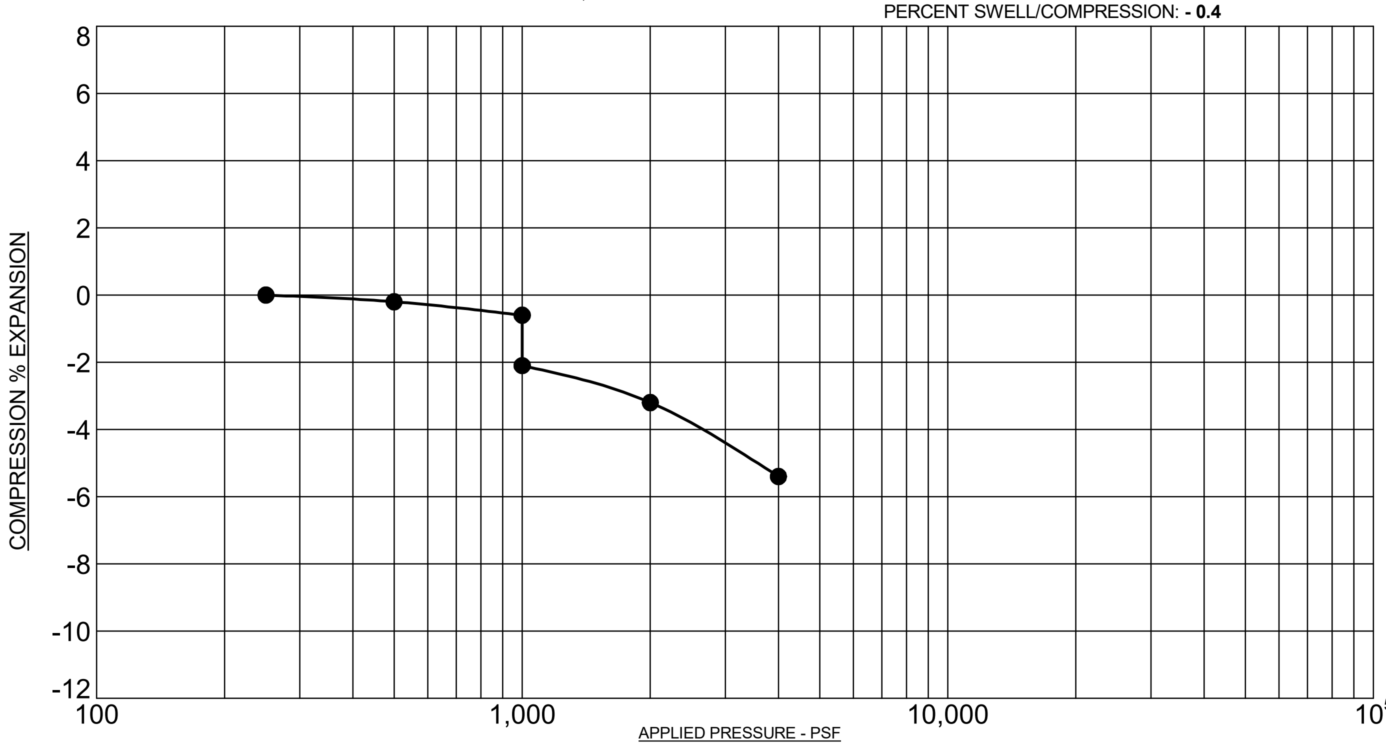
FIGURE No. 66

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **32 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **96.4 PCF**
NATURAL MOISTURE CONTENT: **13.4%**
PERCENT SWELL/COMPRESSION: **- 0.4**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **36 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **101.6 PCF**
NATURAL MOISTURE CONTENT: **6.0%**
PERCENT SWELL/COMPRESSION: **- 1.5**

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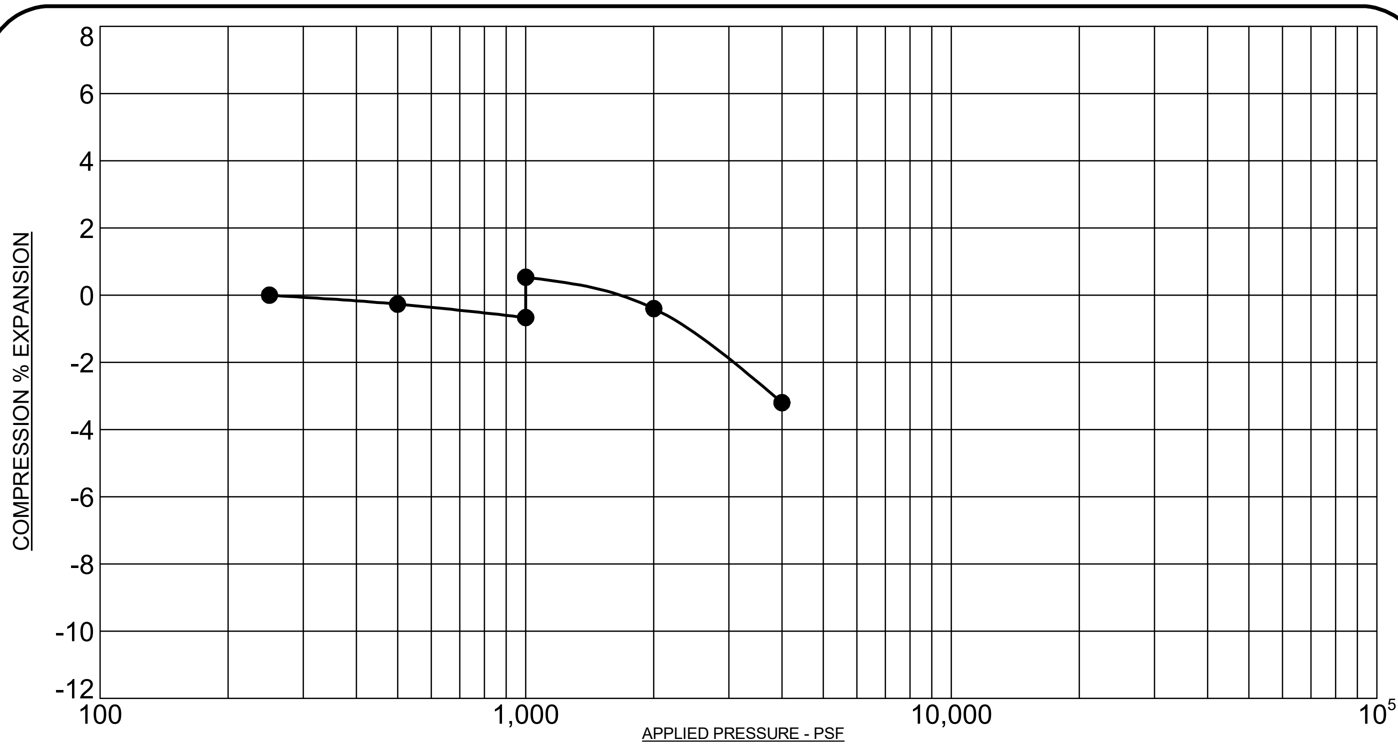
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

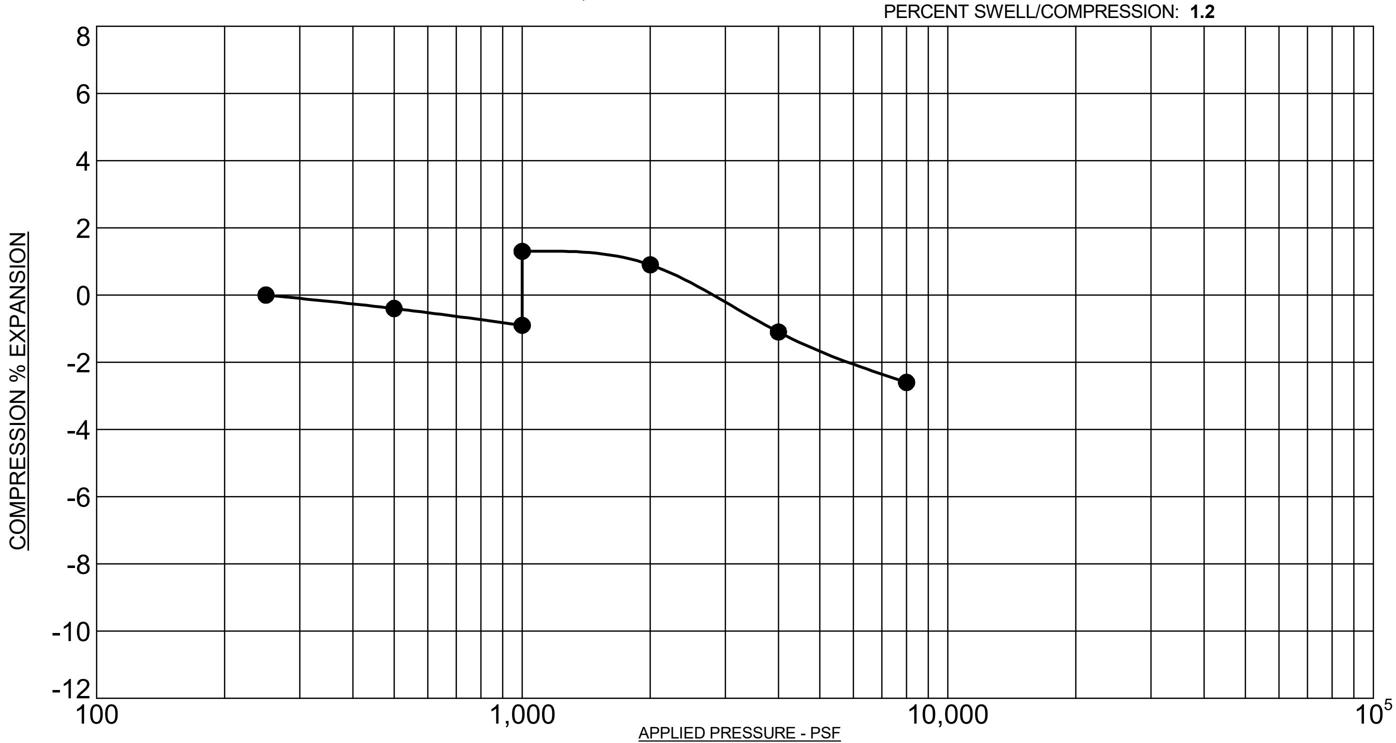
FIGURE No. 67

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **37 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **106.2 PCF**
NATURAL MOISTURE CONTENT: **10.2%**
PERCENT SWELL/COMPRESSION: **1.2**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **38 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **102.5 PCF**
NATURAL MOISTURE CONTENT: **20.4%**
PERCENT SWELL/COMPRESSION: **2.2**

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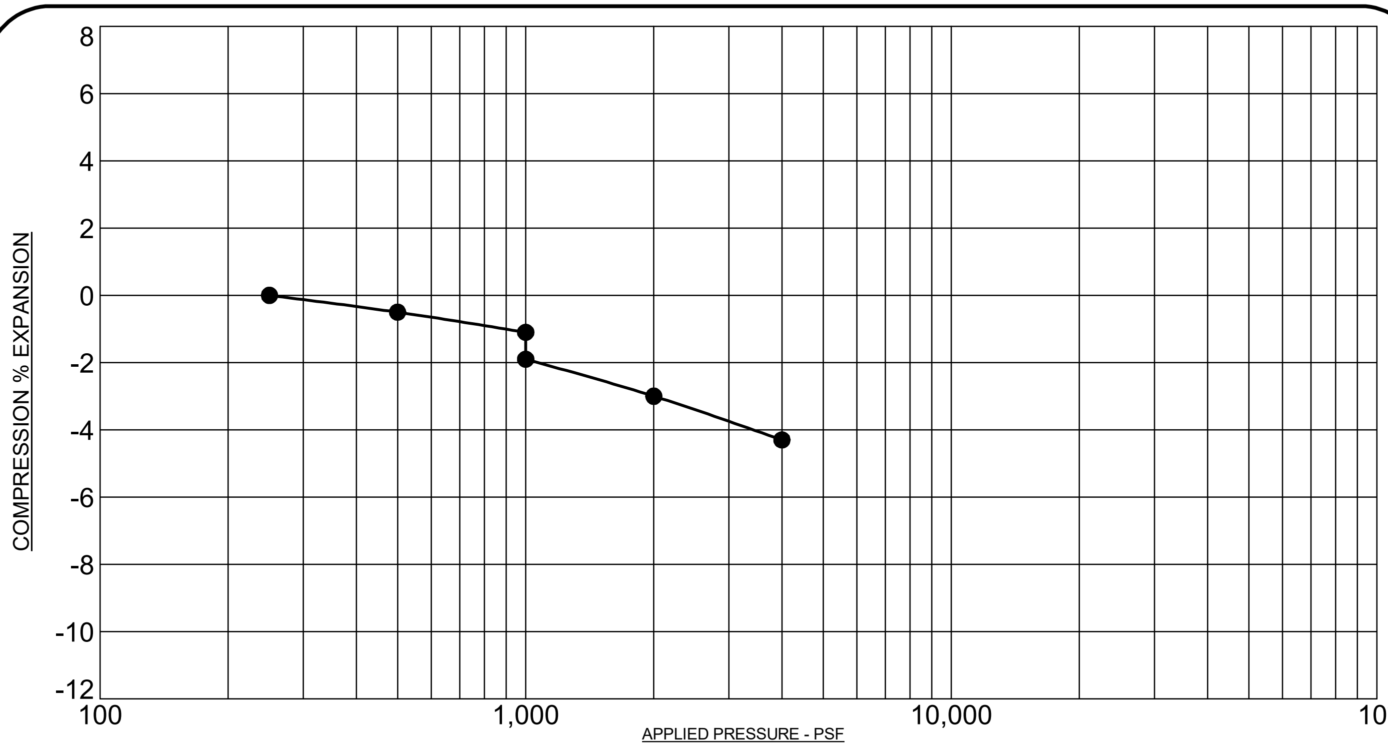
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

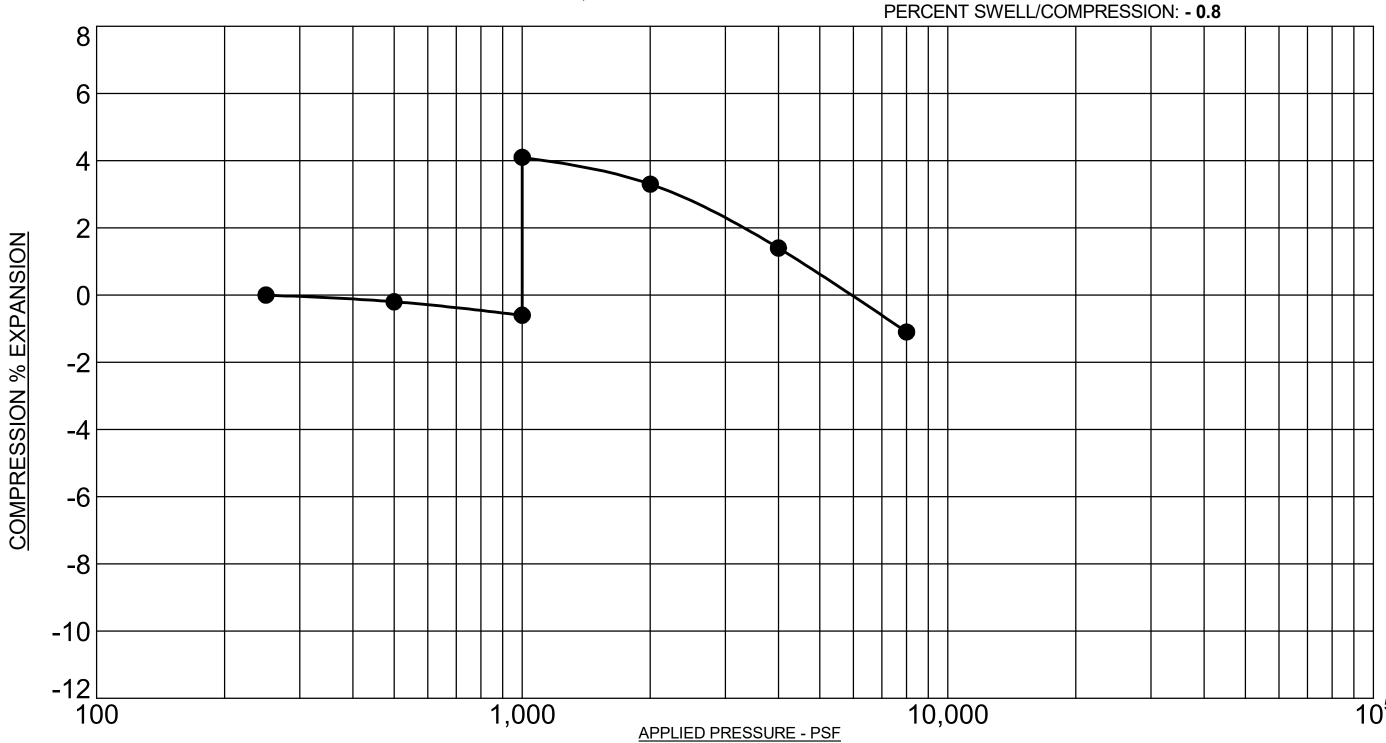
FIGURE No. 68

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **38 @ 29 FT**
NATURAL DRY UNIT WEIGHT: **108.9 PCF**
NATURAL MOISTURE CONTENT: **17.5%**
PERCENT SWELL/COMPRESSION: **- 0.8**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **42 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **111.8 PCF**
NATURAL MOISTURE CONTENT: **10.2%**
PERCENT SWELL/COMPRESSION: **4.7**

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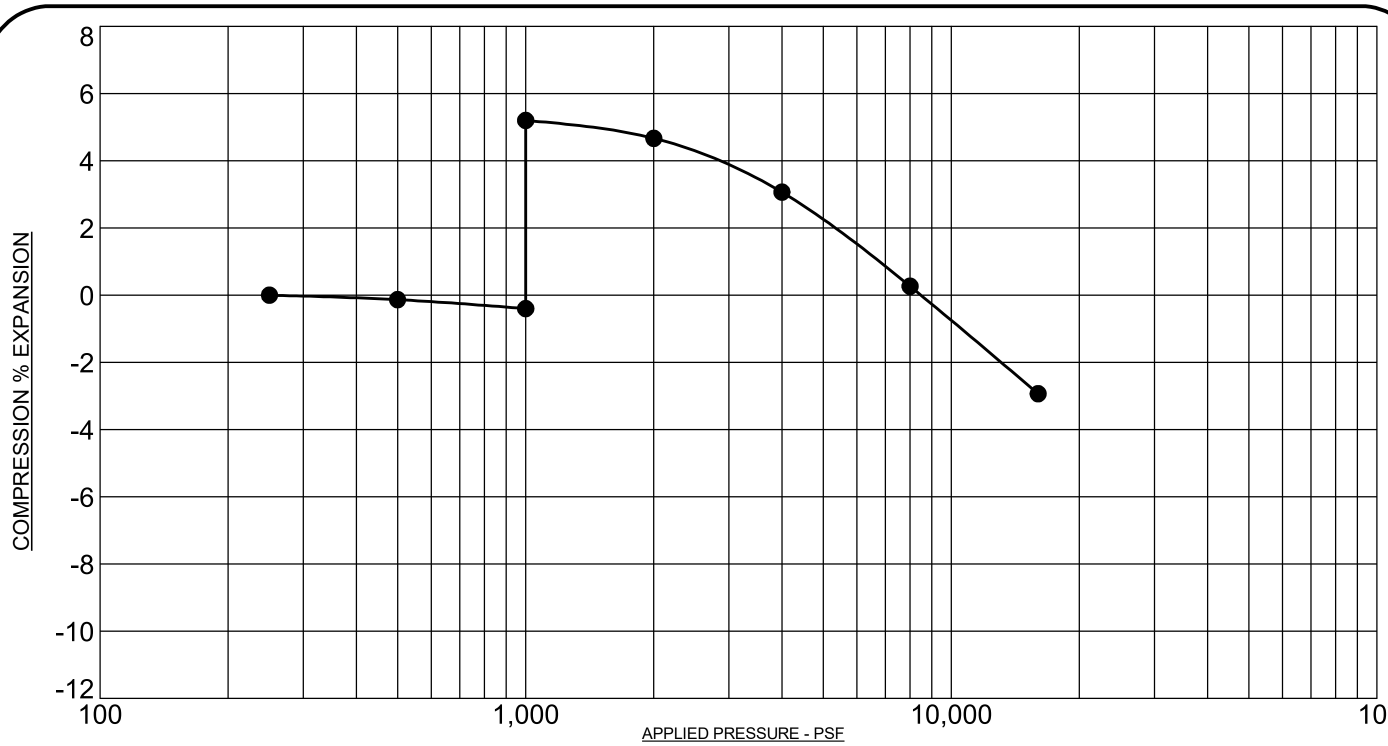
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

