



Land Suitability Analysis Report:

Pine Canyon Planned Development

February 19, 2025
Rev 1 – April 9, 2025

Prepared for the Town of Castle Rock

Prepared By:
PCS Group
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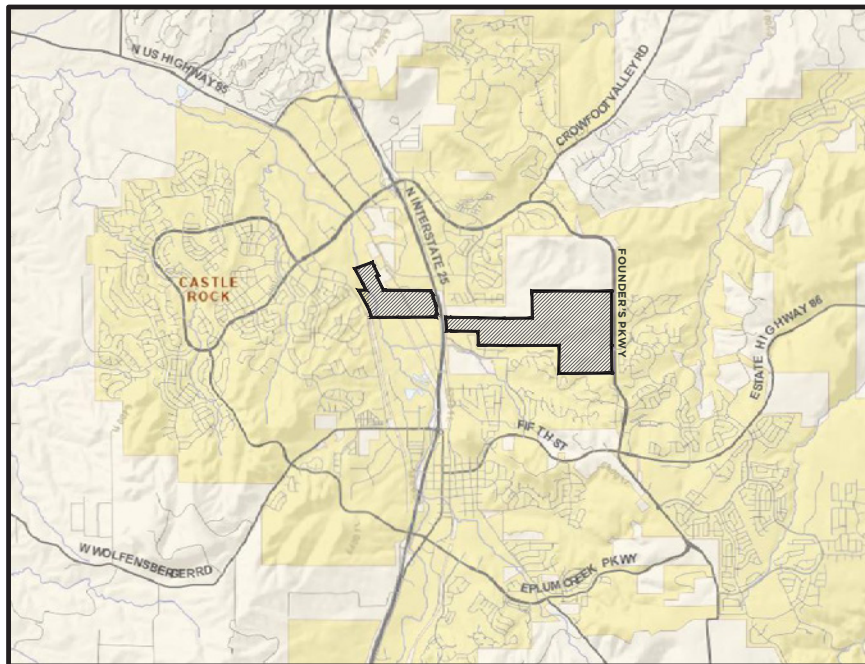
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Introduction

This Land Suitability Analysis Report (LSAR) has been prepared for Pine Canyon Planned Development. The Property is located generally within the north-central area of Castle Rock. It lies within unincorporated Douglas County, but is currently applying for annexation into the Town. The property consists of approximately 530 acres and plans for a maximum of 1,800 residential units, an allowance for a 175-room hotel/resort, and up to 600,000 s.f. of business/industrial uses. A third of the property, over 170 acres, will be preserved as Parks and Open Space, and will also include a 12-acre elementary school site. This analysis explores the property's opportunities and constraints for development by identifying prominent ridges and drainages, slope of the topography, existing vegetation, and other unique natural features found on the site.

Vicinity Map



Location

The site is located generally adjacent to the north-central areas of Castle Rock, between Founders Parkway on the East and the BNSF Railway on the West. The Property is South of Black Feather Trail and North of Scott Boulevard, spanning across both sides of I-25. Specifically, the Property is located in part of Section 1 of Township 8 South, Range 67 West of the 6th Principal Meridian together with parts of Section 36, 35, and 34 of Township 7 South, Range 67 West of the 6th Principal Meridian.

Methodology

The LSAR has been compiled utilizing several existing reports and maps, supplemented by an onsite review of existing conditions. The process for compiling the LSAR included site investigation and field inventory to determine physical and environmental opportunities and constraints to development. Based on review of the existing documents and the on-site analysis, a Composite Analysis Map was created to illustrate the site opportunities and constraints. The map is included as Appendix A of this document.

Sources of information researched in the development of this LSAR include:

- Geologic and Preliminary Geotechnical Investigations Pine Canyon Development by CTL/Thompson; August 19, 2021
- Forest Management Plan Pine Canyon Ranch by William R. Williams, Forester, Double W Services, Inc.; September 12, 2019
- Natural Resources Assessment Pine Canyon by ERQ Resources Corporation; May 12, 2023
- Cultural Resource Survey Pine Canyon Development Project by Justin Batista & Jonathan Hedlund, Principal Investigator, ERQ Resources Corporation; July 14, 2020

The LSAR will highlight components of these reports. However, the full reports will be found as appendices.

Slope Analysis

The site consists of various topographic conditions. The Slope Analysis was prepared using 5' contour intervals and identifies slopes into (3) categories: slopes less than 20%, slopes between 20–25%, and slopes greater than 25%. Most of the central and western portions of site is under 20%. Plum Creek lies on the most western portion of the site. The site generally drains westward toward Plum Creek. Except in the east portion of the site where there are more areas of steep slopes and ridges, the site drains slightly toward Founders Parkway. The eastern portion of the sight is characterized by more distinct topographic changes and rockier terrain. Therefore, the plan will focus on residential development of large lot & clustered single family homes that can be built within the natural terrain and carefully planned to be integrated with local parks and open spaces crisscrossing throughout this region.

Geologic Hazards Summary

1. The primary geologic hazard and geotechnical concern is expansive soil and bedrock. We believe these concerns can be mitigated with proper planning, engineering, design, and construction.
2. Strata encountered in our exploratory borings were erratic, and generally consisted of 2 to over 30 feet of sandy clay and/or slightly silty to clayey, sand and gravel underlain in 12 borings by claystone and sandstone bedrock to the maximum depth explored

- of 30 feet. The clay and claystone are expansive, while the sand and sandstone are judged to be low to non-expansive.
3. Groundwater was encountered in two borings during drilling at depths of about 20 and 30 feet. When the holes were checked on July 27, 2021, groundwater was measured in five borings at depths ranging from about 20 to 27 feet below existing ground surface (Fig. 2). Unless deep cuts are planned, groundwater will likely not influence construction except possibly during deep utility excavation and sub-excavation. Groundwater levels will likely fluctuate seasonally and may rise in response to precipitation and landscape irrigation.
 4. We estimate total potential ground heave could range from less than 0.5-inch to about 11 inches considering a depth of wetting of 24 feet (from existing grades). Grading plans for the development were not available at the time of this investigation. Site grading will affect potential heave estimates.
 5. Footing foundations may be considered where the underlying soil and bedrock are low swelling or non-expansive. Drilled piers or another deep foundation system and structurally supported basement floors may be required in areas where moderate to high swelling soils are present unless sub-excavation is performed.
 6. Sub-excavation can be considered to allow use of footing foundations and reduce potential risk of poor performance of slab-on-grade basement floors. We typically advocate a minimum 5-foot buffer zone between bottom of foundations and claystone bedrock, though deeper sub-excavation may be merited if claystone is moderate to highly expansive. Sub-excavation attempted near or below groundwater will likely require installation of interceptor drains during sub-excavation. Additional investigation with more closely-spaced borings and review of grading plans will be necessary to delineate depth and extent of sub-excavation.
 7. Control of surface and subsurface drainage will be critical to the performance of foundations, slabs-on-grade and pavements. Overall surface drainage should be designed to provide rapid run-off of surface water away from structures, and off pavements and flatwork.