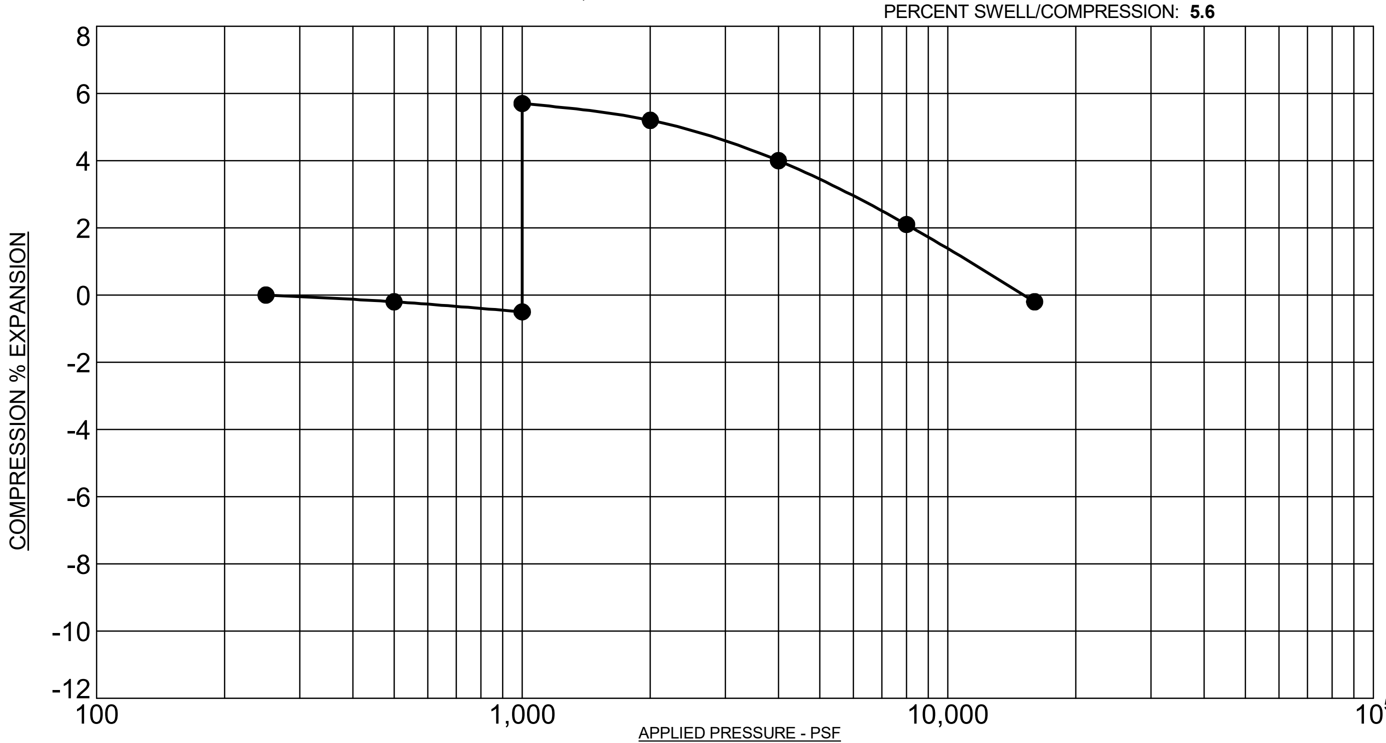
FIGURE No. 69

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **43 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **112.0 PCF**
NATURAL MOISTURE CONTENT: **12.9%**
PERCENT SWELL/COMPRESSION: **5.6**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **44 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **118.6 PCF**
NATURAL MOISTURE CONTENT: **13.2%**
PERCENT SWELL/COMPRESSION: **6.2**

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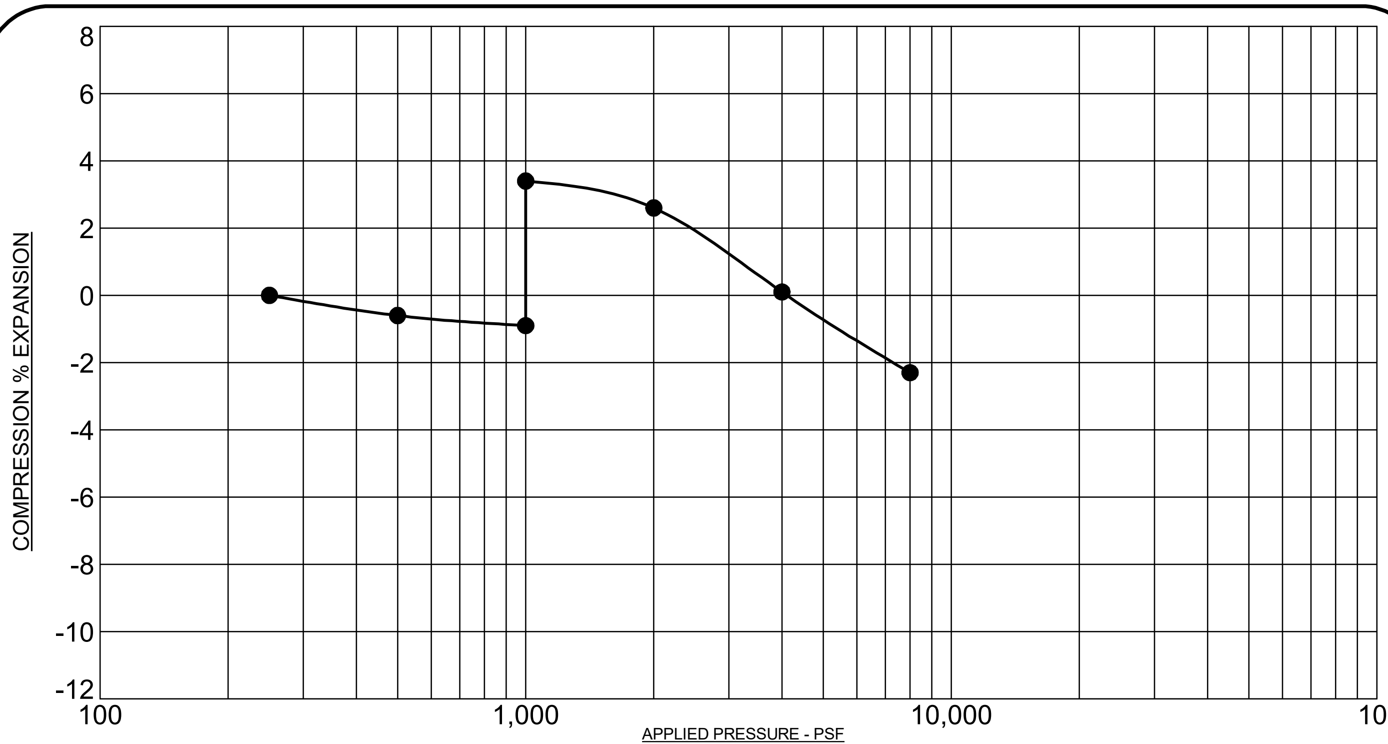
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

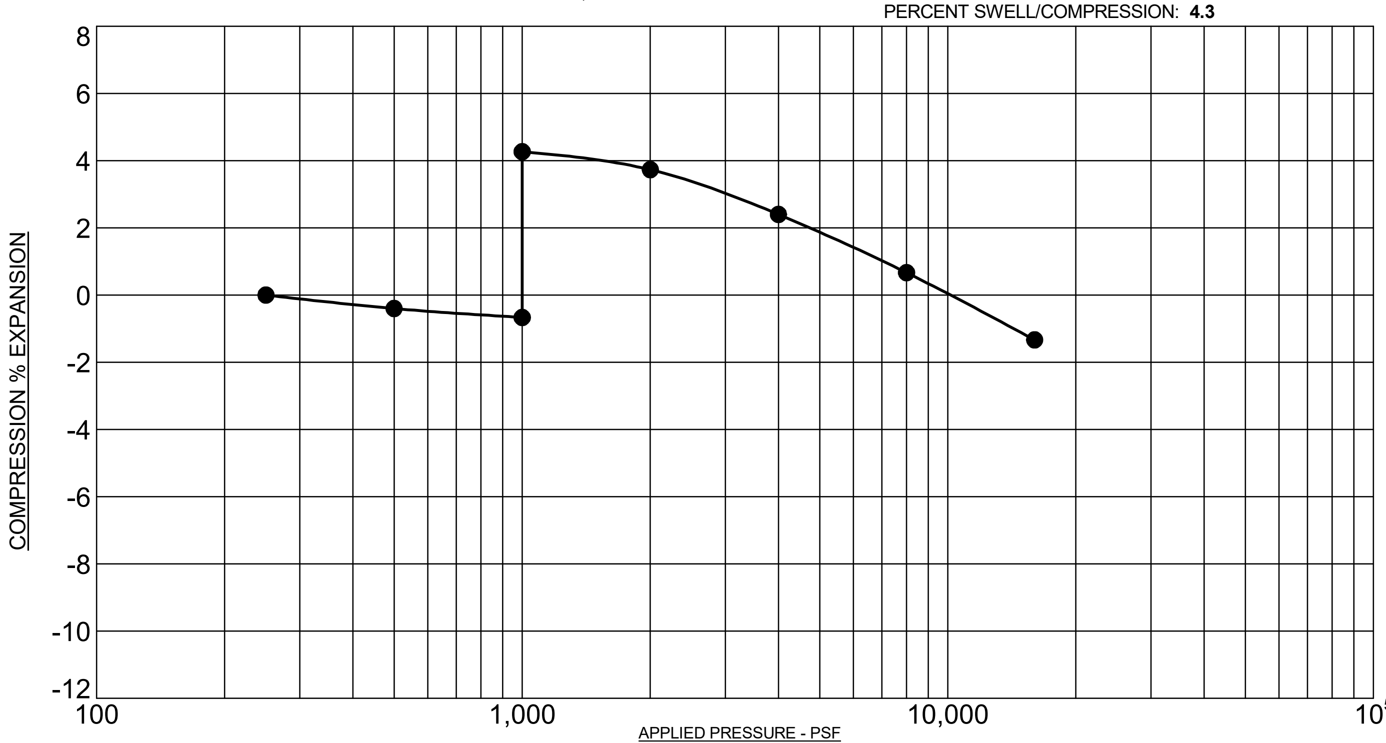
FIGURE No. 70

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **46 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **118.9 PCF**
NATURAL MOISTURE CONTENT: **9.6%**
PERCENT SWELL/COMPRESSION: **4.3**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **48 @ 29 FT**
NATURAL DRY UNIT WEIGHT: **121.2 PCF**
NATURAL MOISTURE CONTENT: **13.7%**
PERCENT SWELL/COMPRESSION: **4.9**

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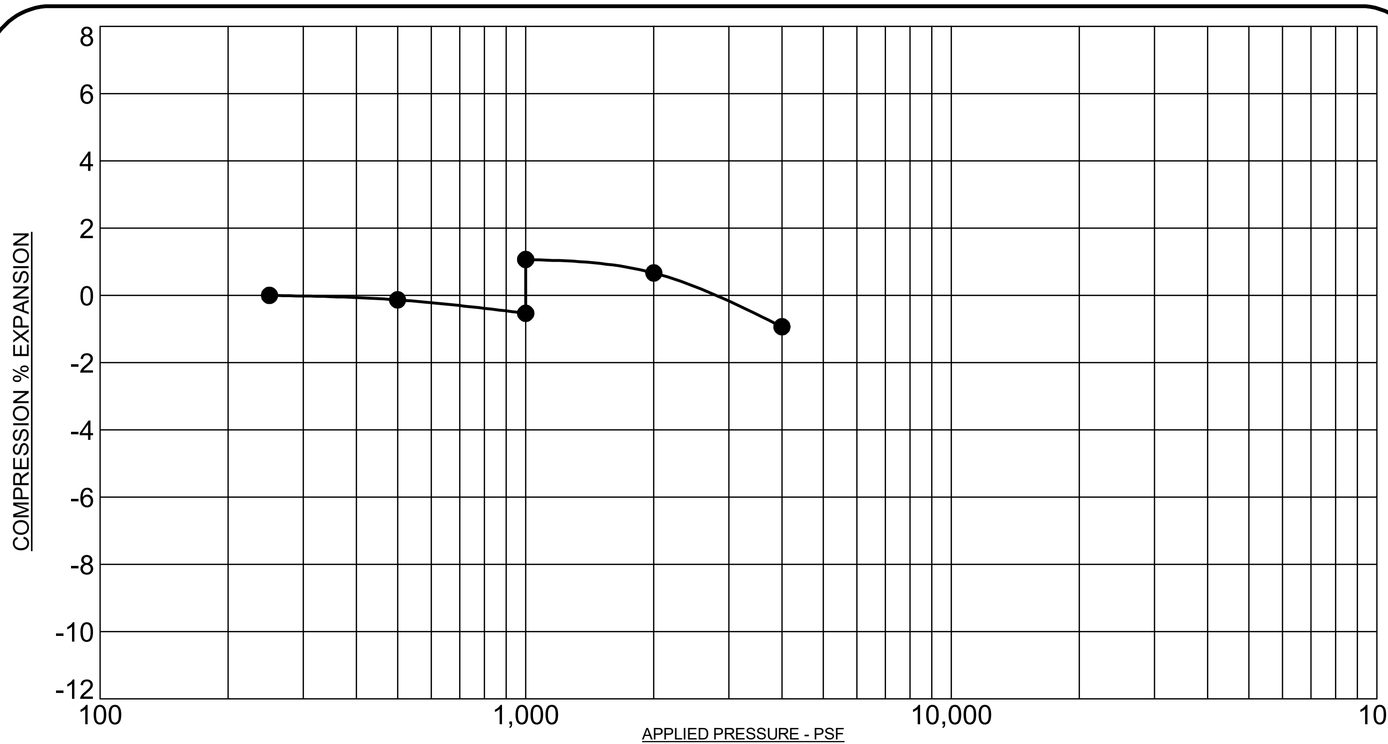
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

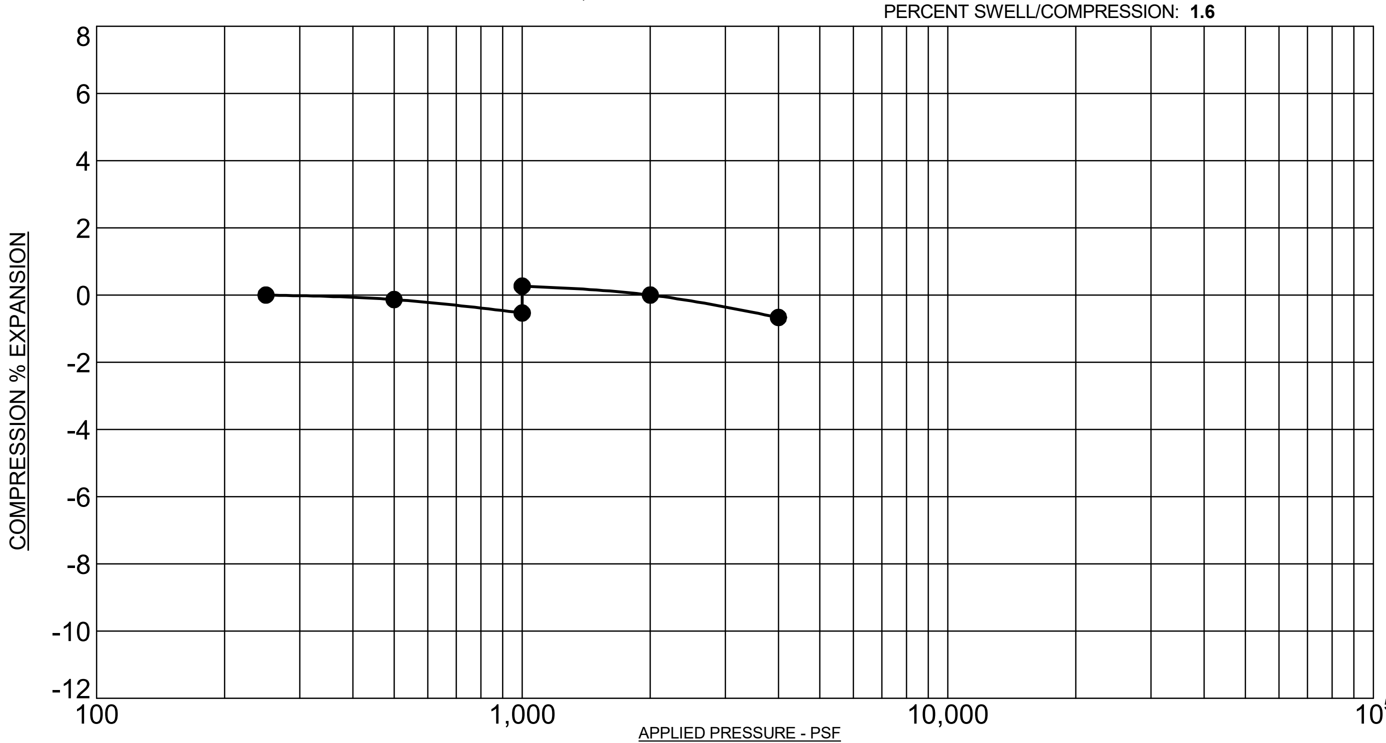
FIGURE No. 71

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **50 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **111.1 PCF**
NATURAL MOISTURE CONTENT: **10.3%**
PERCENT SWELL/COMPRESSION: **1.6**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **51 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **119.2 PCF**
NATURAL MOISTURE CONTENT: **6.1%**
PERCENT SWELL/COMPRESSION: **0.8**

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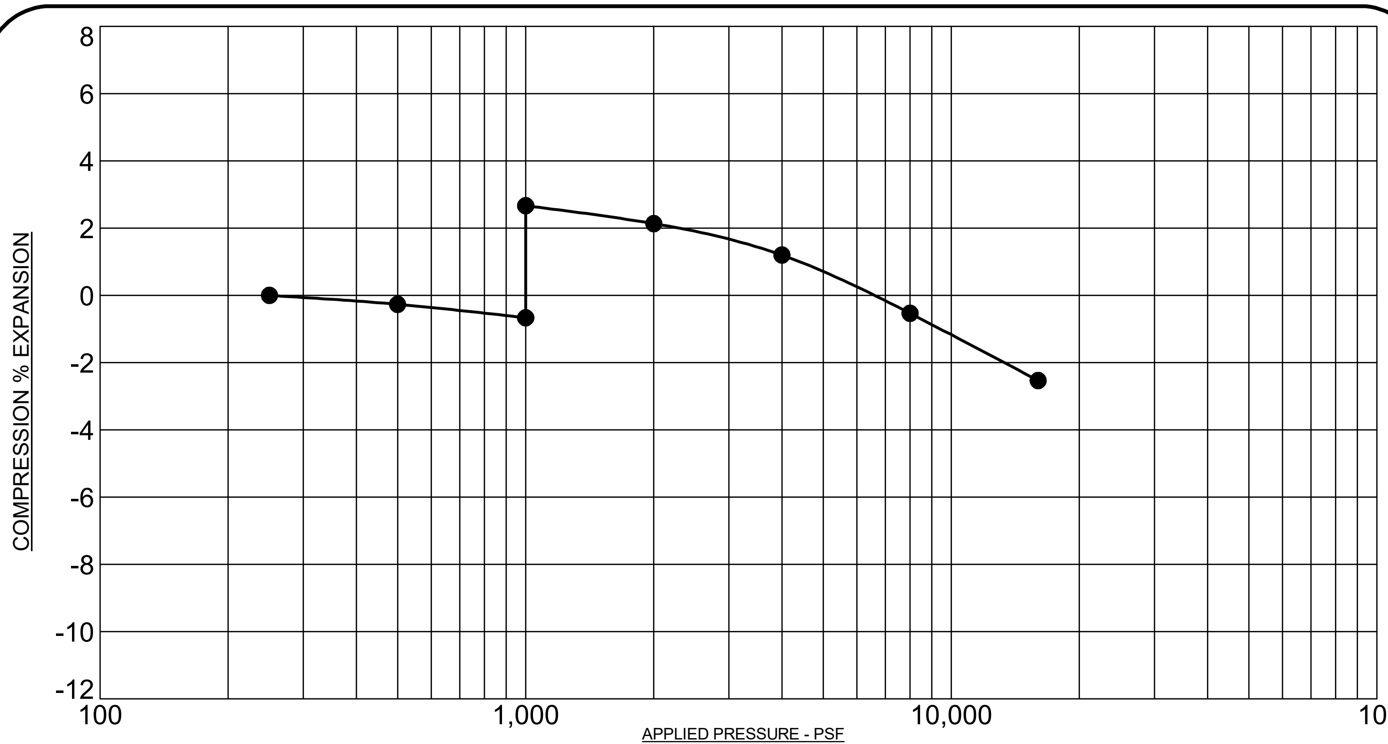
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