Vegetation/Cover

There are (4) main vegetation types on the Pine Canyon property. They are categorized as grass-forb, Gambel oak, Gambel oak-ponderosa pine, and ponderosa pine. The grass-forb is/was native short-grass prairie and shows signs of heavy grazing with native weeds in abundance. This area consists of 159 acres and will not be directly addressed in the management plan. The second vegetation type is the Gambel oak where the canopy cover exceeds fifty percent and covers approximately 46 acres. The third vegetation type is the Gambel oak-ponderosa pine which contains enough ponderosa pine to classify as forest land. Gambel oak and mountain mahogany are the dominant species – the combined cover of shrubs & trees is estimated at greater than 80 percent and covers approximately 157 acres. Lastly, the ponderosa pine vegetation type has a dense understory of Gambel oak. There are approximately 56 acres of this type.

Wildfire Mitigation

Management units are identified for each year over the ten years included in the Forest Management plan. The units are based on treating a target of ten acres per year and the need to accomplish wildfire mitigation along the south boundary. Units include a mix of the three primary vegetation types. The treatments will reduce the number of ponderosa pine trees, where needed, and will reduce the density of Gambel oak. The 10-year Plan Implementation schedule will include:

- Insect and Disease monitoring – Each year the forest will be monitored for insect and disease problems.
- Weed control – Each year weed control work will be done as needed.
- Brush Management (Practice 314) – The plan includes ten acres per year for ten years.
- Forest Stand Improvement (NRCS Practice 666) – A total of 24 acres will be treated. The number of acres thinned varies each year. The schedule of acres treated is shown in the table below.
- Woody Residue Treatment (NRCS Practice 384) – Mastication and chipping are the primary slash treatments. Slash can be strategically piled to provide hiding cover for wildlife. The number of acres treated is shown in the table below.
- The implementation schedule will be reviewed and revised as needed. Natural events (insect activity, fire, blowdown, etc.) could necessitate changing the location of treatments.

Wildlife Habitat/Migration

The existing vegetation communities and topographical features in the project area provide contiguous habitat, water resources, and core wildlife values such as cover and forage for various natural resources and wildlife species. In particular, the drainage corridors along East Plum Creek, its tributaries, and contiguous grasslands and shrublands along these drainages contribute to the overall diversity of the project area and provide wildlife movement passageways that help maintain connections between wildlife populations. Preservation of the drainages as open space would help maintain and conserve the wildlife values of the project area. Additionally, conservation of larger contiguous parcels, such as the proposed open space areas along the eastern and western portions of the project area, provides a greater value to wildlife than numerous smaller parcels.

Cultural Resources

ERO's Class II and III survey indicates that the Pine Canyon Development property was inhabited by Native Americans during the Early Archaic and Middle Ceramic periods. Sites are most common along East Plum Creek, which would have provided access to water and increased biodiversity along the riparian corridor. ERO recommends most of the sites do not require any additional work because they are either completely disturbed or have

no potential to provide additional significant information regarding history or prehistory. Four sites may have potential for buried cultural deposits, and ERO recommends shovel testing to assess their subsurface potential if the sites will be impacted by construction. Refer to the Cultural Resource Survey (Appendix E) for more information.

Composite Analysis

Natural and man-made conditions that affect this site are shown in the Composite Analysis (Appendix A). The composite analysis represents the opportunities and constraints to the development on the site. In areas where no constraints are identified, the property shall be considered fully developable.

Opportunities and Constraints/Conclusion

The most significant environmentally sensitive areas such as the heavily vegetated areas, steep slopes, rock outcroppings and wetlands can create challenges for development. However, Pine Canyon has created opportunities for integrated development and design that enhances the unique environment of this site. Pine Canyon is keen to ensure the conservation of its unique environment and natural resources. A Forest Management Plan was commissioned which has already been used, and will continue to be used, to ensure the health and vitality of the forested parts of the Property, while mitigating the risk of potential devastating wildfires. A tree preservation plan is incorporated in the Forest Management Plan. The entirety of the riparian area and wildlife movement corridor within the property is going to be preserved as Open Space. The Pine Canyon PD proposes the preservation of over 10% of the property as a working agricultural ranch to honor one of Douglas County's most prominent ranching families. As part of the Reserve, the historic homestead may be used to facilitate cultural and agricultural experiences. The Planned Development outlines an extensive system of trail linkages and natural buffers. In areas of the prominent steeper land formations, single family large lot homes clustered to fit within the natural terrain along with an extensive system of local parks and open spaces.

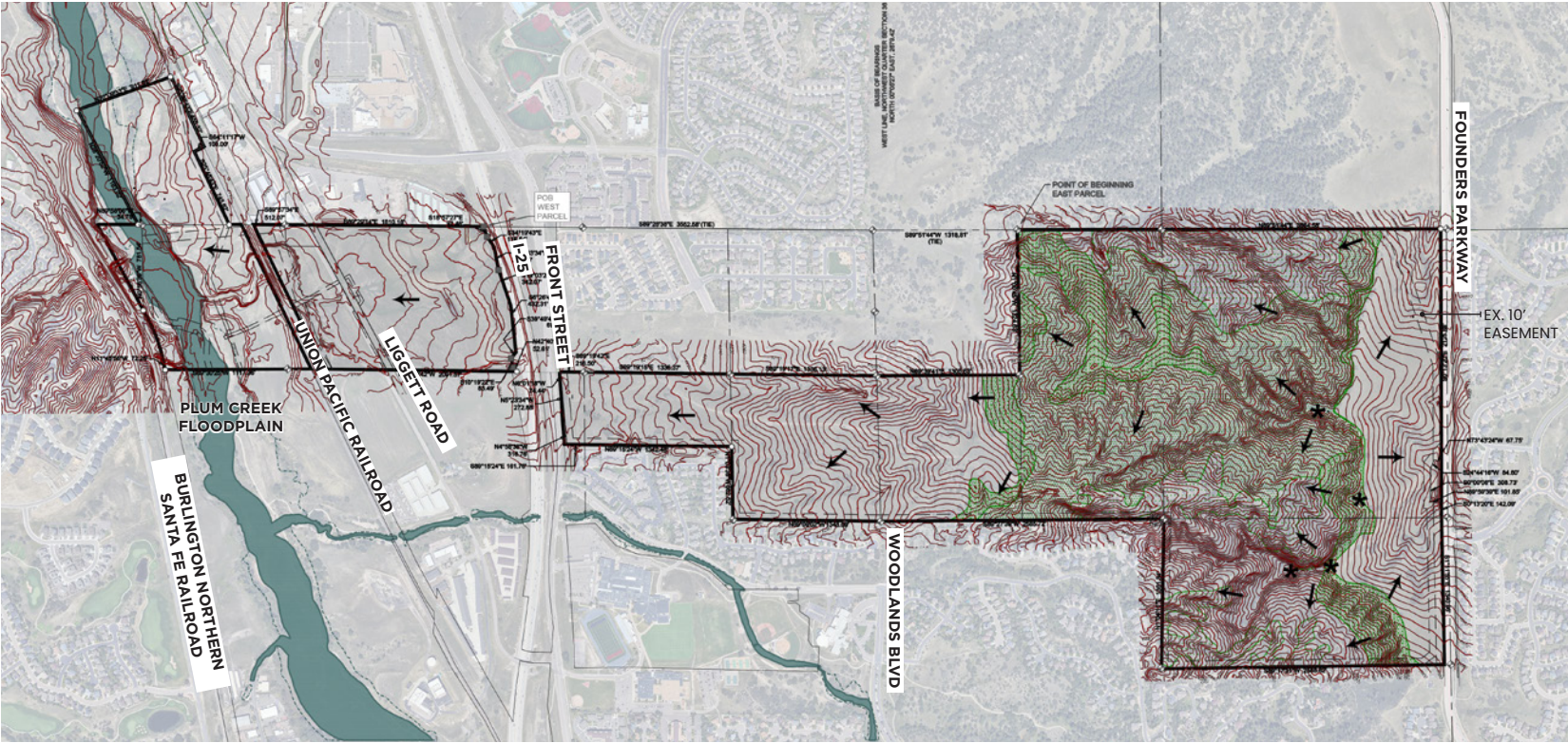
This Land Suitability Analysis Report determines that this site is suitable for development as proposed.

APPENDIX A – COMPOSITE ANALYSIS

PINE CANYON PLANNED DEVELOPMENT

CASTLE ROCK, CO

APRIL 9, 2025



LEGEND

- | | | | |
|-----------------|----------------|-----------------|------------------------------|
| 5' CONTOURS | SLOPES > 25% | PONDEROSA PINE | FLOODPLAIN |
| HIGH POINTS | SLOPES 20%–25% | G. OAK– P. PINE | PLANNED DEVELOPMENT BOUNDARY |
| SLOPE DIRECTION | SLOPES < 20% | GAMBEL OAK | |



**GEOLOGIC AND PRELIMINARY
GEOTECHNICAL INVESTIGATION
PINE CANYON DEVELOPMENT
WEST OF FOUNDERS PARKWAY,
EAST OF PRAIRIE HAWK DRIVE,
SOUTH OF METZLER'S RANCH SUBDIVISION,
AND NORTH OF THE WOODLANDS SUBDIVISION
DOUGLAS COUNTY, COLORADO**

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Attention: Kurt Walker

Project No. DN51,162-115-R1

August 19, 2021



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SCOPE

This report presents the results of our Geologic and Preliminary Geotechnical Investigation for future Pine Canyon Development located west of Founders Parkway, east of Prairie Hawk Drive, south of Metzler's Ranch Subdivision, and north of the Woodlands Subdivision in Douglas County, Colorado (Fig. 1). The purpose of our investigation was to evaluate the subsurface conditions to assist in preliminary planning for future development. The report includes descriptions of soil, bedrock and groundwater conditions found in our exploratory borings, and discussions of site development and construction as influenced by geotechnical considerations. The scope was described in a Service Agreement (DN 21-0337) dated June 10, 2021.

This report is based on subsurface conditions found in our exploratory borings, results of field and laboratory tests, engineering analysis of field and laboratory data, and our experience. The report contains discussions of geologic hazards, recommendations for site development, potential foundation and floor support alternatives, and surface and subsurface drainage. The preliminary discussions of foundation and floor system alternatives are intended for planning purposes only. Additional investigations will be necessary to further delineate sub-excavation recommendations and design structures. A brief summary of our conclusions and recommendations follows, with more detailed discussion in the report.

SUMMARY OF CONCLUSIONS

1. The primary geologic hazard and geotechnical concern is expansive soil and bedrock. We believe these concerns can be mitigated with proper planning, engineering, design, and construction.
2. Strata encountered in our exploratory borings were erratic, and generally consisted of 2 to over 30 feet of sandy clay and/or slightly silty to clayey, sand and gravel underlain in 12 borings by claystone and sandstone bedrock to the maximum depth explored of 30 feet. The clay and claystone are expansive, while the sand and sandstone are judged to be low to non-expansive.



3. Groundwater was encountered in two borings during drilling at depths of about 20 and 30 feet. When the holes were checked on July 27, 2021, groundwater was measured in five borings at depths ranging from about 20 to 27 feet below existing ground surface (Fig. 2). Unless deep cuts are planned, groundwater will likely not influence construction except possibly during deep utility excavation and sub-excavation. Groundwater levels will likely fluctuate seasonally and may rise in response to precipitation and landscape irrigation.
4. We estimate total potential ground heave could range from less than 0.5-inch to about 11 inches considering a depth of wetting of 24 feet (from existing grades). Grading plans for the development were not available at the time of this investigation. Site grading will affect potential heave estimates.
5. Footing foundations may be considered where the underlying soil and bedrock are low swelling or non-expansive. Drilled piers or another deep foundation system and structurally supported basement floors may be required in areas where moderate to high swelling soils are present unless sub-excavation is performed.
6. Sub-excavation can be considered to allow use of footing foundations and reduce potential risk of poor performance of slab-on-grade basement floors. We typically advocate a minimum 5-foot buffer zone between bottom of foundations and claystone bedrock, though deeper sub-excavation may be merited if claystone is moderate to highly expansive. Sub-excavation attempted near or below groundwater will likely require installation of interceptor drains during sub-excavation. Additional investigation with more closely-spaced borings and review of grading plans will be necessary to delineate depth and extent of sub-excavation.
7. Control of surface and subsurface drainage will be critical to the performance of foundations, slabs-on-grade and pavements. Overall surface drainage should be designed to provide rapid run-off of surface water away from structures, and off of pavements and flatwork.