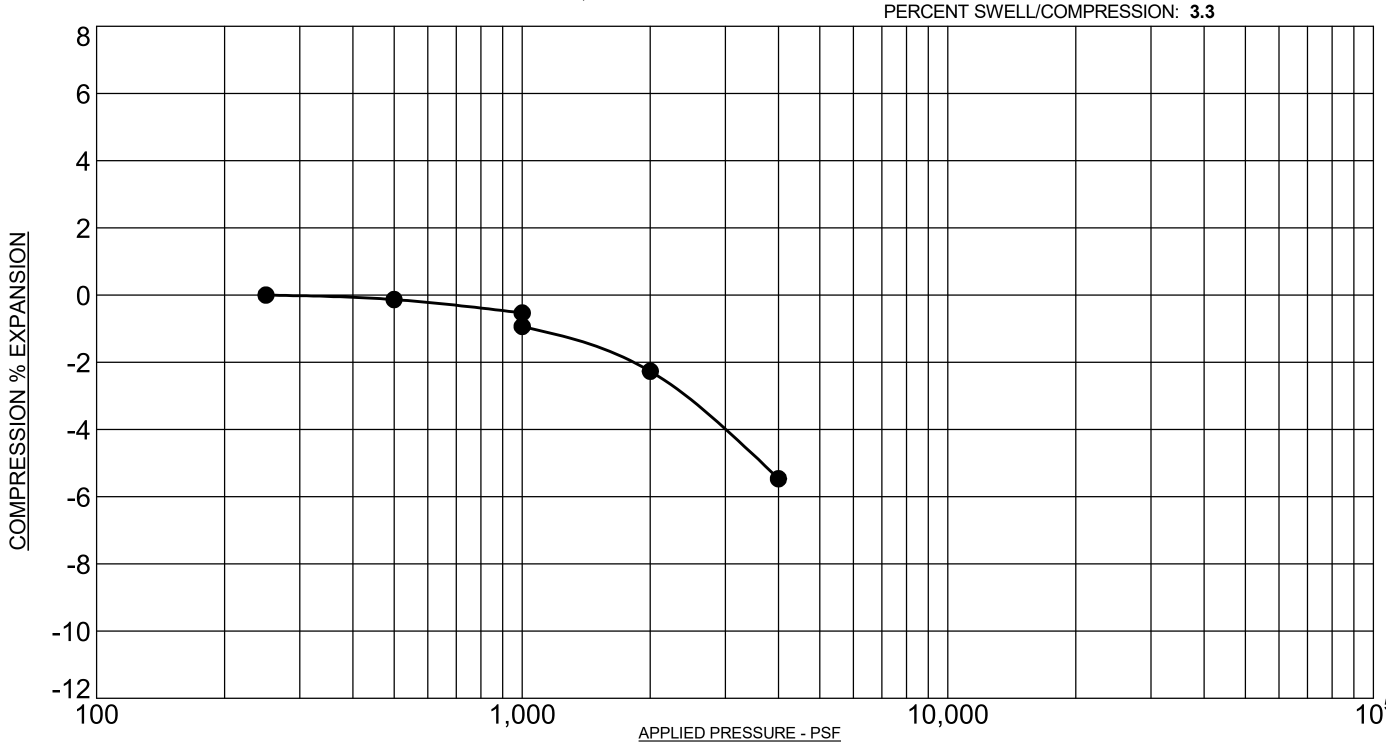
FIGURE No. 72

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **53 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **106.6 PCF**
NATURAL MOISTURE CONTENT: **17.4%**
PERCENT SWELL/COMPRESSION: **3.3**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **54 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **89.0 PCF**
NATURAL MOISTURE CONTENT: **12.9%**
PERCENT SWELL/COMPRESSION: **- 0.4**

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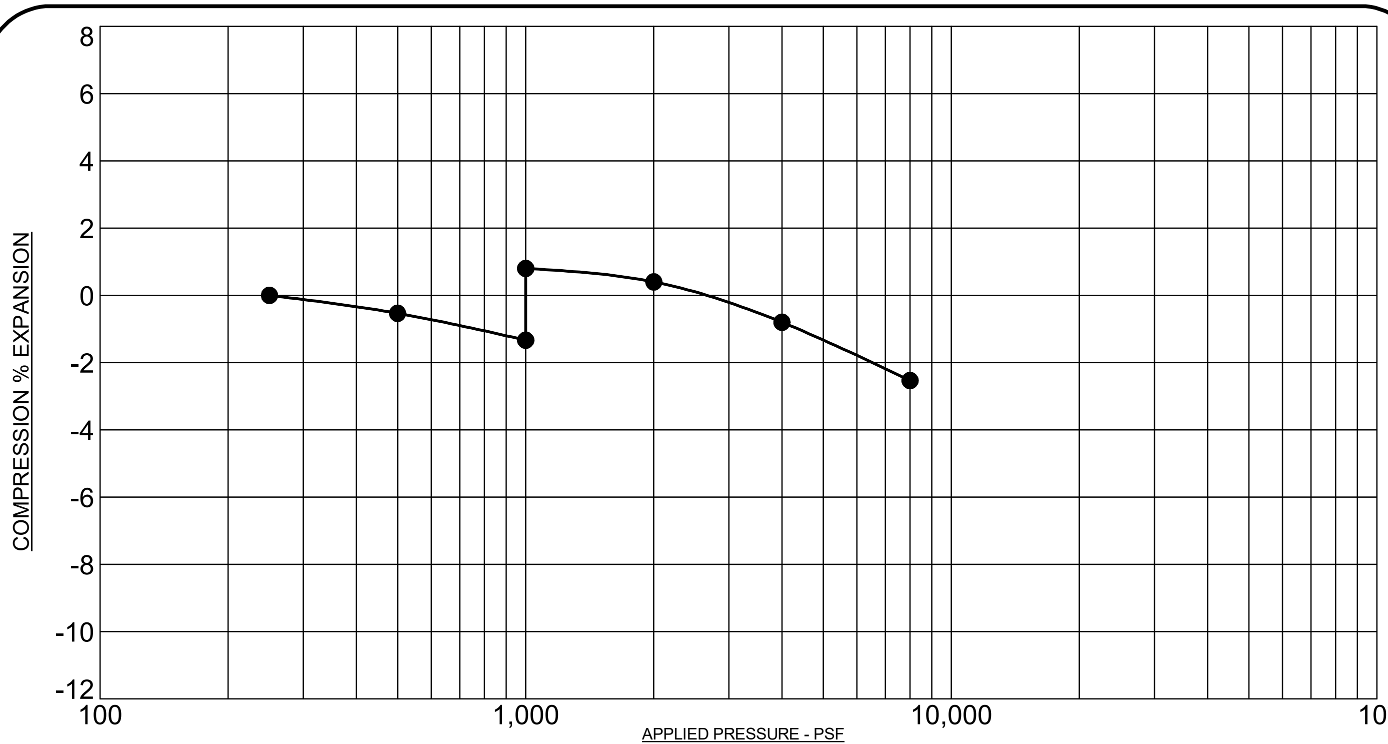
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

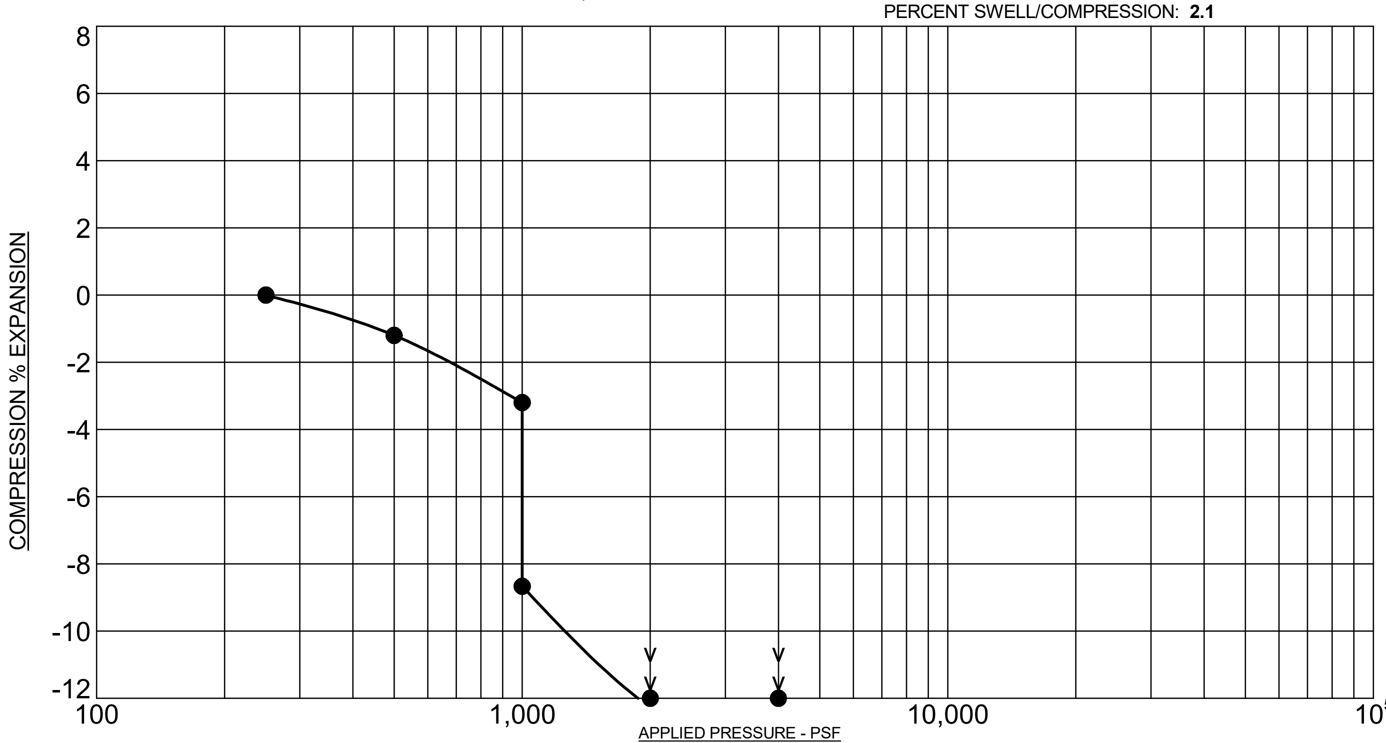
FIGURE No. 73

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **57 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **116.4 PCF**
NATURAL MOISTURE CONTENT: **14.5%**
PERCENT SWELL/COMPRESSION: **2.1**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **SAND, SILTY TO CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **58 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **99.6 PCF**
NATURAL MOISTURE CONTENT: **6.5%**
PERCENT SWELL/COMPRESSION: **- 5.5**

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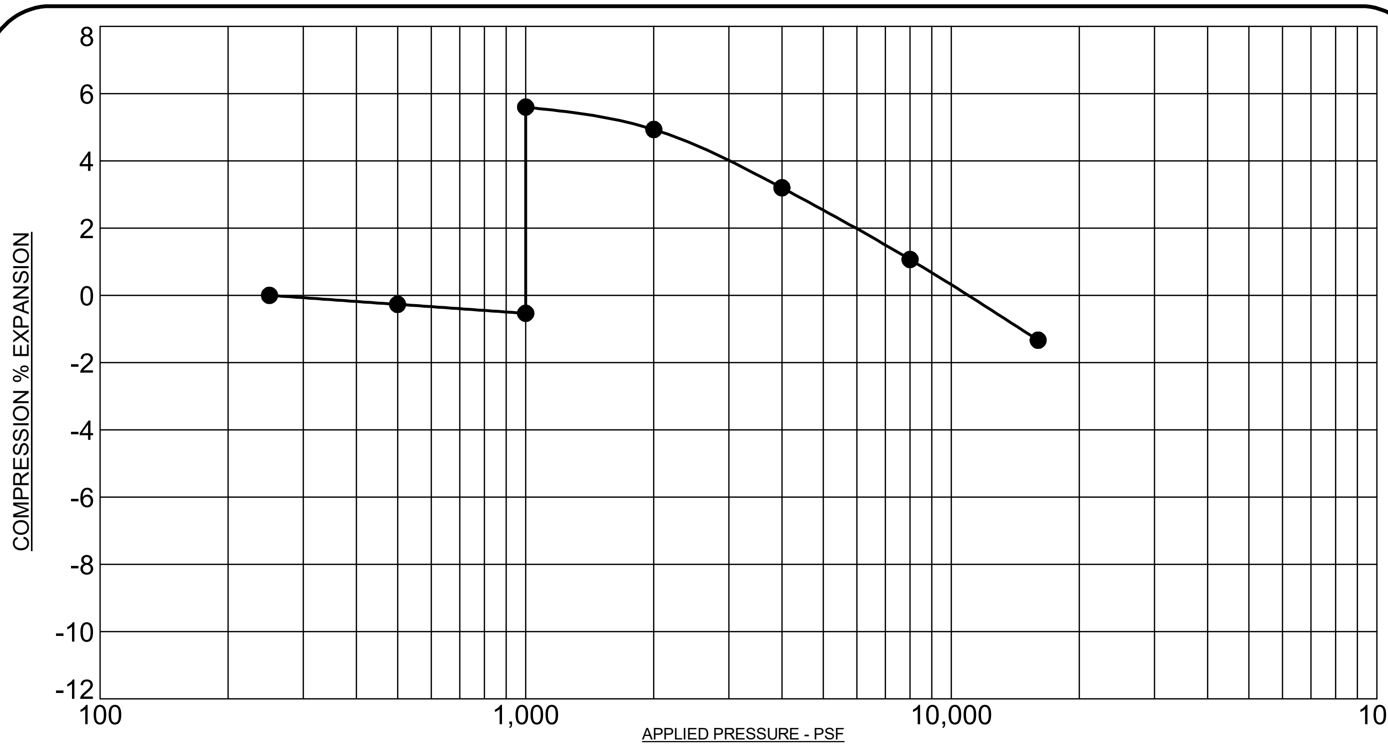
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

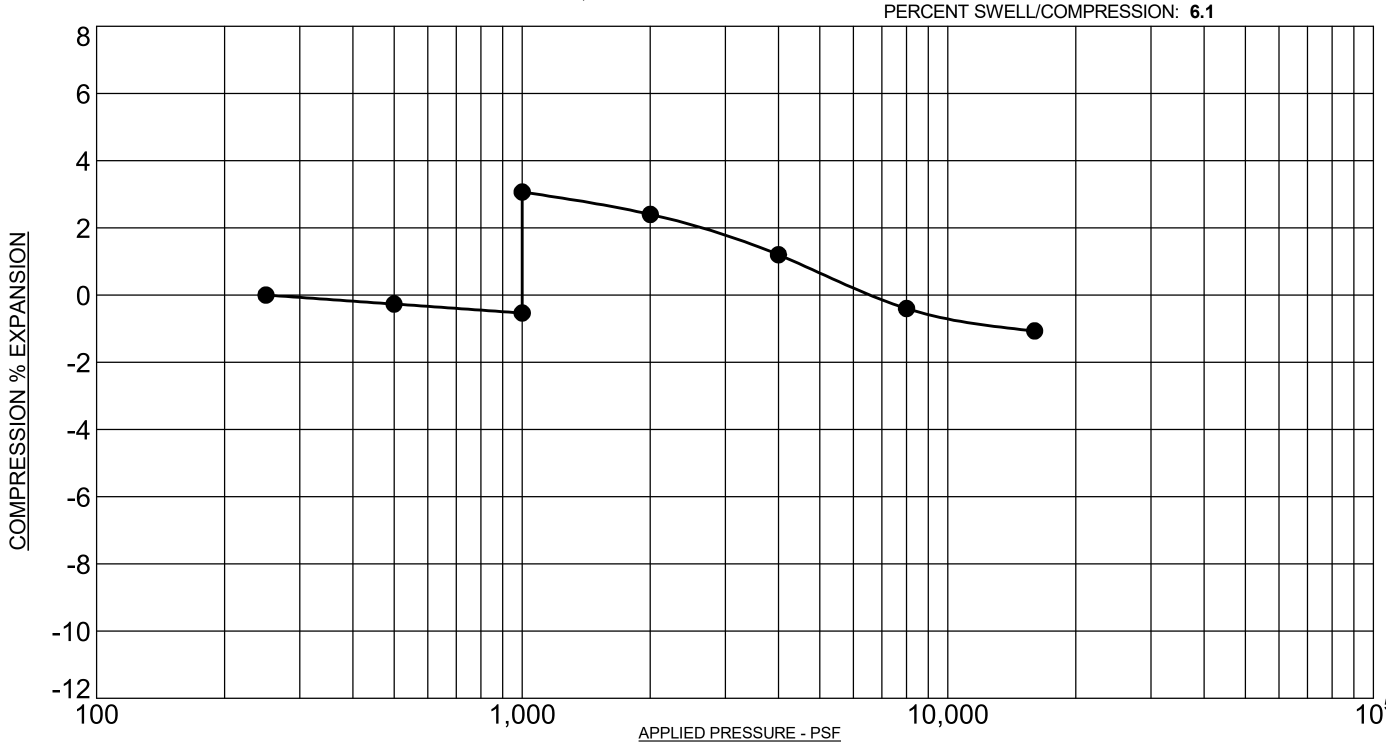
FIGURE No. 74

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **59 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **116.6 PCF**
NATURAL MOISTURE CONTENT: **11.9%**
PERCENT SWELL/COMPRESSION: **6.1**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **61 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **124.4 PCF**
NATURAL MOISTURE CONTENT: **9.5%**
PERCENT SWELL/COMPRESSION: **3.6**

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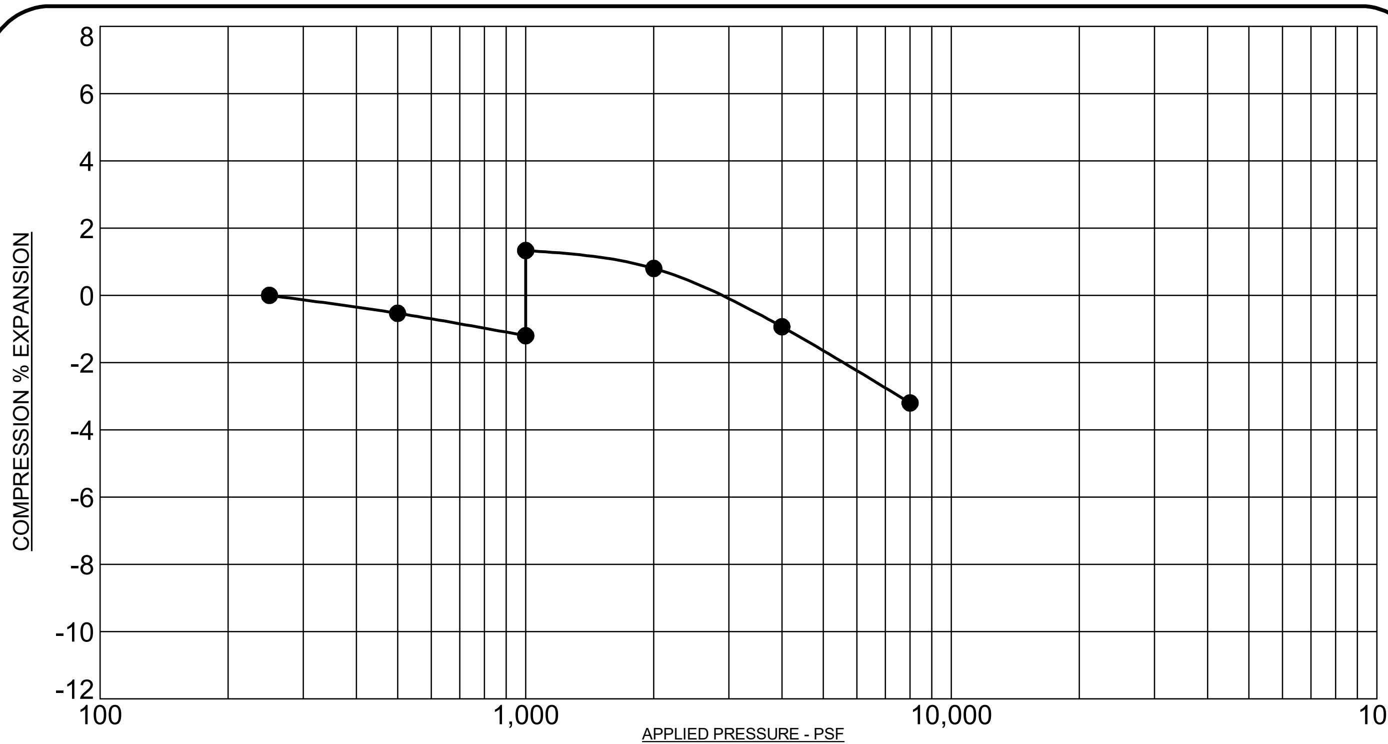
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