SITE CONDITIONS

The site is located west of Founders Parkway, east of Prairie Hawk Drive, south of Metzler's Ranch Subdivision, and north of the Woodlands Subdivision in Douglas County, Colorado (Fig. 1 and Photo 1). The site is divided into two parcels



with Interstate 25 (I-25) effectively dividing the two. The western parcel is located west of I-25, south of Sante Fe Drive, east of Prairie Hawk Drive, and north of Castle Lock Storage Center. The parcel contains approximately 111 acres and mostly contains vacant land with east-west oriented drainages flowing towards Plum Creek. The ground consists of rolling hills covered in grass, weeds, and bushes. Liggett Road runs northwest-southeast through the central portion of the parcel. The parcel slopes to the northwest with a total relief of about 100 feet. The eastern parcel is located east of I-25, west of Founders Parkway, north of the Woodlands Subdivision, and south of Metzler's Ranch Subdivision. The parcel contains approximately 424 acres and mostly contains vacant land. The western portion of the parcel contains in-cut drainages and sparse vegetation and the eastern portion of the parcel contains dense scrub oak and ponderosa pines and higher relief hills. The parcel slopes to the west with a total relief of about 350 feet.

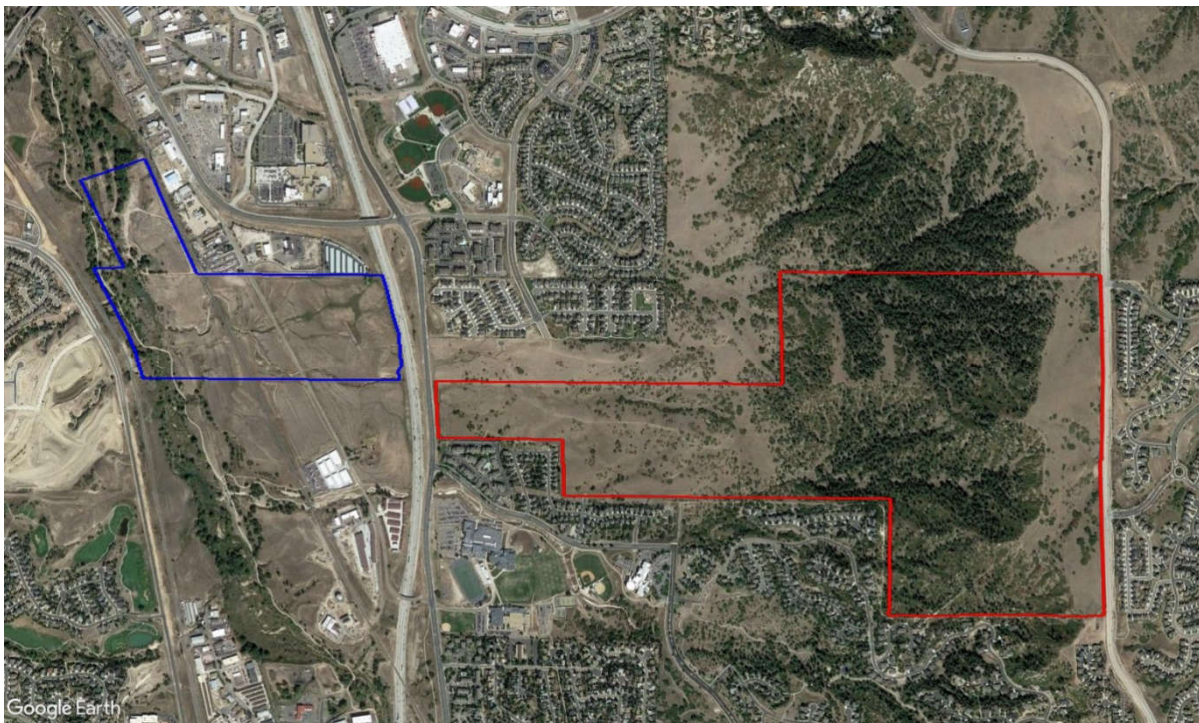


Photo 1. Google Earth® Aerial Site Photo, October 2019.
The western parcel is outlined in blue and the eastern parcel is outlined in red



SITE GEOLOGY AND GEOLOGIC HAZARDS

We reviewed geologic mapping prepared by Thorson, J.P. (Geologic Map of the Castle Rock North Quadrangle, Douglas County, Colorado, Colorado Geological Survey Open File Report 05-2, 2005). The mapping and our investigation indicate the western parcel contains primarily quaternary age younger alluvial terrace and fan deposits presumably deposited by Plum Creek with the eastern portion of this parcel containing older Piney Creek alluvial deposits. A zone of artificial fill is found adjacent to the location of Liggett Road. The eastern parcel consists of Quaternary age Piney Creek alluvial and colluvial clay and sand deposits on the western portion of this parcel with the entire parcel underlain by arkosic fine to medium grained, friable sandstone with claystone interbeds from the Tertiary age Dawson Formation.

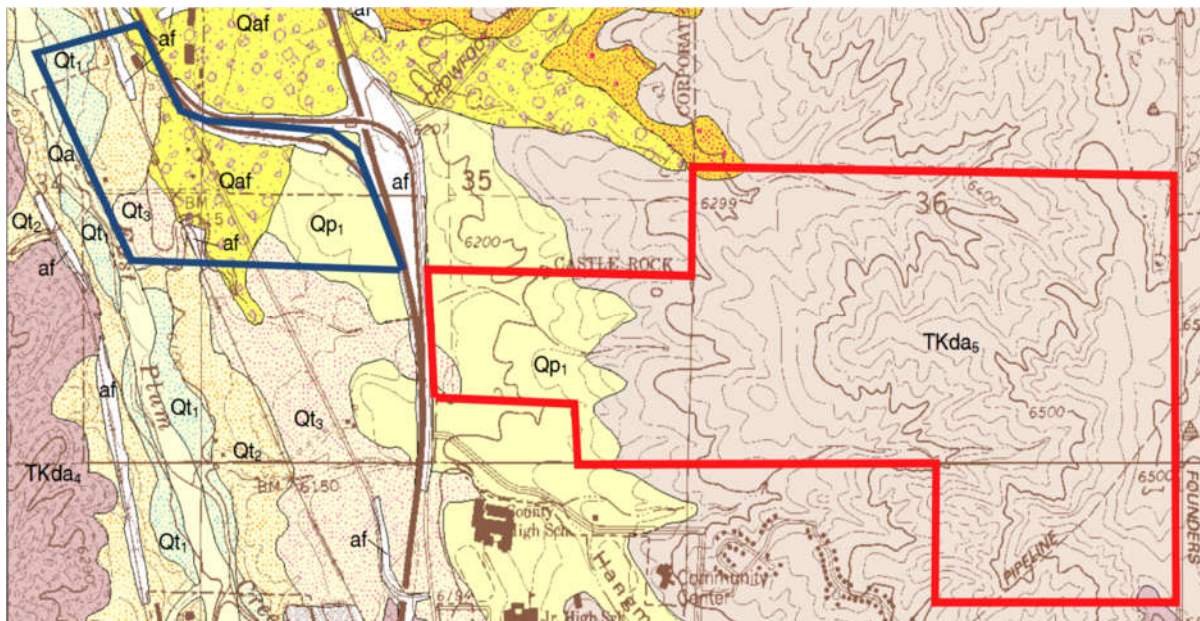


Photo 2. Excerpt from Geologic Map of Castle Rock North Quadrangle (2005). The western parcel is outlined in blue and the eastern parcel is outlined in red. Qt represents terrace alluvium. Qp represents older alluvium. Qaf represents alluvial fan deposits. af represents artificial fill. TKda represent Dawson Formation.

Geologic hazards at the site include expansive soil and bedrock, undocumented fill, and the regional geologic hazards of seismicity and naturally occurring radioactive materials. No geologic hazards that would preclude the proposed devel-



opment were noted. We believe potential hazards can be mitigated with proper engineering, design, and construction practices, as discussed in this report.

Expansive Clay and Claystone

The clayey soils and claystone bedrock are expansive. There is risk that ground heave will damage pavements, slabs-on-grade, and foundations. Engineered design of grading, pavements, foundations, slabs-on-grade, and surface drainage can mitigate, but not eliminate, the effects of expansive soil and bedrock. Bedrock surface elevations and depths from existing grade are presented on Fig. 2. Sub-excavation can be considered to help mitigate heave. Figure 3 shows estimated risk based on calculated potential heave at each boring location. Estimates of potential heave are presented later in the report and do not account for future grading.

Undocumented Fill

Although not encountered in our exploratory borings, existing (undocumented) fill may be present in areas across the site, particularly adjacent to I-25 and Liggett Road. Existing fill is judged to be unsuitable to support new improvements and should be removed and replaced as moisture-conditioned, compacted fill as discussed in Fill and Backfill (if encountered). Clean portions of the fill can be re-used.

Seismicity

Based on available mapping, we found no active faults within or near the site. The soil is not expected to respond unusually to seismic activity. According to the 2018 International Building Code (IBC) for seismic design, we believe the eastern portion of the site classifies as Site Class C and the western portion of the site classifies as Site Class D.



Radioactivity

It is normal in the Front Range of Colorado and nearby eastern plains area to measure radon gas in poorly ventilated spaces (e.g., full depth residential basements) in contact with soil or bedrock. Radon 222 gas is considered a health hazard and is just one of several radioactive products in the chain of the natural decay of uranium into lead. Radioactive nuclides are common in the soil and bedrock underlying the subject site. Because these sources exist or will exist on most sites in the area, there is a potential for radon gas accumulation in poorly ventilated spaces. The concentration of radon that can develop is a function of many factors, including the radionuclide activity of the soil and bedrock, construction methods and materials, soil gas pathways, and accumulation areas. The only reliable method to determine if a hazard exists is to perform radon testing of completed residential structures to determine the level of radon gas accumulation. Typical mitigation methods consist of sealing soil gas entry areas, ventilation of below-grade spaces, and venting from foundation drain systems. We recommend provision for ventilation of foundation drain systems to allow mitigation if a radon issue is discovered.

Other Considerations

We observed no evidence of unstable slopes. Erosion potential is considered moderate to high, increasing where steeper slopes are present. Erosion potential will increase during construction but should return to pre-construction rates or less if proper grading practices, surface drainage design, and re-vegetation efforts are implemented.

INVESTIGATION

We investigated subsurface conditions by drilling 16 exploratory borings at the locations shown on Fig. 1. Boring locations and elevations were determined using a Leica GS18 GPS unit referencing the North American Datum of 1983 (NAD



83). Prior to drilling, we contacted the Utility Notification Center of Colorado and local sewer and water districts to clear boring locations for conflicts with buried utilities. The borings were advanced to depths of 25 and 30 feet using solid stem, continuous-flight auger and a truck-mounted drill rig.

Samples of the soil and bedrock were obtained at 1 to 5-foot intervals using 2.5-inch diameter (O.D.) modified California barrel samplers driven by a 140-pound hammer falling 30 inches. Representatives of CTL | Thompson, Inc. were present during drilling to observe drilling operations, log the soil and bedrock, and obtain samples. Summary logs of the exploratory borings are presented in Appendix A.

Samples were returned to our laboratory where they were examined by our engineers. Laboratory tests included dry density, moisture content, percent silt and clay-sized particles (passing the No. 200 sieve), Atterberg limits, swell-consolidation, and water-soluble sulfate concentration. Swell-consolidation tests were performed by wetting the samples under approximate existing overburden pressures (the pressure exerted by overlying soil). Results of laboratory tests are presented in Appendix B and summarized in Table B-I.

SUBSURFACE CONDITIONS

Strata encountered in our exploratory borings were erratic, and generally consisted of 2 to over 30 feet of sandy clay and/or slightly silty to clayey sand and gravel underlain in 12 borings by claystone and sandstone bedrock to the maximum depth explored of 30 feet. Pertinent engineering characteristics of the soil and bedrock are presented in the following paragraphs.

Clay, Sand, and Gravel

Sandy clay and slightly silty to clayey sand and gravel was encountered in all borings at the existing ground surface to depths ranging from 2 to over 30 feet. The



clay was medium stiff to very stiff and the sand and gravel was loose to dense based on field penetration resistance tests. Two clay samples compressed 0.3 and 0.8 percent and fourteen samples swelled 0.7 to 14.5 percent when wetted. Three samples swelled over 11 percent when wetted. These higher swelling samples were located on the western parcel presumably in the floodplain of Plum Creek. Higher swelling samples (swell over 4 percent) were also present on the eastern parcel. Eight soil samples contained 9 to 93 percent silt and clay-sized particles (passing No. 200 sieve) with three clay samples exhibiting slight to moderate plasticity. The clay is very highly expansive, and the sand and gravel are judged to be low to non-expansive.

Bedrock

Claystone and sandstone bedrock was encountered in 12 borings underlaying the clay, sand, and gravel. Bedrock was not encountered in the four borings to the west of I-25. The bedrock was medium hard to very hard. Two samples compressed 0.4 and 0.5 percent and ten claystone samples swelled 0.5 to 8.1 percent when wetted. Seven bedrock samples contained 11 to 91 percent silt and clay-sized particles with three claystone samples exhibiting moderate to high plasticity. The claystone is expansive, and the sandstone judged to be non-expansive. Bedrock surface elevations and depths from existing grade are presented on Fig. 2.