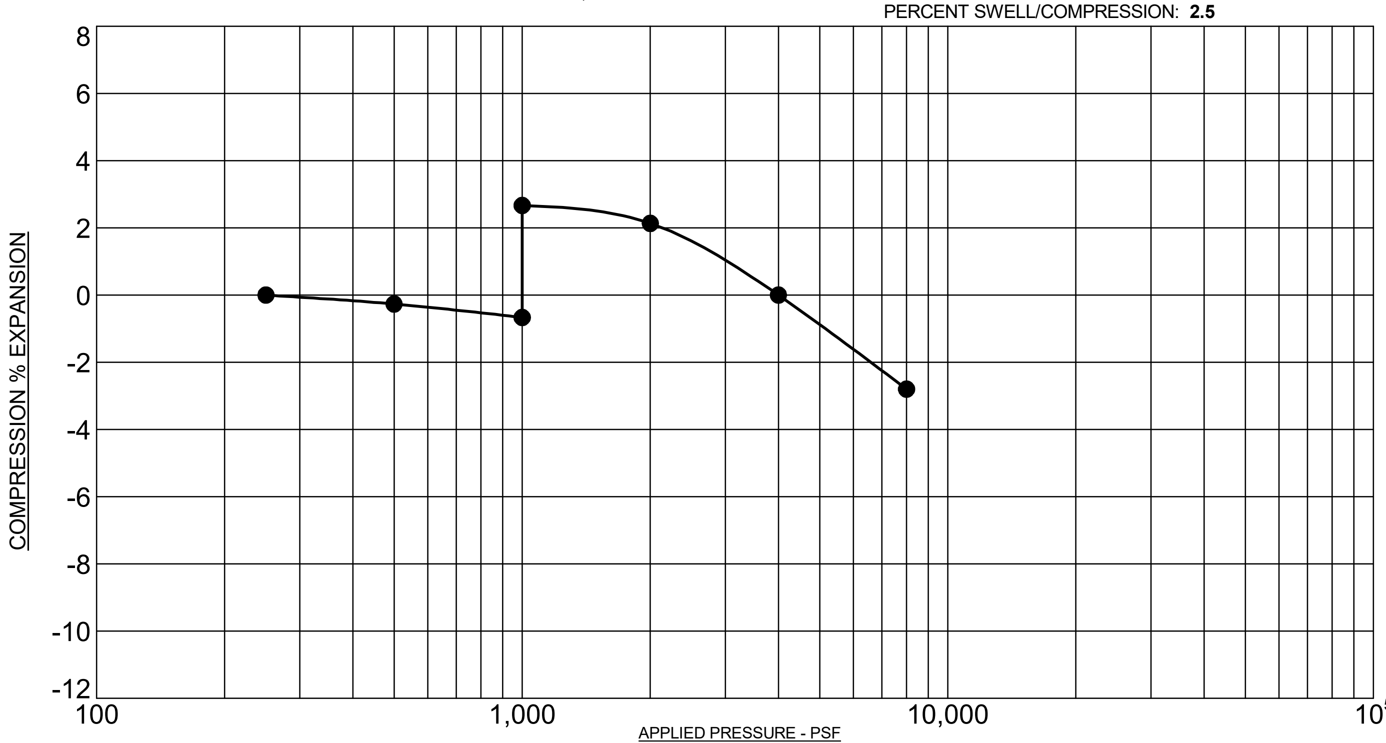
FIGURE No. 75

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **62 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **117.2 PCF**
NATURAL MOISTURE CONTENT: **10.9%**
PERCENT SWELL/COMPRESSION: **2.5**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **63 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **111.1 PCF**
NATURAL MOISTURE CONTENT: **10.9%**
PERCENT SWELL/COMPRESSION: **3.3**

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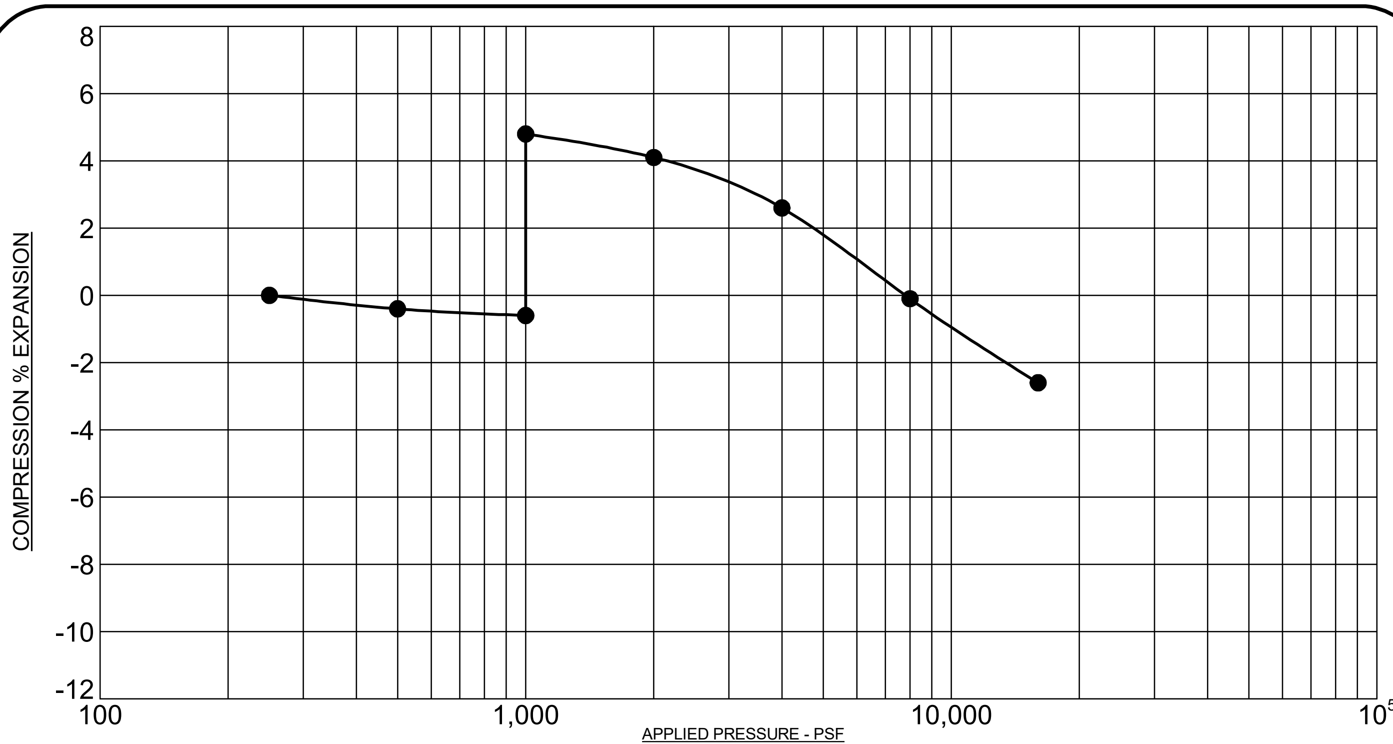
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

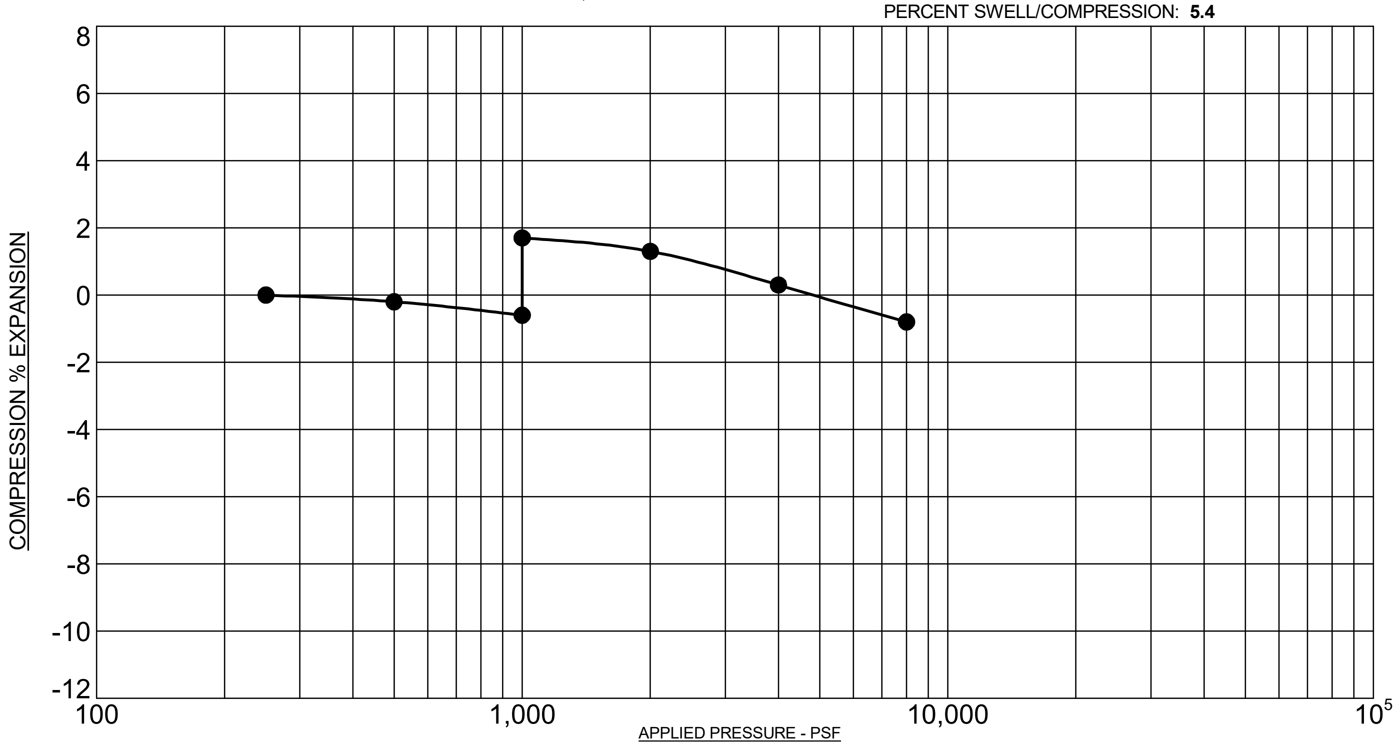
FIGURE No. 76

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **65 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **118.5 PCF**
NATURAL MOISTURE CONTENT: **10.4%**
PERCENT SWELL/COMPRESSION: **5.4**



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **66 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **122.2 PCF**
NATURAL MOISTURE CONTENT: **12.3%**
PERCENT SWELL/COMPRESSION: **2.3**

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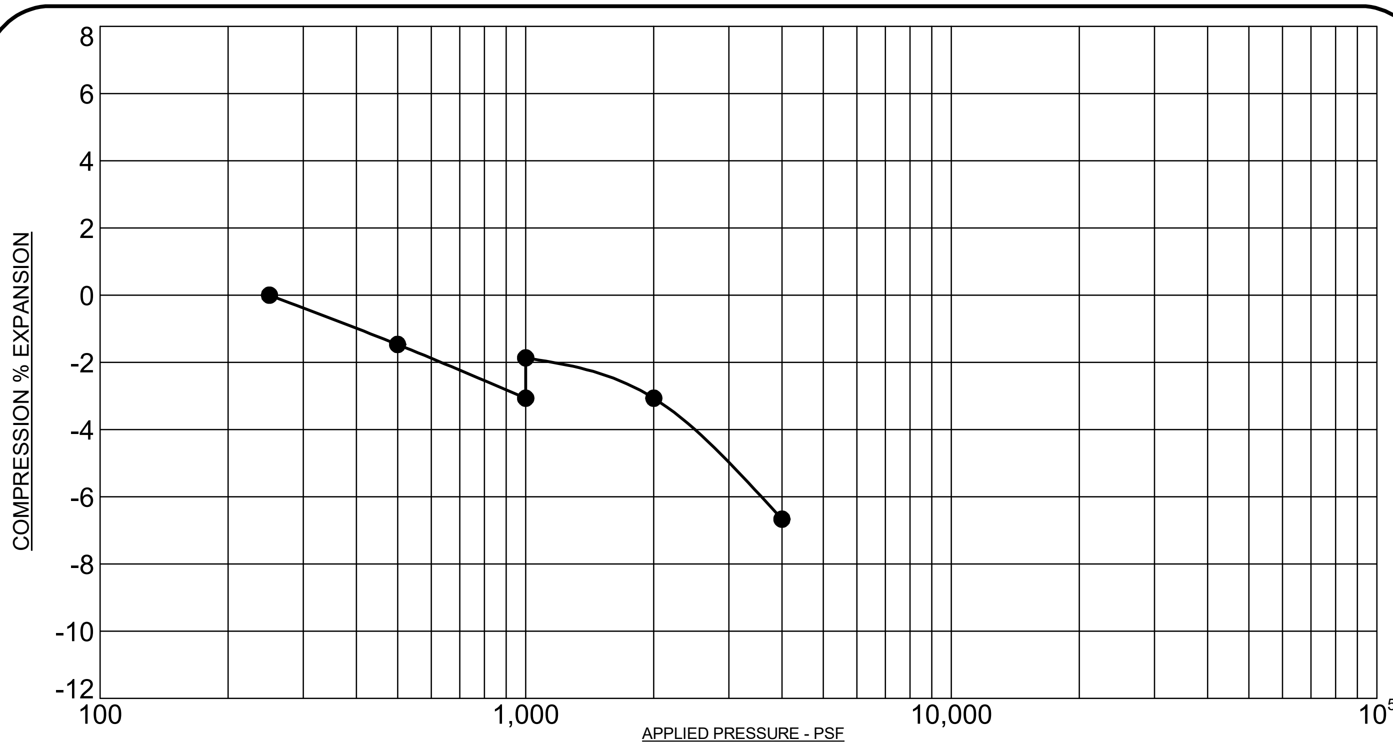
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

FIGURE No. 77

DATE Aug/05/2022



PROJECT: **Rolling Hills El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **69 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **102.4 PCF**
NATURAL MOISTURE CONTENT: **10.2%**
PERCENT SWELL/COMPRESSION: **1.2**

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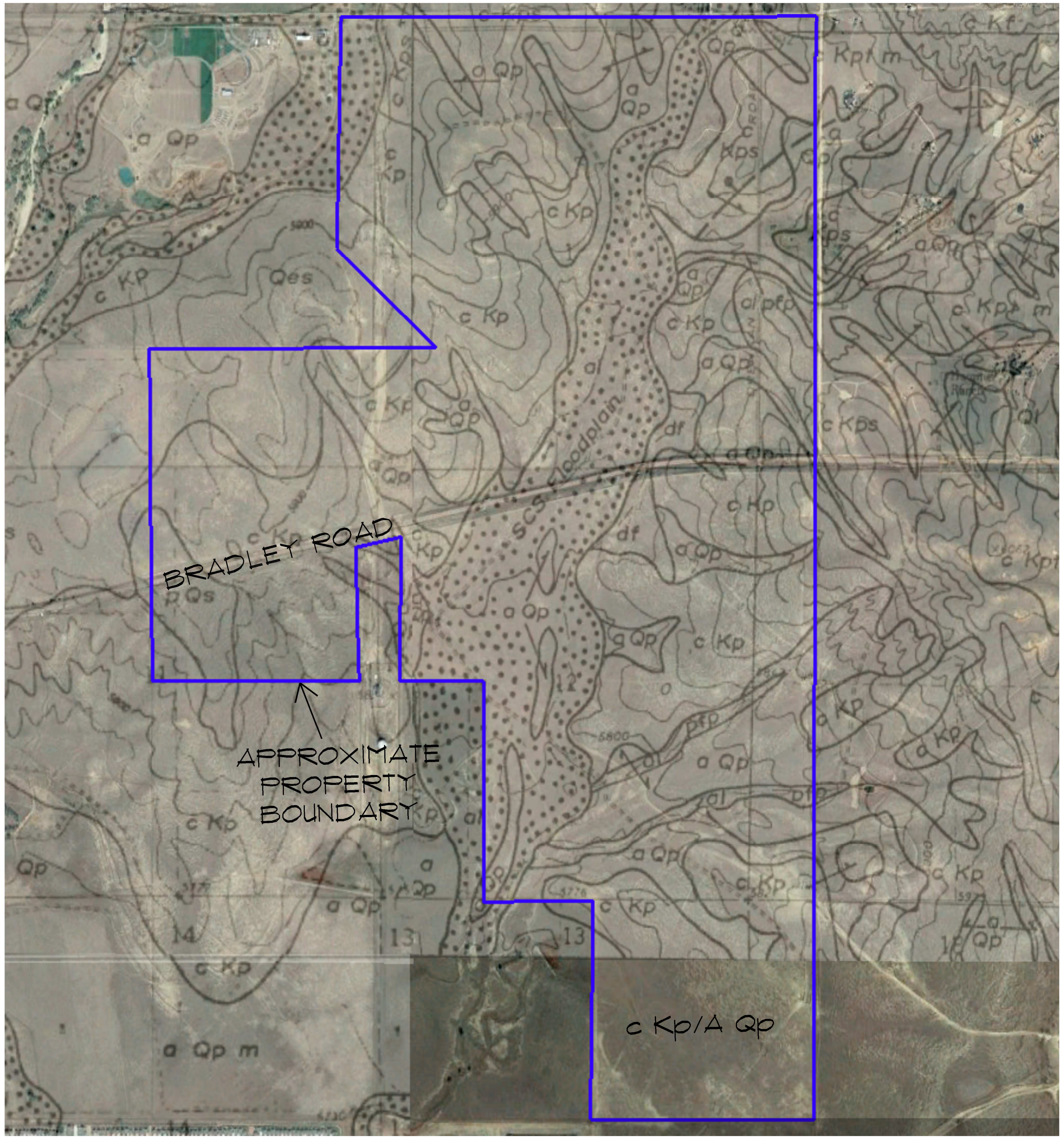
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 187746

FIGURE No. 78

DATE Aug/05/2022



NOT TO SCALE

ENGINEERING CONDITIONS

p Qs - Slocum Alluvium

a Qp - Piney Creek Alluvium

al - Alluvium

Qes - Eolian Sand

df - Debris Fan

c Kp/c Kps - Colluvium, Pierre Shale (locally subdivided)

pfp - Physiographic Floodplain

SCS Floodplain - Soil Conservation Service Floodplain

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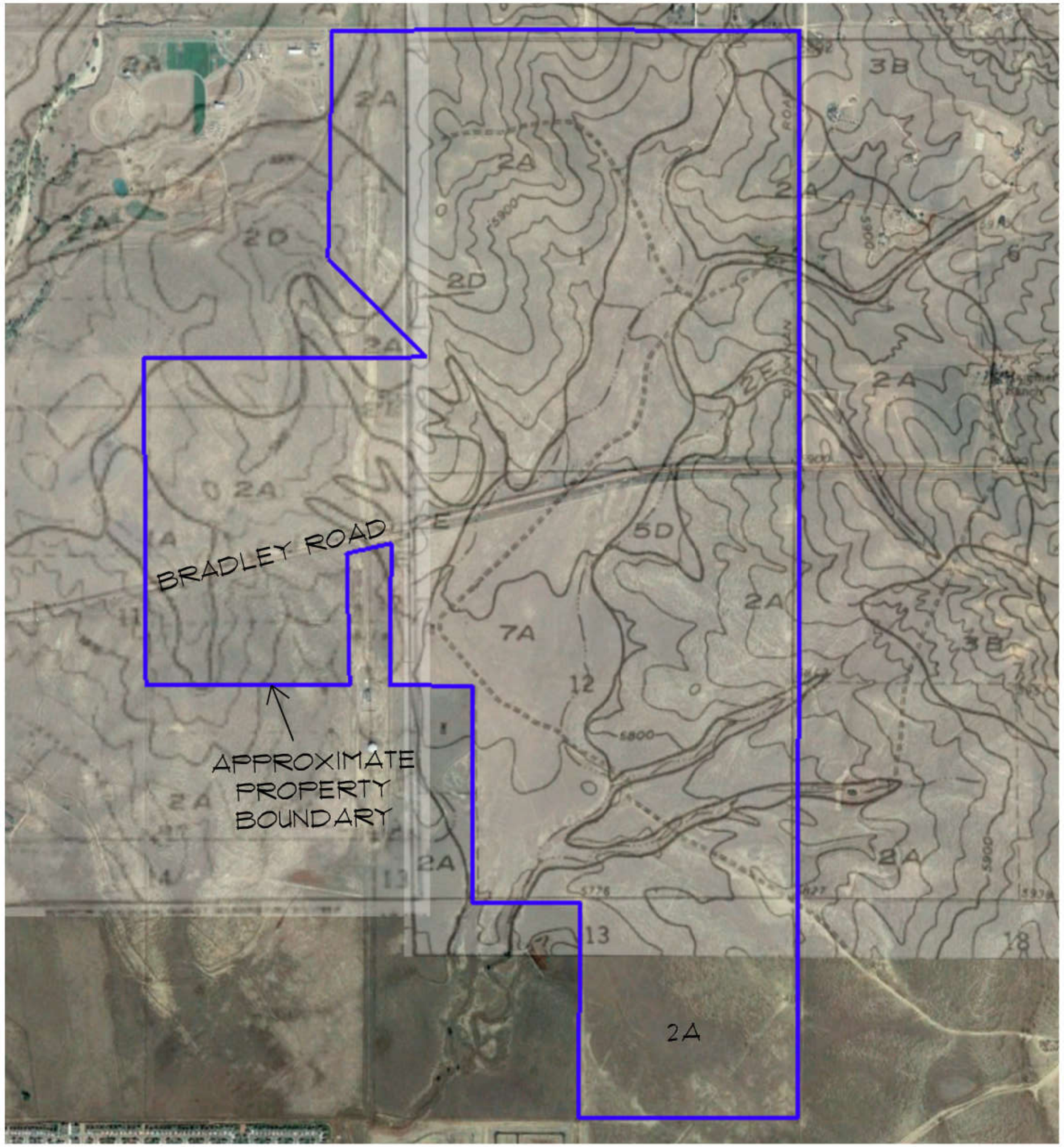
BRADLEY ROAD
EL PASO COUNTY, COLORADO
LANDUIS COMPANY

ENGINEER:	TPM
DRAWN BY:	KCR
CHECKED BY:	TPM
ISSUED:	8-5-2022

ENGINEERING MAP OF POTENTIAL GEOLOGIC HAZARDS AND SURFICIAL DEPOSITS

SHEET No.
FIG-79



NOT TO SCALE

ENGINEERING CONDITIONS

1A - Stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%)

2A - Stable alluvium, colluvium and bedrock on gentle to moderate slopes (5-12%)

2D - Eiolian deposits generally on flat to gentle slopes of upland areas

2E - Low terraces and valleys of minor tributary streams

3B - Expansive and potentially expansive soil and bedrock on flat to moderate slopes (0-12%)

5D - Debris Fan

7A - Physiographic floodplain were erosion and deposition presently occur and is generally subject to recurrent flooding. Includes 100-year floodplain along major streams where floodplain studies have been conducted

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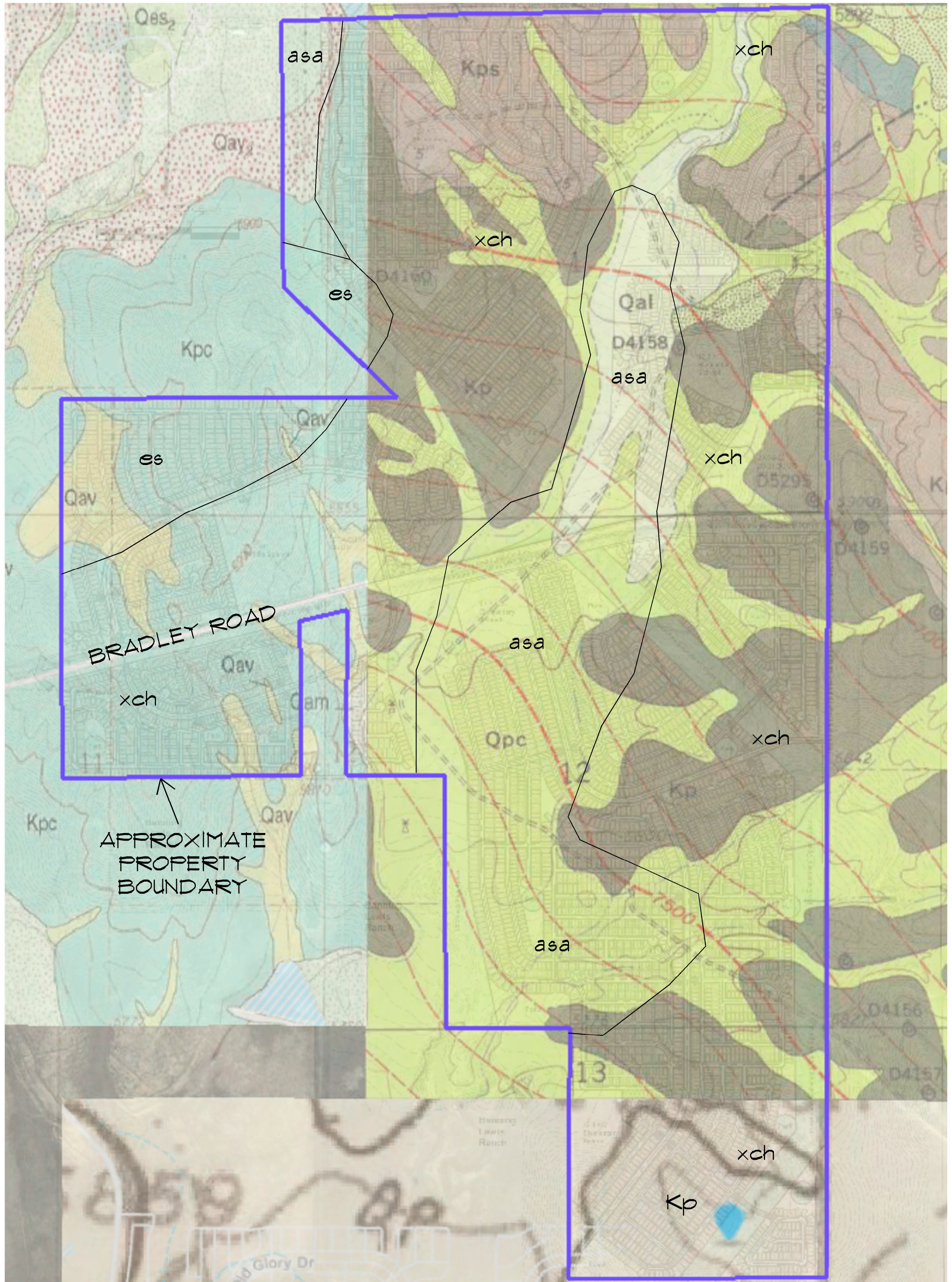
ENVIRONMENTAL AND ENGINEERING GEOLOGIC MAP FOR LAND USE

SHEET No. FIG-80



NOT TO SCALE

GEOLOGIC CONDITIONS

es - Eolian Sand

asa - Alluvial sand, silt, clay, and gravel

xch - clayey, calcareous disintegration residuum

Qam - Middle Alluvium (Late Pleistocene)

Qav - Valley-side Alluvium, Undivided (Holocene and Late Pleistocene)

Kpc - Cone-in-cone of Lavington (1933)

Kpts - Lower Part of Upper Transition Member

Qay2 - Young Alluvium Two (Late and Middle? Holocene)

Qs - Slocum Alluvium (Sangamon Interglaciation or Illinoian Glaciation

Kps - Pierre Shale, Sandstone at or Just Above Base of Upper Transition Member

Kp - Pierre Shale, Main Part of Formation

Qpc - Piney Creek Alluvium

Qal - Alluvium

Kpt - Pierre Shale, Main Part of Upper Transition Member

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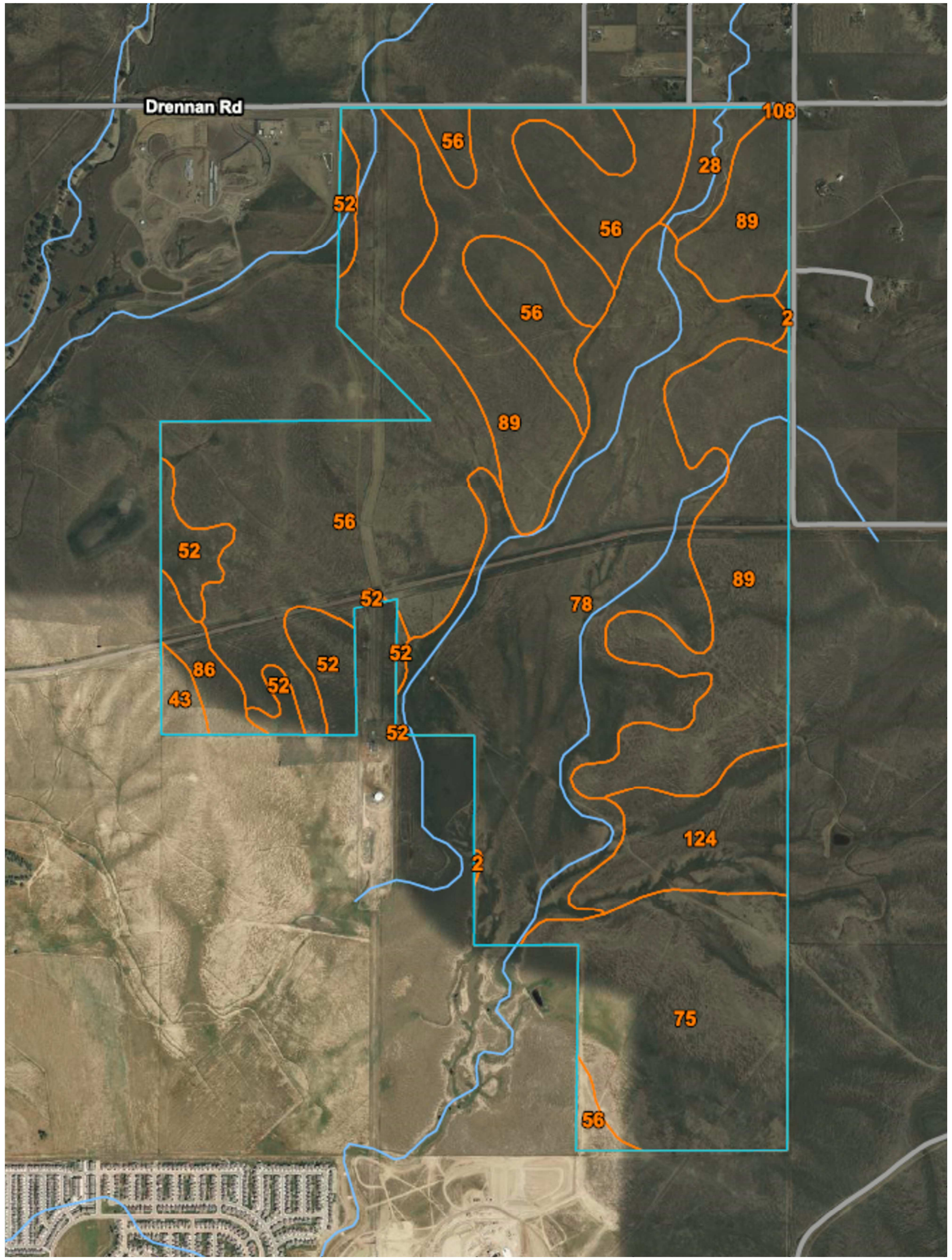
GENERAL GEOLOGIC MAP

SHEET No. FIG-81



USDA SOIL SURVEY MAP UNITS

56 - Nelson-Tassel fine sandy loam, 3 to 18 percent slopes

108 - Wiley silt loam, 3 to 9 percent slopes

2 - Ascalon sandy loam, 1 to 3 percent slopes

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

43 - Kim loam, 1 to 8 percent slopes

52 - Manzanst clay loam, 0 to 3 percent slopes

75 - Razor-Midway Complex

78 - Sampson loam, 0 to 3 percent slopes

86 - Stoneham sandy loam, 3 to 8 percent slopes

89 - Tassel fine sandy loam, 3 to 18 percent slopes

124 - Olnest sandy loam, 0 to 3 percent slopes

NOT TO SCALE

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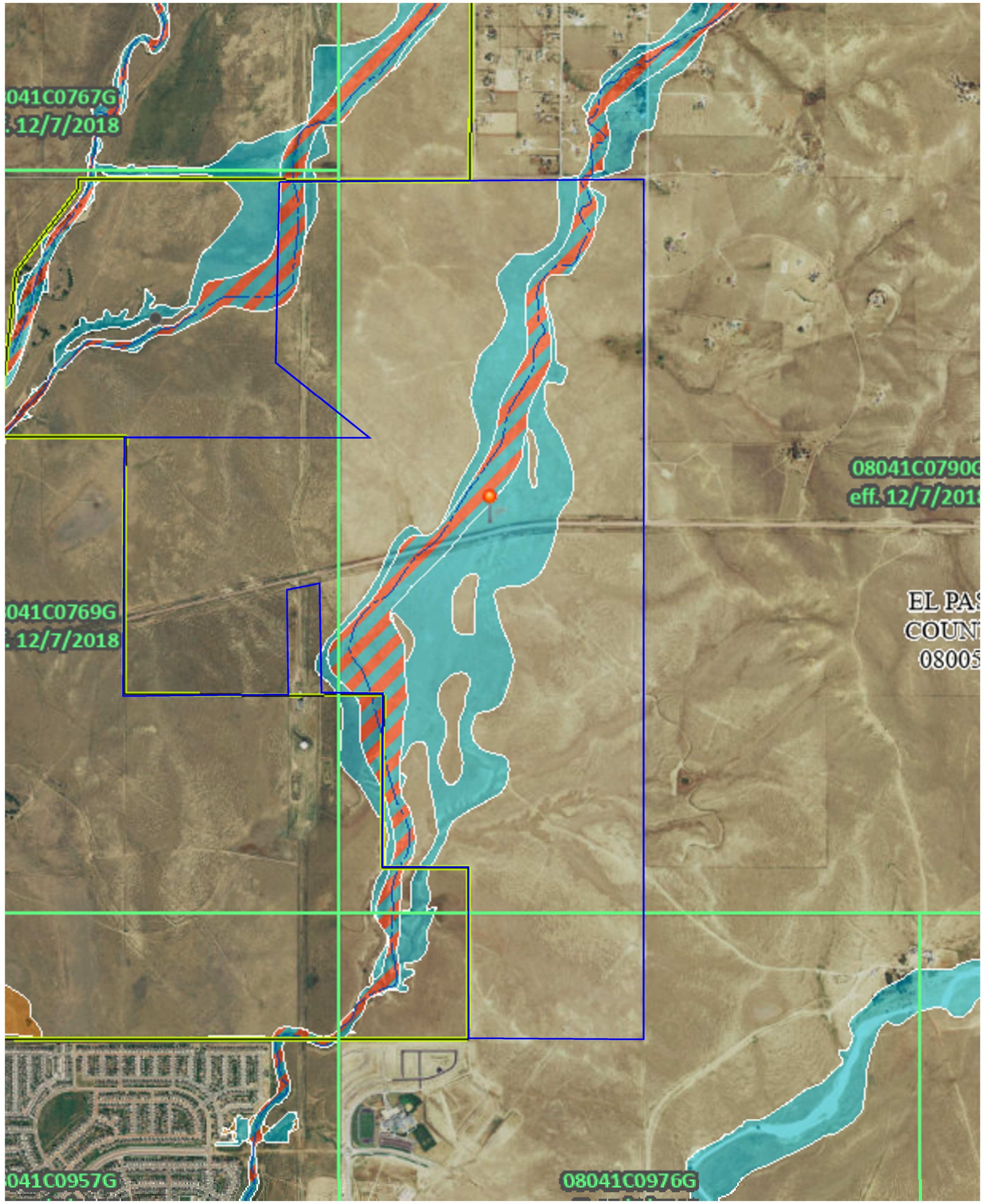
USDA SOIL SURVEY MAP

SHEET No.
FIG-82



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP
FOR DRAFT 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
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOT TO SCALE

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FEMA MAP

SHEET No.
FIG-83

APPENDIX A
Additional Reference Documents

1. *Overall Sketch Plan,* received via electronic email from Matrix, plan not dated.
2. *Conceptual Layout 01, Rolling Hills – Bull Hill,* prepared by Matrix Design Group, dated November 9, 2021.
3. *Conceptual Layout 03, Rolling Hills – Bull Hill,* prepared by Matrix Design Group, dated January 27, 2022.
4. *Overall Conceptual Layout, Rolling Hills – Bull Hill,* prepared by Matrix Design Group, dated October 25, 2021.
5. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 08041C0790G, 08041C0769G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
6. *Corral Bluffs Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
7. *Corral Bluffs Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
8. *Elsmere Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
9. *Elsmere Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
10. *Geologic Map of the Elsmere 7.5 Minute Quadrangle, El Paso County, Colorado,* Madole, R.F., and Thorson, J.P., CGS, Open-File Report OF02-02, 2003.
11. *Generalized Surficial Geologic Map of the Pueblo 1 degree x 2 degree Quadrangle, Colorado,* Moore, D.E., Straub, A.W., Berry, M.E., Baker, M.L., and Brandt, T.R., USGS, Miscellaneous Field Studies Map MF-2388, 2002.
12. *Geologic Map of the Corral Bluffs Quadrangle, El Paso County, Colorado,* Soister, P.E., USGS, Geologic Quadrangle Map GQ-783, 1968.
13. *Geologic Map of the Pueblo 1 degree x 2 degrees quadrangle, south central Colorado,* Scott, G.R., Taylor, R.B., Epis, R.C., and Wobus, R.A., Miscellaneous Investigations Series Map I-1022, 1978.
14. *Geologic map of the Pueblo 1 degree x 2 degrees quadrangle, south-central Colorado,* Scott, G.R., Taylor, R.B., Epis, R.C., and Wobus, R.A., Miscellaneous Field Studies Map MF-775, 1976.
15. *El Paso County Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction, Map 1*
16. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County, State and Mineral Lands, Open-File Report OF-03-07*
17. *Colorado Springs and Vicinity Natural Hazard Explorer ArcGIS WebViewer* https://www.arcgis.com/apps/MapSeries/index.html?appid=dce03f88b282442d8ec751fd439e357e
18. *USDA Web Soil Survey* https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

19. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
20. El Paso County Assessor Real Property Search
https://property.spatialest.com/co/elpaso/#/property/
21. *USGS National Geologic Map Database*
https://ngmdb.usgs.gov/mapview/?center=-97,39.6&zoom=4
22. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1955, 1960, 1969, 1983, 1999, 2005, 2009, 2011, 2013, 2015, 2017, and 2019.
23. *USGS TopoView Historical Topographic Map Viewer*
https://ngmdb.usgs.gov/topoview/viewer/#15/38.7488/-104.6183
Fountain Quadrangle, Colorado, dated 1948, 1950, 1951, 1961, 2010, 2013, 2016, 2019, and 2022.
24. *USGS TopoView Historical Topographic Map Viewer*
https://ngmdb.usgs.gov/topoview/viewer/#15/38.7488/-104.6183
Corral Bluffs Quadrangle, Colorado, dated 1961, 2010, 2013, 2016, 2019, and 2022.
25. *USGS TopoView Historical Topographic Map Viewer*
https://ngmdb.usgs.gov/topoview/viewer/#15/38.7488/-104.6183
Fountain NE Quadrangle, Colorado, dated 1950, 1961, 2010, 2013, 2016, 2019, and 2022.
26. *USGS TopoView Historical Topographic Map Viewer*
https://ngmdb.usgs.gov/topoview/viewer/#15/38.7488/-104.6183
Elsmere Quadrangle, Colorado, dated 1950, 1961, 2010, 20113, 2016, 2019, and 2022.
27. *Google Earth Pro*, Imagery dated 1999, 2003, 2004, 2005, 2006, 2011, 2015, 2017, 2019, 2020 and 2021.

APPENDIX B

Guideline Site Grading Specifications

Description: Unless specified otherwise by local or state regulatory agencies, these guideline specifications are for the excavation, placement and compaction of material from locations indicated on the plans, or staked by the Engineer, as necessary to achieve the required elevations. These specifications shall also apply to compaction of materials that may be placed outside of the project.

General: The Geotechnical Engineer shall approve fill materials, method of placement, moisture contents and percent compactions, and shall give written approval of the compacted fill.

Clearing Site: The Contractor shall remove trees, brush, rubbish, vegetation, topsoil and existing structures before excavation or fill placement is commenced. The Contractor shall dispose of the cleared material to provide the Owner with a clean job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures. Clearing shall also include removal of existing fills that do not meet the requirements of this specification and existing structures.

Preparation of Slopes or Drainage Areas to Receive Fill: Natural slopes or slopes of drainage gullies where grades are 20 percent (5:1, horizontal to vertical) or steeper shall be benched prior to fill placement. Benches shall be at least 10 feet wide. Benches may require additional width to accommodate excavation or compaction equipment. At least one bench shall be provided for each 5 feet or less of vertical elevation difference. The bench surface shall be essentially horizontal perpendicular to the slope or at a slight incline into the slope.

Scarifying: Topsoil and vegetation shall be removed from the ground surface in areas to receive fill. The surface shall be plowed or scarified a minimum of 12 inches until the surface is free from ruts, hummocks or other uneven features which would prevent uniform compaction by the equipment to be used.

Compacting Area to Receive Fill: After the area to receive fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods, moisture conditioned to a proper moisture content and compacted to the maximum density as specified for the overlying fill. Areas to receive fill shall be worked, stabilized, or removed and replaced, if necessary, in accordance with the Geotechnical Engineer's recommendations in preparation for fill.

Fill Materials: Fill material shall be free from organic material or other deleterious substances, and shall not contain rocks or lumps having a diameter greater than six inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer or imported to the site and shall be approved by the Geotechnical Engineer prior to placement. It is recommended that the fill materials have nil to low expansion potential, i.e., consist of silty to slightly clayey sand.

- The moisture-conditioned materials should be placed in maximum 6" compacted lifts. These materials should be compacted to a minimum of 92 percent of the maximum

- Modified Proctor dry density or 95 percent of the maximum Standard Proctor dry density. Material not meeting the above requirements shall be reprocessed.

Materials used for moisture-conditioned structural fill should be approved by RMG prior to use. Moisture-conditioned structural fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement.

Moisture Content: Fill materials shall be moisture conditioned to within limits of optimum moisture content specified. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas or imported to the site.

The contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Geotechnical Engineer, it is not possible to obtain uniform moisture content by adding water to the fill material during placement. The Contractor may be required to rake or disk the fill soils to provide uniform moisture content through the soils.

The application of water to embankment materials shall be made with watering equipment, approved by the Geotechnical Engineer, which will give the desired results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are eroded.

Should too much water be added to the fill, such that the material is too wet to permit the desired compaction to be obtained, compacting and work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework the wet material in an approved manner to hasten its drying.

Compaction of Fill Areas: Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Fill materials shall be placed such that the thickness of loose material does not exceed 10 inches and the compacted lift thickness does not exceed 6 inches.

Compaction, as specified above, shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the Geotechnical Engineer. Granular fill shall be compacted using vibratory equipment or other equipment approved by the Geotechnical Engineer. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area.

Moisture Content and Density Criteria:

A. Fill placed in roadways and utility trenches should be moisture conditioned and compacted in accordance with El Paso County Specifications.

B. Fill placed outside of roadways and utility trenches should be compacted to at least 92% of the maximum Modified Proctor density (ASTM D-1557) or at least 95% of the maximum Standard Proctor density (ASTM D-698) at a moisture content within 2% of optimum.

Compaction of Slopes: Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and such that there is no appreciable amount of loose soil on the slopes. Compaction of slopes may be done progressively in increments of three to five feet in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

Density Testing: Field density testing shall be performed by the Geotechnical Engineer at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate the density or moisture content of any layer of fill or portion thereof is below that required, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

Observation and Testing of Fill: Observation by the Geotechnical Engineer shall be sufficient during the placement of fill and compaction operations so that he can declare the fill was placed in general conformance with Specifications. All observations necessary to test the placement of fill and observe compaction operations will be at the expense of the Owner.