Groundwater

Groundwater was encountered in two borings during drilling at depths of about 20 and 30 feet. When the holes were checked on July 27, 2021, groundwater was measured in five borings at depths ranging from about 20 to 27 feet below existing ground surface. Unless deep cuts are planned, groundwater will likely not influence construction except possibly during deep utility excavation and sub-excavation.



Groundwater levels will likely fluctuate seasonally and may rise in response to precipitation and landscape irrigation. Groundwater surface elevations and depths from existing grade are presented on Fig. 2.

ESTIMATED POTENTIAL HEAVE

We used the results of swell tests to evaluate potential heave of the soils below the site. The analysis involves dividing the soil profile into layers and modeling the heave of each layer from representative swell tests. Based on the swell-consolidation test results and our experience, we estimate potential heave may range up to about 11 inches based on a 24-foot depth of wetting (from the existing ground surface). Heave estimates for each boring are shown in Table I. These estimates neglect potential compression of non-expansive soils and do not account for site grading. Site grading will affect these estimates. Estimated risk at each boring location is shown on Fig. 3.

TABLE I: ESTIMATED POTENTIAL GROUND SURFACE HEAVE*

BORING	ESTIMATED HEAVE (IN.)	BORING	ESTIMATED HEAVE (IN.)
TH-1	10.8	TH-9	5.6
TH-2	7.3	TH-10	7.7
TH-3	10.8	TH-11	<0.5
TH-4	1.3	TH-12	3.3
TH-5	0.6	TH-13	<0.5
TH-6	<0.5	TH-14	6.4
TH-7	3.7	TH-15	3.7
TH-8	0.6	TH-16	6.3

*The estimated heave is based on a 24-foot depth of wetting from existing ground surface.

SITE DEVELOPMENT

The primary geotechnical concerns that we believe will influence development and building performance are the presence of expansive soils and bedrock. These concerns can be mitigated with proper planning, engineering, design and construction. The following sections provide site development recommendations.



Excavation

We believe the soils penetrated by our exploratory borings can generally be excavated with typical heavy-duty equipment. The Dawson Formation can possess lenses of very hard bedrock that may require hard rock excavation. Hard rock excavation techniques including heavy ripping, blasting, rock saws, and/or pneumatic hammers may be required to excavate in areas of very hard bedrock. We recommend the contractors become familiar with applicable local, state and federal safety regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards. For preliminary planning purposes, we anticipate the clay and claystone can be classified as Type B soil and sand and sandstone as Type C soil. Type B soil requires 1:1 slopes (horizontal to vertical) and Type C requires 1½:1 for temporary excavations in dry conditions. These estimated slopes are based on widely spaced borings and our experience. It is ultimately the responsibility of the contractor's "competent person" to determine appropriate slopes during construction by referring to OSHA Standards governing excavations published in 29 CFR, Part 1926. All vehicles and soil stockpiles should be kept a lateral distance from the crest of the slope equal to no less than one-half the slope height. Excavations 20 feet or deeper must be designed by a professional engineer registered in the state of Colorado.

Sub-Excavation and Site Grading

Our investigation indicates expansive clay and claystone are present at depths likely to influence the performance of shallow foundations and slabs-on-grade for most of the site. Sub-excavation may be used at building locations to create more stable soil conditions and reduce potential movement. An estimate of risk based on calculated potential heave at each boring location is shown on Fig. 3. We should review grading plans and drill more closely-spaced borings to better evaluate the extent of sub-excavation. For preliminary budgeting, we estimate excavation to 5



to 10 feet below foundations may be merited for about 60 percent of the site (moderate to high risk areas shown on Fig. 3).

The grading contractor should be chosen carefully to assure they have experience with fill placement at over-optimum moisture and have the necessary compaction equipment. The contractor should provide a construction disc to break down fill materials and anticipate use of push-pull scraper operations and dozer assistance. The operation will be relatively slow. In order for the procedure to be performed properly, close contractor control of fill placement to specifications is required. Grading and sub-excavation fill should be free of deleterious material such as organics, large roots, trash, and other debris. Clods should be processed to about 3 inches or less. Fill should be moisture-conditioned between optimum and 4 percent above optimum moisture content for clay, and within 2 percent of optimum for sand and compacted to at least 95 percent of maximum standard Proctor dry density (ASTM D698).

Special precautions should be taken for compaction of fill at corners, access ramps, and along the perimeters of sub-excavated areas as large compaction equipment cannot easily reach these areas. Our representative should observe placement procedures and test compaction of the fill on a “full-time” basis. The swell of the moisture-conditioned fill should be tested after fill placement. Guideline grading specifications are presented in Appendix C.

Our experience indicates fill and backfill can settle, even if properly compacted to criteria provide above. Factors that influence the amount of settlement are depth of fill, material type, degree of compaction, amount of wetting and time. The degree of compression of fill under its own weight will likely range from low for granular soils ($\frac{1}{2}$ percent or less) to moderate for clay/sand mixtures (1 to 2 percent). Most of this compression should occur quickly after placement.



Slopes

We recommend permanent cut and fill slopes be designed with a maximum grade of 3:1 (horizontal to vertical). If site constraints (property boundaries and streets) do not permit construction with recommended slopes, we should be contacted to evaluate the subsurface soils and steeper slopes. Where new fill will be placed on existing slopes steeper than 5:1, the existing slopes should be excavated to form benches. A conceptual benched fill detail is presented on Fig. 4. Slopes greater than 15 feet high should be evaluated by our office on a case-by-case basis. Surface drainage should not be allowed to sheet flow across slopes or pond near the crest of slopes. All cut and fill slopes should be designed and re-vegetated as soon as possible after grading to reduce potential for erosion problems. Excavation contractors should evaluate ground conditions and control slopes in accordance with OSHA criteria.

Underdrain

Groundwater may affect sub-excavation and utility installation. Groundwater levels will fluctuate with seasons and will likely rise after development. We believe this water should be controlled. The water could lead to deep wetting and higher frequency of heave and/or settlement-related foundation problems as well as frequent pumping from basements foundation drains. We advocate use of an underdrain system to provide a means to control water and allow gravity discharge from basement foundation drains. Conceptual sewer underdrain details are provided on Figs. 5 through 7. If the underdrain discharges to a detention pond or drainage, the potential for backflow of water from the discharge point into the underdrain and building foundation drains should be evaluated.