Seasonal Limits: No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Geotechnical Engineer indicates the moisture content and density of previously placed materials are as specified.

Reporting of Field Density Tests: Density tests made by the Geotechnical Engineer shall be submitted progressively to the Owner. Dry density, moisture content, percent compaction, and approximate location shall be reported for each test taken.

Appendix G

Hydraulic Modeling

Note:
HEC-RAS models included as an attachment due to size

Unresolved:
Models were not included in submittal package. Please provide for review

Unresolved:
Please provide HEC-RAS information in appendix (Output tables, cross sections, input data, etc)

Unresolved:
Include HEC-RAS model map for existing & proposed conditions

HY-8 Model

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1100.00 cfs

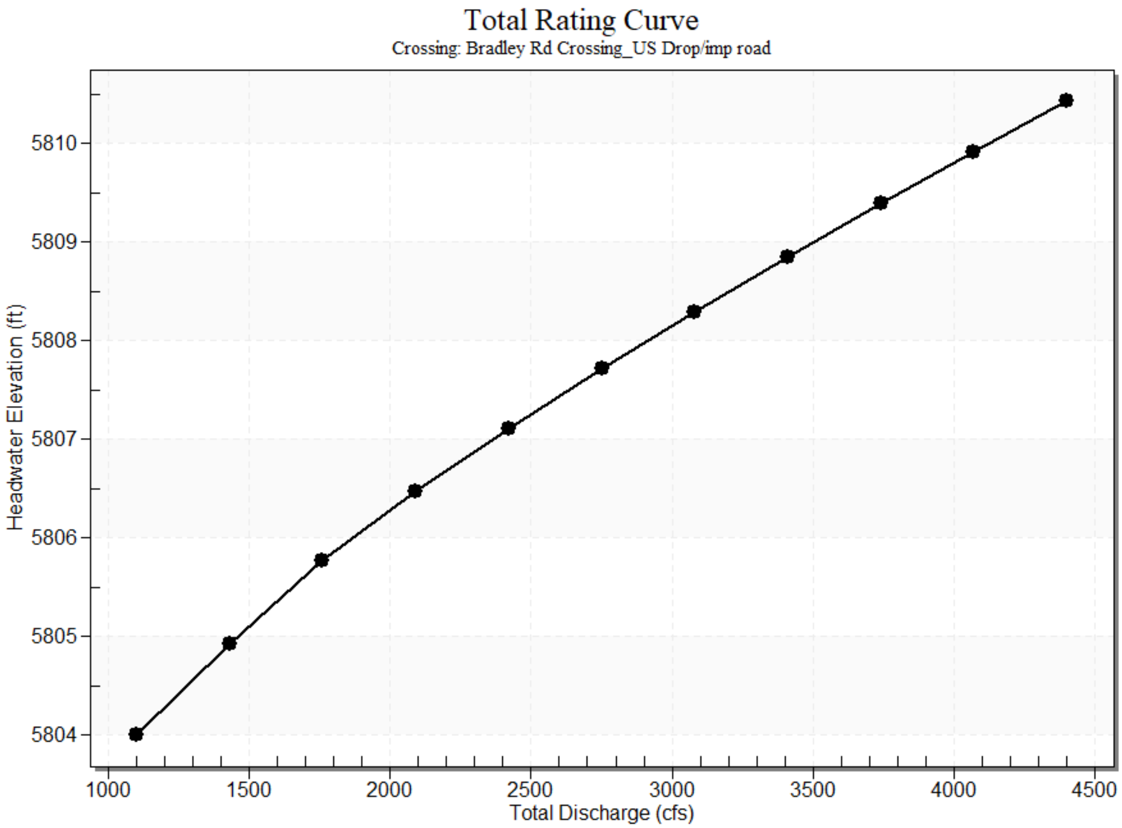
Design Flow: 4400.00 cfs

Maximum Flow: 4400.00 cfs

Table 1 - Summary of Culvert Flows at Crossing: Bradley Rd Crossing_US Drop/imp road

Headwater Elevation (ft)	Total Discharge (cfs)	CONSPAN 0742 Discharge (cfs)	Existing Culverts Discharge (cfs)	Roadway Discharge (cfs)	Iterations
5804.00	1100.00	1099.67	0.00	0.00	5
5804.93	1430.00	1429.97	0.00	0.00	3
5805.77	1760.00	1750.57	9.63	0.00	3
5806.47	2090.00	2029.24	60.64	0.00	3
5807.11	2420.00	2292.15	127.75	0.00	3
5807.72	2750.00	2545.26	204.66	0.00	3
5808.30	3080.00	2791.41	288.56	0.00	3
5808.85	3410.00	3031.84	378.09	0.00	3
5809.39	3740.00	3267.65	472.27	0.00	3
5809.92	4070.00	3496.82	573.15	0.00	3
5810.43	4400.00	3721.17	678.83	0.00	3
5816.16	7982.70	5953.62	2029.08	0.00	Overtopping

Rating Curve Plot for Crossing: Bradley Rd Crossing_US Drop/imp road



Culvert Data: CONSPAN O742

Table 2 - Culvert Summary Table: CONSPAN O742

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1100.00 cfs	1099.67 cfs	5804.00	4.90	5.075	2-M2c	4.84	2.77	2.77	2.49	9.48	21.35
1430.00 cfs	1429.97 cfs	5804.93	5.85	5.995	2-M2c	5.77	3.29	3.29	2.74	10.37	23.27
1760.00 cfs	1750.57 cfs	5805.77	6.67	6.836	2-M2c	6.65	3.77	3.77	2.95	11.12	24.89
2090.00 cfs	2029.24 cfs	5806.47	7.32	7.538	2-M2c	7.42	4.16	4.16	3.15	11.71	26.29

2420.00 cfs	2292.15 cfs	5807.11	7.88	8.181	2-M2c	8.17	4.50	4.50	3.33	12.25	27.53
2750.00 cfs	2545.26 cfs	5807.72	8.39	8.786	2-M2c	9.04	4.81	4.81	3.50	12.77	28.65
3080.00 cfs	2791.41 cfs	5808.30	8.87	9.366	2-M2c	10.15	5.10	5.10	3.99	13.24	16.18
3410.00 cfs	3031.84 cfs	5808.85	9.32	9.923	2-M2c	11.25	5.38	5.38	4.04	13.69	16.84
3740.00 cfs	3267.65 cfs	5809.39	9.76	10.464	2-M2c	11.25	5.64	5.64	4.09	14.12	17.46
4070.00 cfs	3496.82 cfs	5809.92	10.18	10.987	2-M2c	11.25	5.90	5.90	4.14	14.52	18.05
4400.00 cfs	3721.17 cfs	5810.43	10.60	11.501	7-M2c	11.25	6.14	6.14	4.19	14.90	18.61

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

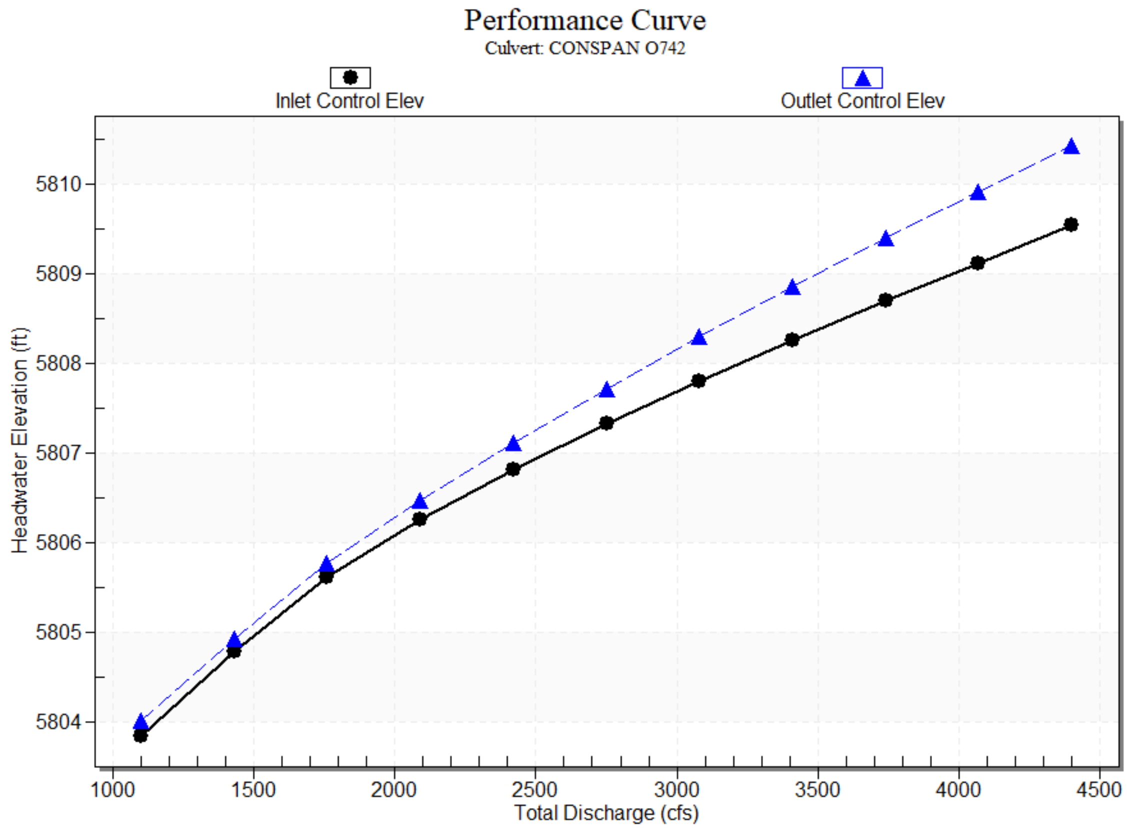
Inlet Elevation (invert): 5798.93 ft,

Outlet Elevation (invert): 5798.49 ft

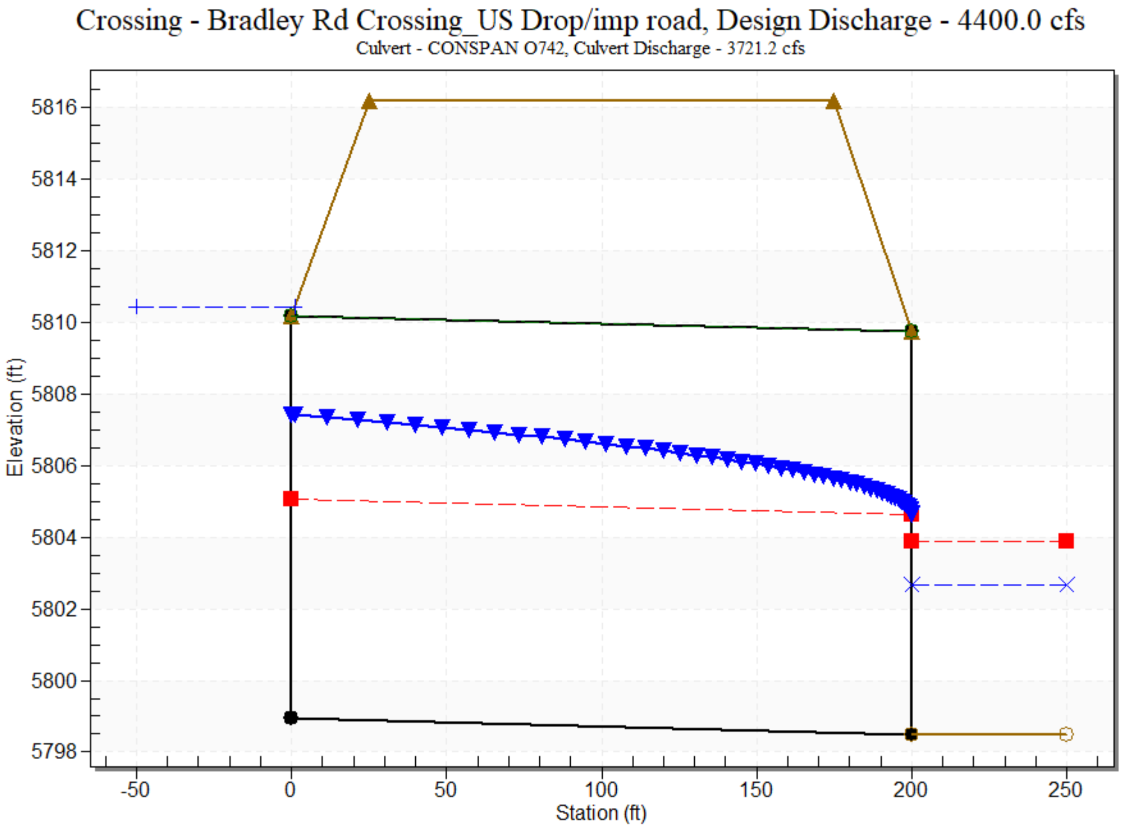
Culvert Length: 200.00 ft,

Culvert Slope: 0.0022

Culvert Performance Curve Plot: CONSPAN O742



Water Surface Profile Plot for Culvert: CONSPAN O742



Site Data - CONSPAN O742

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 5798.93 ft

Outlet Station: 200.00 ft

Outlet Elevation: 5798.49 ft

Number of Barrels: 1

Culvert Data Summary - CONSPAN O742

Barrel Shape: Concrete Open-Bottom Arch

Barrel Span: 42.00 ft

Barrel Rise: 11.25 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0350 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Culvert Data: Existing Culverts

Table 3 - Culvert Summary Table: Existing Culverts

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
1100.00 cfs	0.00 cfs	5804.00	0.00	0.000	0-NF	0.00	0.00	0.00	2.49	0.00	21.35
1430.00 cfs	0.00 cfs	5804.93	0.00	0.000	0-NF	0.00	0.00	0.00	2.74	0.00	23.27
1760.00 cfs	9.63 cfs	5805.77	0.29	0.296	2-M2c	0.18	0.17	0.17	2.95	2.35	24.89
2090.00 cfs	60.64 cfs	5806.47	1.00	0.0*	1-S2n	0.58	0.58	0.58	3.15	4.36	26.29
2420.00 cfs	127.75 cfs	5807.11	1.64	0.351	1-S2n	0.93	0.96	0.93	3.33	5.74	27.53
2750.00 cfs	204.66 cfs	5807.72	2.25	0.723	1-S2n	1.26	1.31	1.26	3.50	6.77	28.65
3080.00 cfs	288.56 cfs	5808.30	2.83	1.092	1-S2n	1.57	1.65	1.58	3.99	7.63	16.18
3410.00 cfs	378.09 cfs	5808.85	3.38	1.463	1-S2n	1.88	1.98	1.88	4.04	8.39	16.84
3740.00 cfs	472.27 cfs	5809.39	3.92	1.839	1-S2n	2.18	2.29	2.18	4.09	9.02	17.46
4070.00 cfs	573.15 cfs	5809.92	4.45	2.234	1-S2n	2.48	2.61	2.48	4.14	9.61	18.05

4400.00 cfs	678.83 cfs	5810.43	4.96	2.644	1-S2n	2.79	2.92	2.79	4.19	10.13	18.61

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

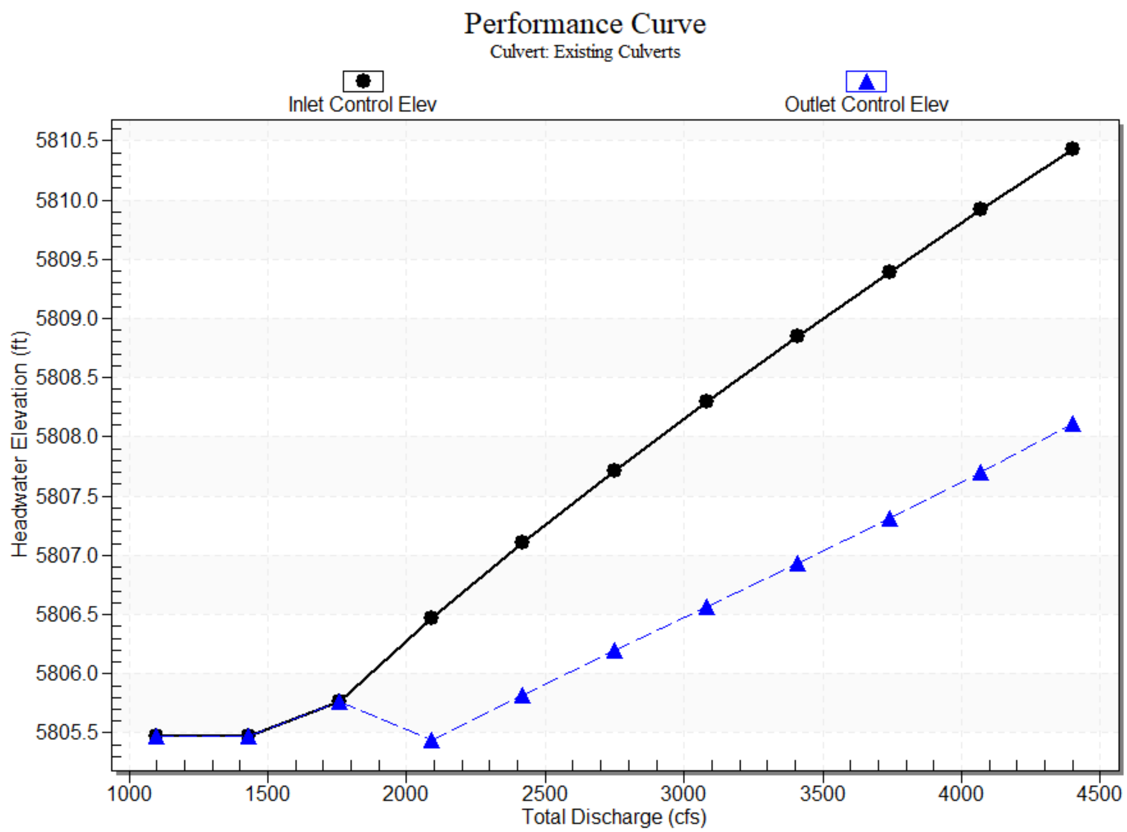
Inlet Elevation (invert): 5805.47 ft,

Outlet Elevation (invert): 5804.85 ft

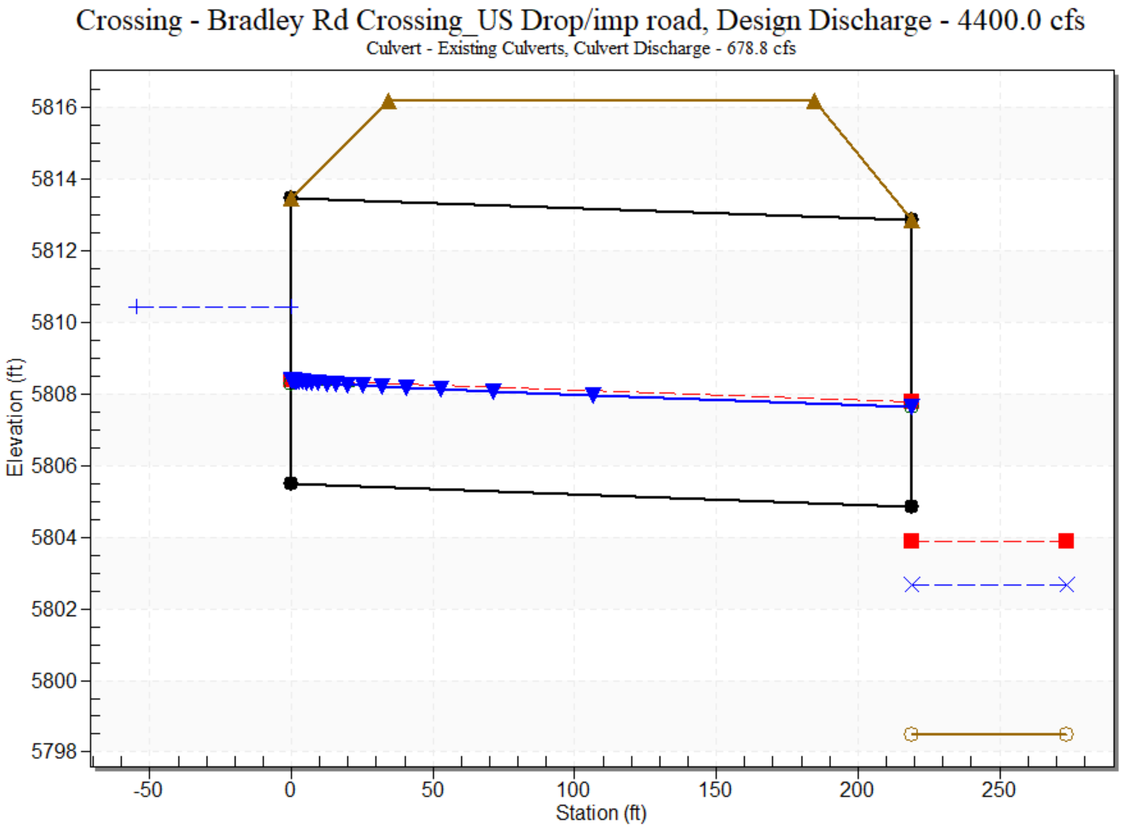
Culvert Length: 219.00 ft,

Culvert Slope: 0.0028

Culvert Performance Curve Plot: Existing Culverts



Water Surface Profile Plot for Culvert: Existing Culverts



Site Data - Existing Culverts

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 5805.47 ft

Outlet Station: 219.00 ft

Outlet Elevation: 5804.85 ft

Number of Barrels: 2

Culvert Data Summary - Existing Culverts

Barrel Shape: Concrete Box

Barrel Span: 12.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90º) Headwall