Utilities

Water and sewer lines are usually constructed beneath paved roads. Compaction of trench backfill can have a significant effect on the life and serviceability of pavements. Trench backfill should be placed in thin (8 inches or less) loose lifts and moisture conditioned to between optimum and 4 percent above optimum moisture content for clay and claystone and compacted to at least 95 percent of maximum dry density (ASTM D 698). Sand fill should be moisture conditioned to within 2 percent of optimum moisture content and compacted to 100 percent of maximum dry density. The placement and compaction of trench fill and backfill should be observed and tested by our firm during construction.

Our experience indicates use of a self-propelled compactor results in more reliable performance compared to backfill “compacted” by a sheepsfoot wheel attachment on a backhoe or trackhoe. The upper portion of the trenches should be widened to allow the use of a self-propelled compactor. Special attention should be paid to backfill placed adjacent to manholes as we have seen instances where settlement in excess of 2 percent has occurred. Any improvements placed over backfill should be designed to accommodate movement.

Pavements

Pavement subgrade soils will likely consist of silty to clayey sand with lesser amounts of sandy clay or fill of similar composition. The clay at this site is considered poor subgrade and will likely classify an A-7-6 soil per AASHTO standards. Sand is considered better subgrade material. Douglas County requires the following minimum pavement sections. Actual required pavement thicknesses are likely to exceed these minimums. A design-level subgrade and pavement investigation should be performed after grading is complete.



DOUGLAS COUNTY MINIMUM PAVEMENT THICKNESSES

Roadway Classification	Hot Mix Asphalt Concrete (HMAC) + Aggregate Base Course (ABC)	Hot Mix Asphalt Concrete (HMAC) + Cement Treated Subgrade (CTS)	Portland Cement Concrete (PCC)
Local Residential	4" HMAC + 6" ABC	4" HMAC + 5" CTS	6" PCC
Residential Collectors	5" HMAC + 6" ABC	4" HMAC + 6" CTS	7" PCC

Douglas County will also require mitigation of expansive material. If expansive clays are present immediately below pavements, Douglas County allows three methods to mitigate the effects of expansive soil:

- Mitigation shall include over excavation and replacement of the swelling soil with an A-2 to A-6 soil group with less than 2% swell. The over excavation shall be a minimum of three (3) feet below the bottom of the approved pavement section. Upon removal of the three feet of material, the existing surface shall be scarified and reconditioned to a depth of 8 inches. The reconditioning shall be moisture treated to within 2 percent of optimum moisture content (optimum to +4% for A-6 soils) and compacted.
- An option is to remove the swelling soil to a depth of one (1) foot below the bottom of the pavement section, then replace the excavated materials with one (1) foot of Class 6 Road Base. If the road base option is used, this may require the use of an approved geotextile fabric between the native material and the Class 6 Road Base. Upon removal of the one foot of material, the existing surface shall be scarified and reconditioned to a depth of 8 inches. The reconditioning shall be moisture treated to within 2 percent of optimum moisture content (optimum to +4% for A-6 and A-7-6 soils) and compacted.
- Other methods of swell mitigation could include the use of lime or Portland cement. Methods of mitigation to be used are subject to approval by the Department. The submittal of an alternative for swell mitigation as described above, should include the requirements associated with the scarification and reconditioning of the subgrade below the proposed mitigation treatment.



BUILDING CONSTRUCTION CONSIDERATIONS

The following discussions are preliminary and are not intended for design or construction. After grading is completed, design-level investigations should be performed on a lot-specific basis.

Foundations

Footing foundations may be used for sites where non-expansive and low swelling site-grading fill, natural soil and bedrock are present within depths likely to influence performance of foundations. Where moderate to high swelling clay and/or claystone are present, drilled piers or another deep foundation system would be merited to control risk of heave and settlement. Sub-excavation can be considered to allow use of footing foundations and reduce potential risk for slab-on-grade basement floors. We typically advocate a minimum 5-foot buffer zone between bottom of foundations and claystone bedrock. Sub-excavation attempted near or below groundwater will likely require installation of interceptor drains during sub-excavation.

Slab-On-Grade Construction

Slab-on-grade basement floors may be considered on low and some moderate risk sites where potential heave is acceptable to builders and home buyers. Structurally supported basement floors should be used on sites with high or very high risk of poor basement slab performance. Sub-excavation should reduce potential heave to about 2 inches or less and allow wider use of slab-on-grade floors.

The performance of garage floors, driveways, sidewalks, and other surface flatwork may be poor where expansive soils are present. The following precautions will be required to reduce the potential for damage due to movement of slabs-on-grade for this site:



1. Isolation of the slabs from foundation walls, columns and other slab penetrations;
2. Voiding of interior partition walls to allow slab movement without transferring movement to the structure;
3. Flexible water and gas connections to allow slab movement. A flexible plenum above furnaces will be required; and
4. Proper surface grading and foundation drain installation to reduce water availability to sub-slab and foundation soils

Below-Grade Areas

Surface water can penetrate relatively permeable loose backfill soils located adjacent to residences and collect at the bottom of relatively impermeable excavations causing wet or moist conditions. Foundation drains will be necessary around all below-grade areas. We prefer foundation drains be connected to an underdrain system below the sewer main with a piped connection. A typical foundation drain connection to the underdrain system is shown on Fig. 7. Sump pits should be provided as a backup if underdrains do not perform as intended. If no piped underdrain connection is made, pumps should be installed during construction to remove water from sump pits and discharge to the ground surface. Discharge areas should be graded so that water will flow away from the structure.

Surface Drainage

The performance of improvements will be influenced by surface drainage. When developing an overall drainage scheme, consideration should be given to drainage around each residence. The ground surface around the residences should be sloped to provide positive drainage away from the foundations. We recommend a slope of at least 10 percent for the first 10 feet surrounding each residence with basement, where practical. If the distance between houses is less than 20 feet, the



slope in this area should be 10 percent to the swale between houses. Where possible, drainage swales should slope at least 2 percent. Variation from these criteria is acceptable in some areas. For example, for lots graded to direct drainage from the rear yard to the front, it is difficult to achieve the recommended slope at the high point behind a house. We believe it is acceptable to use a slope of about 6 inches in the first 10 feet (5 percent) in this instance and others when achieving 10 percent is not practical. Roof downspouts and other water collection systems should discharge beyond the limits of all backfill around structures.

Proper control of surface runoff is also important to control the erosion of surface soils. Sheet flow should not be directed over unprotected slopes. Water should not be allowed to pond at the crest of slopes. Permanent slopes should be prepared in such a way to reduce erosion.