Inlet Depression: None

Tailwater Data for Crossing: Bradley Rd Crossing_US Drop/imp road

Table 4 - Downstream Channel Rating Curve (Crossing: Bradley Rd Crossing_US Drop/imp road)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
1100.00	5800.98	2.49	21.35	38.92	3.32
1430.00	5801.23	2.74	23.27	42.68	3.39
1760.00	5801.44	2.95	24.89	46.05	3.45
2090.00	5801.64	3.15	26.29	49.12	3.50
2420.00	5801.82	3.33	27.53	51.96	3.54
2750.00	5801.99	3.50	28.65	54.62	3.58
3080.00	5802.48	3.99	16.18	62.22	3.15
3410.00	5802.53	4.04	16.84	63.03	3.18
3740.00	5802.58	4.09	17.46	63.82	3.21
4070.00	5802.63	4.14	18.05	64.57	3.24
4400.00	5802.68	4.19	18.61	65.31	3.26

Tailwater Channel Data - Bradley Rd Crossing_US Drop/imp road

Tailwater Channel Option: Irregular Channel

Channel Slope: Irregular Channel

User Defined Channel Cross-Section

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	5806.89	0.0400
2	4.00	5805.89	0.0400
3	4.00	5805.89	0.0400
4	19.20	5802.09	0.0400
5	109.20	5802.09	0.0400
6	116.40	5800.29	0.0400
7	122.40	5800.29	0.0400
8	127.20	5799.09	0.0400
9	130.20	5799.09	0.0400
10	130.20	5798.49	0.0400
11	137.20	5798.49	0.0400
12	137.20	5799.09	0.0400
13	140.20	5799.09	0.0400
14	145.00	5800.29	0.0400
15	151.00	5800.29	0.0400

16	158.20	5802.09	0.0400
17	248.20	5802.09	0.0400
18	263.40	5805.89	0.0400
19	263.40	5805.89	0.0400
20	267.40	5806.89	0.0000

Roadway Data for Crossing: Bradley Rd Crossing_US Drop/imp road

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 267.00 ft

Crest Elevation: 5816.16 ft

Roadway Surface: Paved

Roadway Top Width: 150.00 ft

FlowMaster Results

On Flowmaster Reports, indicate what scenario/flow is being analyzed

Worksheet for Lower Reach

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00250 ft/ft
Discharge	4.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-1+33.70	8.40
-1+29.70	7.40
-1+29.70	7.40
-1+14.50	3.60
-0+24.50	3.60
-0+17.30	1.80
-0+11.30	1.80
-0+06.50	0.60
-0+03.50	0.60
-0+03.50	0.00
0+03.50	0.00
0+03.50	0.60
0+06.50	0.60
0+11.30	1.80
0+17.30	1.80
0+24.50	3.60
1+14.50	3.60
1+29.70	7.40
1+29.70	7.40
1+33.70	8.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-1+33.70, 8.40)	(-0+11.30, 1.80)	0.060
(-0+11.30, 1.80)	(0+11.30, 1.80)	0.035
(0+11.30, 1.80)	(1+33.70, 8.40)	0.060

Options

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

Results

Worksheet for Lower Reach

Results	
Normal Depth	0.5 ft
Roughness Coefficient	0.035
Elevation	0.48 ft
Elevation Range	0.0 to 8.4 ft
Flow Area	3.4 ft²
Wetted Perimeter	8.0 ft
Hydraulic Radius	0.4 ft
Top Width	7.00 ft
Normal Depth	0.5 ft
Critical Depth	0.2 ft
Critical Slope	0.03221 ft/ft
Velocity	1.19 ft/s
Velocity Head	0.02 ft
Specific Energy	0.50 ft
Froude Number	0.304
Flow Type	Subcritical

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

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.5 ft
Critical Depth	0.2 ft
Channel Slope	0.00250 ft/ft
Critical Slope	0.03221 ft/ft

Worksheet for Lower Reach

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.00250 ft/ft
Discharge	40.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-1+33.70	8.40
-1+29.70	7.40
-1+29.70	7.40
-1+14.50	3.60
-0+24.50	3.60
-0+17.30	1.80
-0+11.30	1.80
-0+06.50	0.60
-0+03.50	0.60
-0+03.50	0.00
0+03.50	0.00
0+03.50	0.60
0+06.50	0.60
0+11.30	1.80
0+17.30	1.80
0+24.50	3.60
1+14.50	3.60
1+29.70	7.40
1+29.70	7.40
1+33.70	8.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-1+33.70, 8.40)	(-0+11.30, 1.80)	0.060
(-0+11.30, 1.80)	(0+11.30, 1.80)	0.035
(0+11.30, 1.80)	(1+33.70, 8.40)	0.060

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

Results

Worksheet for Lower Reach

Results	
Normal Depth	1.9 ft
Roughness Coefficient	0.045
Elevation	1.89 ft
Elevation Range	0.0 to 8.4 ft
Flow Area	28.7 ft²
Wetted Perimeter	36.8 ft
Hydraulic Radius	0.8 ft
Top Width	35.33 ft
Normal Depth	1.9 ft
Critical Depth	0.9 ft
Critical Slope	0.03961 ft/ft
Velocity	1.39 ft/s
Velocity Head	0.03 ft
Specific Energy	1.92 ft
Froude Number	0.272
Flow Type	Subcritical

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

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	1.9 ft
Critical Depth	0.9 ft
Channel Slope	0.00250 ft/ft
Critical Slope	0.03961 ft/ft

Worksheet for Lower Reach

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.00250 ft/ft
Discharge	227.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-1+33.70	8.40
-1+29.70	7.40
-1+29.70	7.40
-1+14.50	3.60
-0+24.50	3.60
-0+17.30	1.80
-0+11.30	1.80
-0+06.50	0.60
-0+03.50	0.60
-0+03.50	0.00
0+03.50	0.00
0+03.50	0.60
0+06.50	0.60
0+11.30	1.80
0+17.30	1.80
0+24.50	3.60
1+14.50	3.60
1+29.70	7.40
1+29.70	7.40
1+33.70	8.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-1+33.70, 8.40)	(-0+11.30, 1.80)	0.060
(-0+11.30, 1.80)	(0+11.30, 1.80)	0.035
(0+11.30, 1.80)	(1+33.70, 8.40)	0.060

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

Results

Worksheet for Lower Reach

Results	
Normal Depth	4.0 ft
Roughness Coefficient	0.058
Elevation	4.02 ft
Elevation Range	0.0 to 8.4 ft
Flow Area	198.0 ft²
Wetted Perimeter	234.4 ft
Hydraulic Radius	0.8 ft
Top Width	232.37 ft
Normal Depth	4.0 ft
Critical Depth	2.2 ft
Critical Slope	0.05097 ft/ft
Velocity	1.15 ft/s
Velocity Head	0.02 ft
Specific Energy	4.04 ft
Froude Number	0.219
Flow Type	Subcritical

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

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	4.0 ft
Critical Depth	2.2 ft
Channel Slope	0.00250 ft/ft
Critical Slope	0.05097 ft/ft

Worksheet for Lower Reach

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00250 ft/ft
Discharge	3,729.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-1+33.70	8.40
-1+29.70	7.40
-1+29.70	7.40
-1+14.50	3.60
-0+24.50	3.60
-0+17.30	1.80
-0+11.30	1.80
-0+06.50	0.60
-0+03.50	0.60
-0+03.50	0.00
0+03.50	0.00
0+03.50	0.60
0+06.50	0.60
0+11.30	1.80
0+17.30	1.80
0+24.50	3.60
1+14.50	3.60
1+29.70	7.40
1+29.70	7.40
1+33.70	8.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-1+33.70, 8.40)	(-0+11.30, 1.80)	0.060
(-0+11.30, 1.80)	(0+11.30, 1.80)	0.035
(0+11.30, 1.80)	(1+33.70, 8.40)	0.060

Options

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

Results

Worksheet for Lower Reach

Results

Normal Depth	7.7 ft
Roughness Coefficient	0.058
Elevation	7.74 ft
Elevation Range	0.0 to 8.4 ft
Flow Area	1,118.3 ft²
Wetted Perimeter	265.1 ft
Hydraulic Radius	4.2 ft
Top Width	262.15 ft
Normal Depth	7.7 ft
Critical Depth	5.2 ft
Critical Slope	0.03998 ft/ft
Velocity	3.33 ft/s
Velocity Head	0.17 ft
Specific Energy	7.92 ft
Froude Number	0.285
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	7.7 ft
Critical Depth	5.2 ft
Channel Slope	0.00250 ft/ft
Critical Slope	0.03998 ft/ft

Worksheet for Lower Reach

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.00250 ft/ft
Discharge	4,400.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-1+33.70	8.40
-1+29.70	7.40
-1+29.70	7.40
-1+14.50	3.60
-0+24.50	3.60
-0+17.30	1.80
-0+11.30	1.80
-0+06.50	0.60
-0+03.50	0.60
-0+03.50	0.00
0+03.50	0.00
0+03.50	0.60
0+06.50	0.60
0+11.30	1.80
0+17.30	1.80
0+24.50	3.60
1+14.50	3.60
1+29.70	7.40
1+29.70	7.40
1+33.70	8.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-1+33.70, 8.40)	(-0+11.30, 1.80)	0.060
(-0+11.30, 1.80)	(0+11.30, 1.80)	0.035
(0+11.30, 1.80)	(1+33.70, 8.40)	0.060

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

Results

Worksheet for Lower Reach

Results

Normal Depth	8.2 ft
Roughness Coefficient	0.058
Elevation	8.21 ft
Elevation Range	0.0 to 8.4 ft
Flow Area	1,242.6 ft²
Wetted Perimeter	269.0 ft
Hydraulic Radius	4.6 ft
Top Width	265.91 ft
Normal Depth	8.2 ft
Critical Depth	5.4 ft
Critical Slope	0.03865 ft/ft
Velocity	3.54 ft/s
Velocity Head	0.19 ft
Specific Energy	8.41 ft
Froude Number	0.289
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	8.2 ft
Critical Depth	5.4 ft
Channel Slope	0.00250 ft/ft
Critical Slope	0.03865 ft/ft

Worksheet for Upper Reach

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.00250 ft/ft
Discharge	2.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-1+33.00	8.00
-1+29.00	7.00
-1+29.00	7.00
-1+13.80	3.20
-0+23.80	3.20
-0+17.00	1.50
-0+10.00	1.50
-0+06.00	0.50
-0+02.50	0.50
-0+02.50	0.00
0+02.50	0.00
0+02.50	0.50
0+06.00	0.50
0+10.00	1.50
0+17.00	1.50
0+23.80	3.20
1+13.80	3.20
1+29.00	7.00
1+29.00	7.00
1+33.00	8.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-1+33.00, 8.00)	(-0+10.00, 1.50)	0.060
(-0+10.00, 1.50)	(0+10.00, 1.50)	0.035
(0+10.00, 1.50)	(1+33.00, 8.00)	0.060

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

Results

Worksheet for Upper Reach

Results

Normal Depth	0.4 ft
Roughness Coefficient	0.035
Elevation	0.39 ft
Elevation Range	0.0 to 8.0 ft
Flow Area	1.9 ft²
Wetted Perimeter	5.8 ft
Hydraulic Radius	0.3 ft
Top Width	5.00 ft
Normal Depth	0.4 ft
Critical Depth	0.2 ft
Critical Slope	0.03514 ft/ft
Velocity	1.03 ft/s
Velocity Head	0.02 ft
Specific Energy	0.41 ft
Froude Number	0.290
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.4 ft
Critical Depth	0.2 ft
Channel Slope	0.00250 ft/ft
Critical Slope	0.03514 ft/ft

Worksheet for Upper Reach

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.00250 ft/ft
Discharge	25.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-1+33.00	8.00
-1+29.00	7.00
-1+29.00	7.00
-1+13.80	3.20
-0+23.80	3.20
-0+17.00	1.50
-0+10.00	1.50
-0+06.00	0.50
-0+02.50	0.50
-0+02.50	0.00
0+02.50	0.00
0+02.50	0.50
0+06.00	0.50
0+10.00	1.50
0+17.00	1.50
0+23.80	3.20
1+13.80	3.20
1+29.00	7.00
1+29.00	7.00
1+33.00	8.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-1+33.00, 8.00)	(-0+10.00, 1.50)	0.060
(-0+10.00, 1.50)	(0+10.00, 1.50)	0.035
(0+10.00, 1.50)	(1+33.00, 8.00)	0.060

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

Results

Worksheet for Upper Reach

Results

Normal Depth	1.6 ft
Roughness Coefficient	0.047
Elevation	1.60 ft
Elevation Range	0.0 to 8.0 ft
Flow Area	22.0 ft²
Wetted Perimeter	36.1 ft
Hydraulic Radius	0.6 ft
Top Width	34.81 ft
Normal Depth	1.6 ft
Critical Depth	0.8 ft
Critical Slope	0.04596 ft/ft
Velocity	1.14 ft/s
Velocity Head	0.02 ft
Specific Energy	1.62 ft
Froude Number	0.253
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	1.6 ft
Critical Depth	0.8 ft
Channel Slope	0.00250 ft/ft
Critical Slope	0.04596 ft/ft

Worksheet for Upper Reach

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.00250 ft/ft
Discharge	183.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-1+33.00	8.00
-1+29.00	7.00
-1+29.00	7.00
-1+13.80	3.20
-0+23.80	3.20
-0+17.00	1.50
-0+10.00	1.50
-0+06.00	0.50
-0+02.50	0.50
-0+02.50	0.00
0+02.50	0.00
0+02.50	0.50
0+06.00	0.50
0+10.00	1.50
0+17.00	1.50
0+23.80	3.20
1+13.80	3.20
1+29.00	7.00
1+29.00	7.00
1+33.00	8.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-1+33.00, 8.00)	(-0+10.00, 1.50)	0.060
(-0+10.00, 1.50)	(0+10.00, 1.50)	0.035
(0+10.00, 1.50)	(1+33.00, 8.00)	0.060

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

Results

Worksheet for Upper Reach

Results

Normal Depth	3.6 ft
Roughness Coefficient	0.058
Elevation	3.58 ft
Elevation Range	0.0 to 8.0 ft
Flow Area	173.8 ft²
Wetted Perimeter	232.4 ft
Hydraulic Radius	0.7 ft
Top Width	230.60 ft
Normal Depth	3.6 ft
Critical Depth	1.9 ft
Critical Slope	0.05342 ft/ft
Velocity	1.05 ft/s
Velocity Head	0.02 ft
Specific Energy	3.59 ft
Froude Number	0.214
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	3.6 ft
Critical Depth	1.9 ft
Channel Slope	0.00250 ft/ft
Critical Slope	0.05342 ft/ft

Worksheet for Upper Reach

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00250 ft/ft
Discharge	2,320.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-1+33.00	8.00
-1+29.00	7.00
-1+29.00	7.00
-1+13.80	3.20
-0+23.80	3.20
-0+17.00	1.50
-0+10.00	1.50
-0+06.00	0.50
-0+02.50	0.50
-0+02.50	0.00
0+02.50	0.00
0+02.50	0.50
0+06.00	0.50
0+10.00	1.50
0+17.00	1.50
0+23.80	3.20
1+13.80	3.20
1+29.00	7.00
1+29.00	7.00
1+33.00	8.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-1+33.00, 8.00)	(-0+10.00, 1.50)	0.060
(-0+10.00, 1.50)	(0+10.00, 1.50)	0.035
(0+10.00, 1.50)	(1+33.00, 8.00)	0.060

Options

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

Results

Worksheet for Upper Reach

Results

Normal Depth	6.3 ft
Roughness Coefficient	0.058
Elevation	6.29 ft
Elevation Range	0.0 to 8.0 ft
Flow Area	829.2 ft²
Wetted Perimeter	254.7 ft
Hydraulic Radius	3.3 ft
Top Width	252.32 ft
Normal Depth	6.3 ft
Critical Depth	4.3 ft
Critical Slope	0.04436 ft/ft
Velocity	2.80 ft/s
Velocity Head	0.12 ft
Specific Energy	6.41 ft
Froude Number	0.272
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	6.3 ft
Critical Depth	4.3 ft
Channel Slope	0.00250 ft/ft
Critical Slope	0.04436 ft/ft

Worksheet for Upper Reach

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.00250 ft/ft
Discharge	3,600.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
-1+33.00	8.00
-1+29.00	7.00
-1+29.00	7.00
-1+13.80	3.20
-0+23.80	3.20
-0+17.00	1.50
-0+10.00	1.50
-0+06.00	0.50
-0+02.50	0.50
-0+02.50	0.00
0+02.50	0.00
0+02.50	0.50
0+06.00	0.50
0+10.00	1.50
0+17.00	1.50
0+23.80	3.20
1+13.80	3.20
1+29.00	7.00
1+29.00	7.00
1+33.00	8.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-1+33.00, 8.00)	(-0+10.00, 1.50)	0.060
(-0+10.00, 1.50)	(0+10.00, 1.50)	0.035
(0+10.00, 1.50)	(1+33.00, 8.00)	0.060

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

Results

Worksheet for Upper Reach

Results	
Normal Depth	7.3 ft
Roughness Coefficient	0.058
Elevation	7.32 ft
Elevation Range	0.0 to 8.0 ft
Flow Area	1,094.3 ft²
Wetted Perimeter	263.3 ft
Hydraulic Radius	4.2 ft
Top Width	260.58 ft
Normal Depth	7.3 ft
Critical Depth	4.8 ft
Critical Slope	0.04048 ft/ft
Velocity	3.29 ft/s
Velocity Head	0.17 ft
Specific Energy	7.49 ft
Froude Number	0.283
Flow Type	Subcritical

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

GVF Output Data	
Upstream Depth	0.0 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	7.3 ft
Critical Depth	4.8 ft
Channel Slope	0.00250 ft/ft
Critical Slope	0.04048 ft/ft

Appendix H

Engineering Calculations

Calculation	Number of Pages
Stilling Basin Sizing	3
Seepage Analysis	3
Riprap Sizing – Drop Approach	3
Riprap Sizing – Overbanks	2
Culvert Rundown	2

Stilling Basin Sizing

Project: Rolling Meadows

Date Completed: 11/8/2022
Completed By: Tori Mack, PE
Reviewed By: Elena Lundeen,

References: *USDCM, Chapter 9, Section 2.3*

Using the output from the subcritical and supercritical HEC-RAS hydraulic models, calculations should be completed to verify that the specific force associated with the downstream tailwater is greater than the specific force of the supercritical flow at the toe of the drop, not only for the design discharge, but for flows corresponding to more frequent events as well. Specific force can be calculated using equation 9-3 (Chow 1959):

$$F = \frac{Q^2}{gA} + \bar{z}A \qquad \text{Equation 9-3}$$

Where:

F = specific force

Q = flow at cross section

g = acceleration of gravity

$\bar{z}$ = distance from the water surface elevation to the centroid of the flow area (A)

A = area of flow

The required tailwater depth is determined using Equation 9-4 (Chow 1959). This equation applies to rectangular channel sections and should be applied to a rectangular portion of flow within a drop structure. For irregular (non-rectangular) channel shapes, the designer should apply Equation 9-4 using the unit discharge within a rectangular segment of the drop crest. Assuming the low-flow channel is incorporated into the drop crest and this portion of the crest has the largest unit discharge, the rectangular portion would extend over the bottom width of the low-flow channel. See Section 2.3.6 for additional discussion on evaluating the conditions in both the low-flow channel and the overbanks.

$$\frac{y_2}{y_1} = \frac{1}{2}\left(\sqrt{1+8F_1^2} - 1\right) \qquad \text{Equation 9-4}$$

Where:

y_2 = required depth of tailwater (also called the sequent depth, in feet)

y_1 = depth of water at drop toe, feet (taken from cross section at drop toe, supercritical HEC-RAS model)

F_1 = Froude Number = $V_1/(gy_1)^{1/2}$ (based on depth and velocity at drop toe)

11/08/2022 Summary							
	Length (ft)	Stilling Basin Bottom Width (ft)	Depth (ft)	D/S Riprap (ft) Type H	Sheetpile Depth (ft)	End Sill - Width (ft)	End Sill - Depth (ft)
2.5' Drop	9		1	4	5	2	3
3.5' Drop	11		1	10	5	2	3
4.5' Drop	12		1	10	5	2	3

11/8/22 Summary

Length of... (ft)	**2.5' Drop**	**3.5' Drop**	**4.5' Drop**	**5' Drop**
Hydraulic Jump	15	17	20	27
Stilling Basin	9	11	12	17
End Sill	2	2	2	2
D/S Riprap	4	10	10	10
Protected Length	15	23	24	29

RAS Model: S:\21.1129.009 Rolling Hills Floodplain and Permitting\300 Water Resources\310 Preliminary Design\Models\HEC-RAS\60% Drop Design_FINAL

HEC-RAS Model Plans:

- 3.5' Drop - 1' Basin
- 2.5' Drop - 1' Basin
- 4.5' Drop - 1' Basin_Rev.

2.5' DROP

SUBCRITICAL - 115

		RAS Inputs			Calculations				Sequent Depth Comparision	
Flow	**Q (cfs)**	**Supercritical RAS Station**	**y1 (ft)**	**v1 (fps)**	**F1**	**y2 (ft)**	**L/y2**	**L (ft)**	**y (ft)**	**y ≥ y2?**
Baseflow	2.1	132	0.03	2.71	2.8	0.10	5.12	0.54	1.24	Yes
Bankfull	40	132	0.15	9.43	4.3	0.84	5.86	4.92	2.49	Yes
County Low	440	132	0.49	15.94	4	2.54	5.8	14.72	4.09	Yes
10-yr	2802	132	5.2	15.45	1.2	6.60	#N/A	#N/A	6.88	Yes
100-yr	4400	132	6.19	16.65	1.2	7.86	#N/A	#N/A	7.78	No
500-yr	5500	132	6.66	17.5	1.2	8.45	#N/A	#N/A	8.32	No

Y1 MAX CHANNEL DEPTH

V1 CHANNEL VELOCITY

Assumption: Per Fig, 9.4, no hydraulic jump is formed if Fr < 1.7. Undular or weak jump

Length of... (ft)		Original Design	Post QA
Hydraulic Jump	14.72	15	15
Stilling Basin	8.83	9	9
End Sill	2	2	2
D/S Riprap	3.89	4	4

Silling Basin Depth (ft) 1.0

3.5' DROP

SUBCRITICAL - 100

		RAS Inputs			Calculations				Sequent Depth Comparision	
Flow	**Q (cfs)**	**Supercritical RAS Station**	**y1 (ft)**	**v1 (fps)**	**F1**	**y2 (ft)**	**L/y2**	**L (ft)**	**y (ft)**	**y ≥ y2?**
Baseflow	2.1	127	0.03	2.81	2.9	0.11	5.21	0.57	1.24	Yes
Bankfull	40	127	0.16	9.73	4.3	0.90	5.86	5.25	2.52	Yes
County Low	227	127	0.51	17	4.2	2.78	5.84	16.26	4.19	Yes
10-yr	2802	127	6.12	15.42	1.1	6.94	#N/A	#N/A	6.99	Yes
100-yr	4400	127	7.03	16.8	1.1	7.97	#N/A	#N/A	7.89	No
500-yr	5500	127	7.49	17.76	1.1	8.49	#N/A	#N/A	8.43	No

Assumption: Per Fig, 9.4, no hydraulic jump is formed if Fr < 1.7. Undular or weak jump

Length of... (ft)		Original Design	Post QA	
Hydraulic Jump	16.26	17	16.5	
Stilling Basin	9.76	11	10	
End Sill	2	2	2	
D/S Riprap	4.51	10	10	10' is min

Silling Basin Depth (ft) 1.0

4.5' DROP

RAS Plan: "4.5' Drop - 1' Basin"

SUBCRITICAL - 104

		RAS Inputs			Calculations				Sequent Depth Comparision	
Flow	**Q (cfs)**	**Supercritical RAS Station**	**y1 (ft)**	**v1 (fps)**	**F1**	**y2 (ft)**	**L/y2**	**L (ft)**	**y (ft)**	**y ≥ y2?**
Baseflow	2.1	124	0.04	3.22	2.8	0.14	5.12	0.72	1.34	Yes
Bankfull	40	124	0.2	10.92	4.3	1.12	5.86	6.57	2.59	Yes
County Low	440	124	0.66	18.26	4	3.42	5.8	19.82	4.23	Yes
10-yr	2802	124	6.09	18.32	1.3	8.56	#N/A	#N/A	10.12	Yes
100-yr	4400	124	8.69	16	1	8.69	#N/A	#N/A	10.41	Yes
500-yr	5500	124	9.33	16.5	1	9.33	#N/A	#N/A	10.89	Yes

Assumption: Per Fig, 9.4, no hydraulic jump is formed if Fr < 1.7. Undular or weak jump

Length of... (ft)		Original Design	Post QA	
Hydraulic Jump	19.82	20	20	
Stilling Basin	11.89	12	12	
End Sill	2	2	2	
D/S Riprap	5.93	10	10	10' is min

Silling Basin Depth (ft) 1.0

SEEPAGE ANALYSIS

Project:	Rolling Meadows
Date Completed:	1/9/2023
Completed By:	Tori Mack, PE
Reviewed By:	Elena Lundeen, EI

Design Assumptions:

1. Based on the geotechnical report, the soil was found to be predominantly composed of alluvial sand, silt and clay deposits. A target creep ratio for fine sand (Cw=7.0) was assumed based on the percent of sand and fines found in the soil.
2. Weep drains are being installed, which reduces the calculated creep ratio by 10%.
3. The horizontal creep length (L_H) was taken from the profile in CAD. See figure below.
4. The vertical creep length (L_V) was calculated as the sum of the vertical distance from the upstream channel invert to the bottom of the cutoff wall (y1) and the depth of the downstream end sill (y2). This vertical creep distance is conservative as it does not double count the vertical creep.
5. For sheet pile, the depth in the field is determined by the minimum of the design depth or 2' into bedrock, whichever comes first.
6. Base flow = 2 cfs; Bankfull flow = 25 cfs; 100-year = 3600 or 4400 cfs

References: *Urban Drainage, Chapter 9, Section 2.4.3*

$$C_W = \frac{\left(\frac{L_H}{3} + L_V\right)}{H_S}$$ Equation 9-5

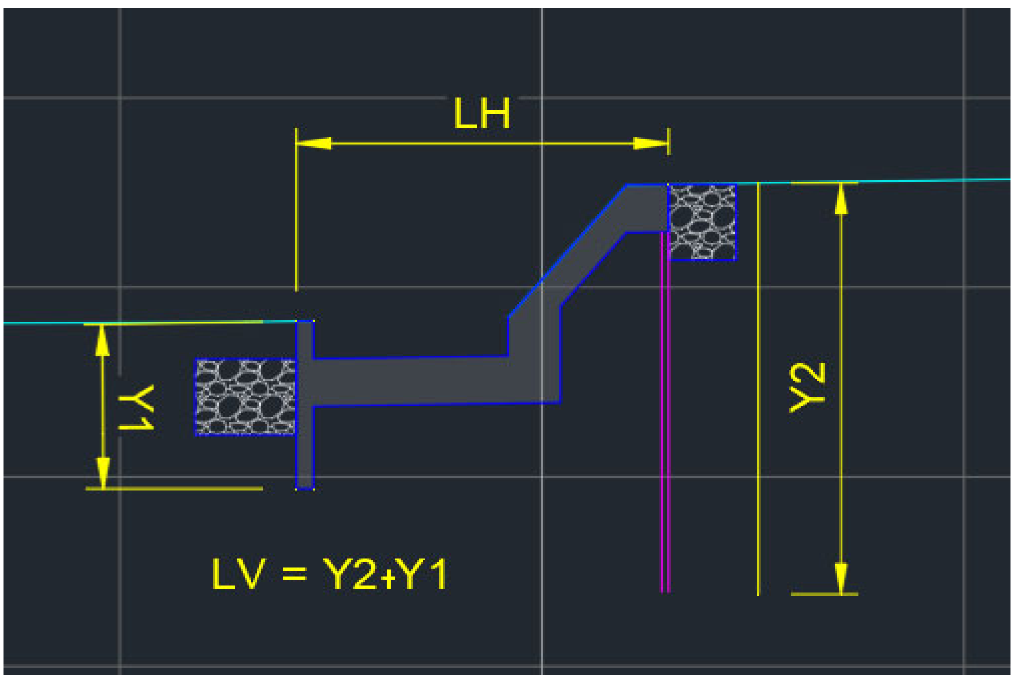
Where:

C_W = creep ratio

H_S = differential head between analysis points (ft)

Table 9-3. Lane's weighted creep: Recommended minimum ratios

Material	Ratio
Very fine sand or silt	8.5
Fine sand	7.0
Medium sand	6.0
Coarse sand	5.0
Fine gravel	4.0
Medium gravel	3.0
Coarse gravel including cobbles	3.0
Boulders with some cobbles and gravel	3.0
Soft clay	3.0
Medium clay	2.0
Hard clay	1.8
Very hard clay or hardpan	1.6



Creep Analysis

Drop	Design Cw	H	L_H	Y1***	Type	Upstream Design Sheet Pile Depth (Y2)**	Calculated Cw	Calculated Cw (non-conservative)
4.5	7.0	4.3	39.0	4.0	Sheet Pile	9.6	5.6	10.4
3.5	7.0	3.4	35.0	4.0	Sheet Pile	5.2	5.6	9.9
2.5	7.0	2.4	30.0	4.0	Sheet Pile	9	8.7	16.7

Creep Analysis - Max Sheet Pile depth

Drop	Design Cw	H	L_H	Y1***	Type	Upstream Design Sheet Pile Depth (Y2)**	Calculated Cw	Calculated Cw (non-conservative)
4.5	7.0	4.3	39.0	4.0	Sheet Pile	10.0	5.7	10.6
3.5	7.0	3.4	35.0	4.0	Sheet Pile	10	6.8	13.0
2.5	7.0	2.4	30.0	4.0	Sheet Pile	10	9.0	17.7

CONSERVATIVE APPROACH: Counts vertical distance once

**0.5' of concrete cap + design sheet pile depth
***measured from structure details

Weep Drains?	Y

Discussion:
The target min Cw = 7.0. When using the conservative approch, this can only be attained for the 2.5' Drops. Matix assumes bedrock will be reached at 10 ft or greater depth. For the other drops, the non-conservative approch where both vertical hieghts are counted. Due to the less conservative approch, a Cw greater than 7.0 was selected.

Riprap Sizing

Project: Rolling Meadows

Date Completed: 1/12/2023
Completed By: Tori Mack, PE
Reviewed By: Elena Lundeen,

References: *USDCM, Chapter 8, Section 8.1.1*

$$d_{50} \geq \left[\frac{VS^{0.17}}{4.5(G_s - 1)^{0.66}} \right]^2$$ Equation 8-11

Where:

V = mean channel velocity (ft/sec)

S = longitudinal channel slope (ft/ft)

d_{50} = mean rock size (ft)

Gs = specific gravity of stone (minimum = 2.50, typically 2.5 to 2.7), Note: In this equation (Gs -1) considers the buoyancy of the water, in that the specific gravity of water is subtracted from the specific gravity of the rock.

Design Assumptions:

1. This worksheet sizes the rock for the approach riprap for all drop structures and the riprap downstream of all drop structures.
2. USDCM specifies using the energy slope and velocity in the channel.
3. USDCM specifies a minimum of Type M riprap.
4. The slope and velocity are taken at a station 5' upstream from the crest for the approach riprap and 5' downstream of the sill location for the downstream riprap.
5. The riprap for along the sides of the structure was not sized, but instead assumed to be the same size (Type M), since that's the minumum size per criteria.

4.5' Drop

Return Interval	Q Left Overbank (cfs)	Q Right Overbank (cfs)	Top Width Channel (ft)	Unit Discharge (cfs/ft)	U/S EGL Elevation	D/S EGL Elevation	EGL Slope (ft/ft)	Calculated D_{50} (in)
Station								
Bankfull*	56.82		8.63	6.6	6555.12	6553.32	0.0400	6.6
5-year**	63.82		8.63	7.4	6555.31	6553.7	0.0358	6.7
10-year**	105.25		8.63	12.2	6555.79	6554.48	0.0291	8.1
50-year**	212.93		8.63	24.7	6556.82	6555.86	0.0213	10.5
100-year**	256.13		8.63	29.7	6557.34	6556.46	0.0196	11.2
	RS4175				RS4201	RS4125		

Assumption: Drops smalled than 4.5' will have lower riprap sizing results

Q left is approximately equal to Q right

RIPRAP SIZING

Upstream					Downstream				
Drop	Cross Section	EG Slope	V	D50	Drop	Cross Section	EG Slope	V	D50
2.5	147.0*	0.0049	8.32	0.30	2.5	108.0*	0.0026	6.260	0.14
3.5	148.13*	0.0049	8.4	0.31	3.5	91.655*	0.0027	6.3	0.14
4.5	147.0*	0.0045	7.97	0.27	4.5	97	0.0078	13.48	0.93

Conclusion: Type M will be used for the riprap at each structure, as the minimum size specified by *USDCM* .

RIPRAP DESIGNATION	% SMALLER THAN GIVEN SIZE BY WEIGHT	INTERMEDIATE ROCK DIMENSION (INCHES)	D_{50}* (INCHES)
TYPE VL	70 – 100 50 – 70 35 – 50 2 – 10	12 9 6 2	6
TYPE L	70 – 100 50 – 70 35 – 50 2 – 10	15 12 9 3	9
TYPE M	70 – 100 50 – 70 35 – 50 2 – 10	21 18 12 4	12
TYPE H	70 – 100 50 – 70 35 – 50 2 – 10	30 24 18 6	18

*D_{50} = MEAN ROCK SIZE

Riprap Sizing

Project: Rolling Meadows
Date Completed: 1/19/2023
Completed By: Tori Mack, PE
Reviewed By: Elena Lundeen, EI

References: *USDCM Section 8.1.2; City of Colorado Springs DCM, Chapter 13*

Steep slope rock sizing equations are used for applications where the slope is greater than 2 percent and/or flows are in the supercritical flow regime. The following rock sizing equations may be referred to for riprap design analysis on steep slopes:

- CSU Equation, *Development of Riprap Design Criteria by Riprap Testing in Flumes: Phase II* (prepared by S.R. Abt, et al, Colorado State University, 1988). This method was developed for steep slopes from 2 to 20 percent.

Riprap embankment protection shall be sized based on methodologies described in *Development of Riprap Testing in Flumes: Phase II Follow-up Investigations* (Apt et al. 1988) to determine the D_{50} dimension. According to this method:

$$D_{50} = 5.23\, S^{0.43}\, (1.35\, C_f\, q)^{0.56} \qquad \text{Equation 13-9}$$

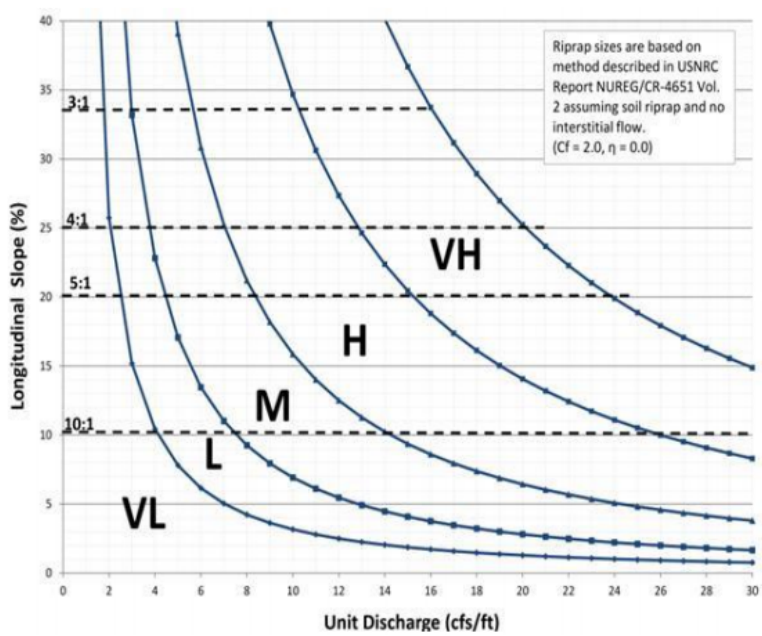
Where:

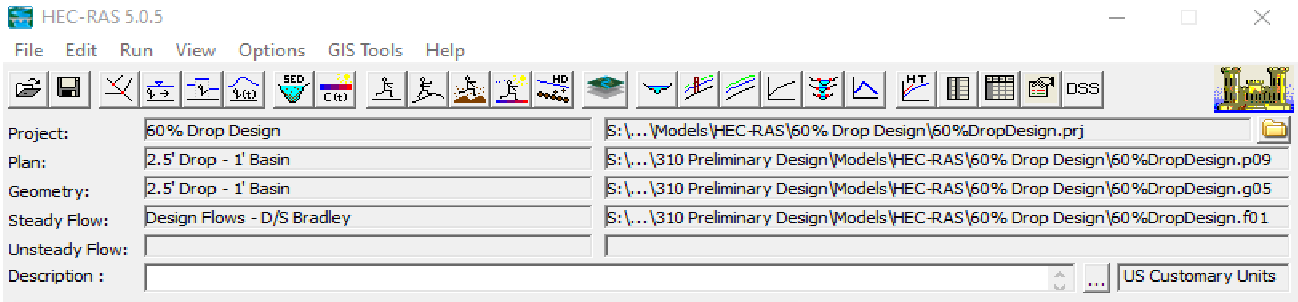
D_{50} = median rock size (in)
S = longitudinal slope (ft/ft)
C_f = concentration factor (1.0 to 3.0)
q = unit discharge (cfs/ft)

When:

η (porosity) = 0.0 (i.e., for buried soil riprap)

Figure 13-12d. Riprap Types for Emergency Spillway Protection





Plans: 4.5' Drop - 1' Basin _Rev
3.5' Drop - 1' Basin
2.5' Drop - 1' Basin

Constants and Notes

C_f	2	Concentration Factor

**Subcritical Flow Regime

Determination - size H soil filled riprap for constructed riffle at 41+50. Calculation confirmed Type M, but riprap was upsized for saftey

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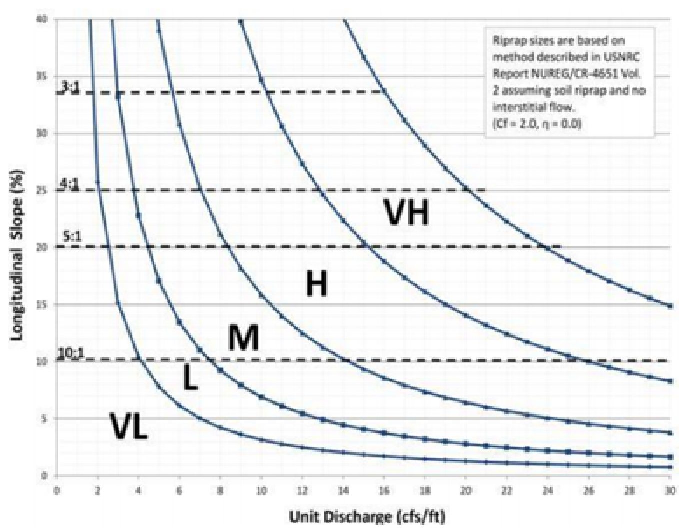

Riprap Rundown

Project:	Rolling Meadows
Date Completed:	1/22/2023
Completed By:	Tori Mack, PE
Reviewed By:	

References: *USDCM, Chapter 9, Section 3.2.1 - Multiple Conduit Installations*

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right)$$ Equation 9-11

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

and:

$$A_t = \frac{Q}{V}$$ Equation 9-12

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft^2)

Design Assumptions:

1. No drop on the downstream side of the CONSPAN
2. The CONSPAN must be approximated as a rectangle, therefore the average width is used

Multiple Conduits: Flow through each culvert (pg 81)

Non-Erosive Vel 7 fps

Total Discharge 4400 CFS

	Q portion (CFS)	W*	H (ft)	Fr Parameter
EX Culverts	678.83	12	8	2.50
CONSPAN	3721.17	36	11.6	2.62

* for CONSPAN, W averaged to approximate a rectangle

H_{eq} 11.6

W_{eq} 42.56726

Extent of Riprap Protection

			Notes
L_p (HEC-RAS)	136	ft	2D model, no Mannings adjustment

A_t	628.6	sq ft	Eq 9-12	
Y_t	4.19	ft	At total flow of 4400 CFS	from HY-8
(theta)	0.70	rad	40 deg = 0.7 rad	
L_p (calculated)	63.8	ft	Eq 9-11	

Checks

3H 34.8

10H 116

Lp is between 3H and 10 H

Width of Protection

Yt/H	0.36	
$Q/WH^{2/3}$	2.21	
Expansion Factor	6.2	
(theta) new	0.08	
T	52.9	ft

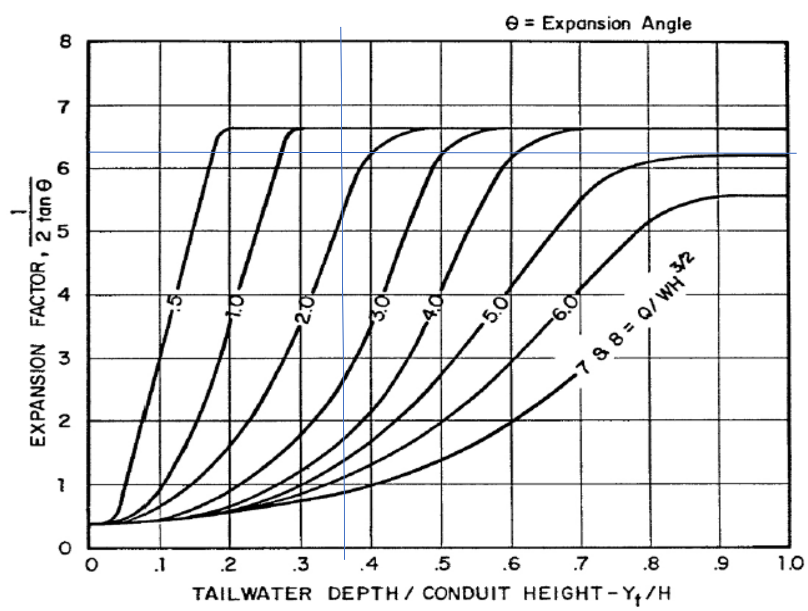

Figure 9-36. Expansion factor for rectangular conduits