Attention should be paid to compact the soils behind curb and gutter adjacent to streets and in utility trenches during the development. If surface drainage between preliminary development and construction phases is neglected, performance of the roadways, flatwork and foundations may be poor. Vapor retarders or barriers should be installed under basement floor slabs in areas of shallow groundwater (if any).

Concrete

Concrete in contact with soil can be subject to sulfate attack. We measured water-soluble sulfate concentrations in three samples at less than 0.01 to 0.04 percent. For this level of sulfate concentration, ACI 332-08 *Code Requirements for Residential Concrete* indicates there are no special requirements for sulfate resistance. Additional testing is recommended during the design-level phase.

Superficial damage may occur to the exposed surfaces of highly permeable concrete, even though sulfate levels are relatively low. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious materials ratio should not



exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high-water tables. Concrete should have a total air content of 6 percent $\pm$ 1.5 percent. We advocate damp-proofing of all foundation walls and grade beams in contact with the subsoils (including the inside and outside faces of garage and crawl space grade beams).

RECOMMENDED FUTURE INVESTIGATIONS

We recommend the following investigations and services:

1. Review grading plans of the planned development;
2. Supplemental investigation consisting of more closely-space borings to delineate extent of sub-excavation (if selected);
3. Construction testing and observation during site development, grading, and pavement construction;
4. Subgrade investigation and pavement design(s) after grading;
5. Design-level Soils and Foundation Investigation(s) after grading; and
6. Foundation installation observations.

CONSTRUCTION OBSERVATIONS

This report has been prepared for the exclusive use of Pine Canyon and your design and construction team to provide geotechnical design and construction criteria for development. The information, conclusions, and recommendations presented herein are based upon consideration of many factors including, but not limited to, the type of structures proposed, the geologic setting, and the subsurface conditions encountered.



We recommend that CTL | Thompson, Inc. provide construction observation services to allow us the opportunity to verify whether soil conditions are consistent with those found during this investigation. If others perform these observations, they must accept responsibility to judge whether the recommendations in this report remain appropriate.

GEOTECHNICAL RISK

The concept of risk is an important aspect with any geotechnical evaluation primarily because the methods used to develop geotechnical recommendations do not comprise an exact science. We never have complete knowledge of subsurface conditions. Our analysis must be tempered with engineering judgment and experience. Therefore, the recommendations presented in any geotechnical evaluation should not be considered risk-free. Our recommendations represent our judgment of those measures that are necessary to increase the chances that the development will perform satisfactorily. It is critical that all recommendations in this report are followed.

LIMITATIONS

Our borings were widely spaced to provide a general picture of subsurface conditions for use in planning. Variations in the subsoil conditions not indicated by our borings are likely. We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing under similar conditions. No warranty, express or implied, is made.



If we can be of further service in discussing either the contents of this report or the analysis of the influence of subsurface conditions on the design of the proposed development, please call.

CTL | THOMPSON, INC.

A handwritten signature in blue ink, appearing to read "Sam Rumel", is positioned above the printed name.

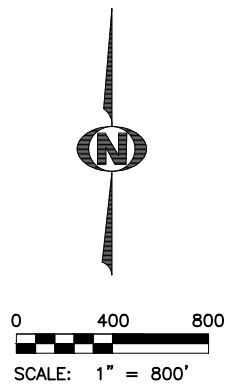
Samuel J. Rumel, E.I.T.
Staff Engineer

Reviewed by:

Alan J. Lisowy, P.E.
Principal

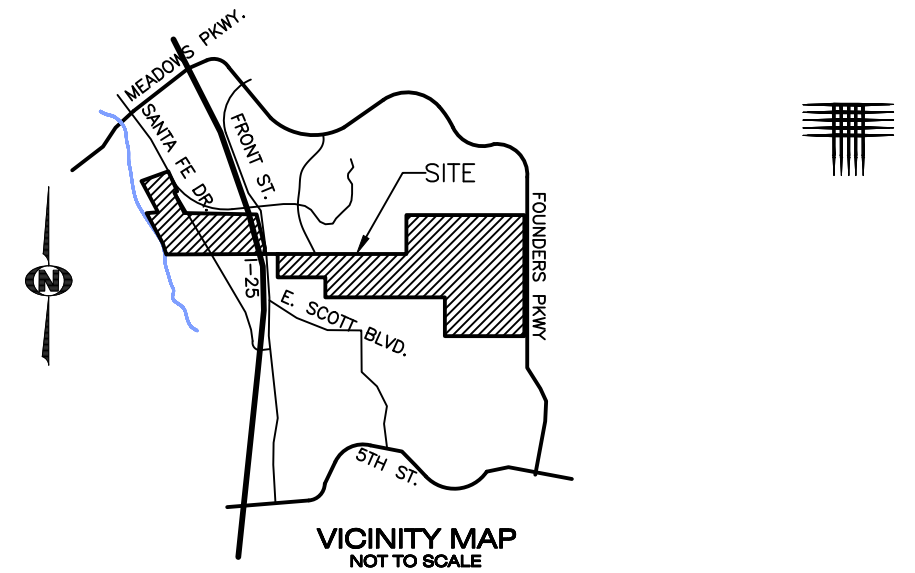
SJR:AJL/nn

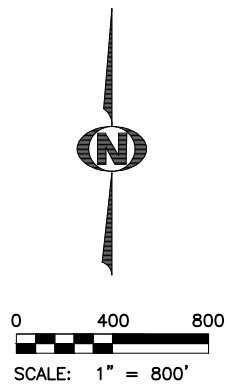
Via e-mail: kuwalker@gmail.com



LEGEND:

- TH-1 APPROXIMATE LOCATION OF EXPLORATORY BORING



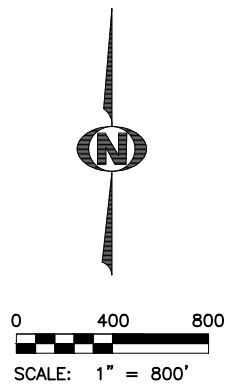


LEGEND:

- TH-1
● APPROXIMATE LOCATION OF EXPLORATORY BORING
- (22)
INDICATES APPROXIMATE DEPTH TO BEDROCK (FEET)
- [6186]
INDICATES APPROXIMATE BEDROCK ELEVATION (FEET)
- (20)
INDICATES APPROXIMATE DEPTH TO GROUNDWATER (FEET)
- [6069]
INDICATES APPROXIMATE GROUNDWATER ELEVATION (FEET)

NOTE: THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF DRILL HOLE DATA AND MAY NOT REFLECT LOCAL VARIATIONS AND SEASONAL FLUCTUATIONS.





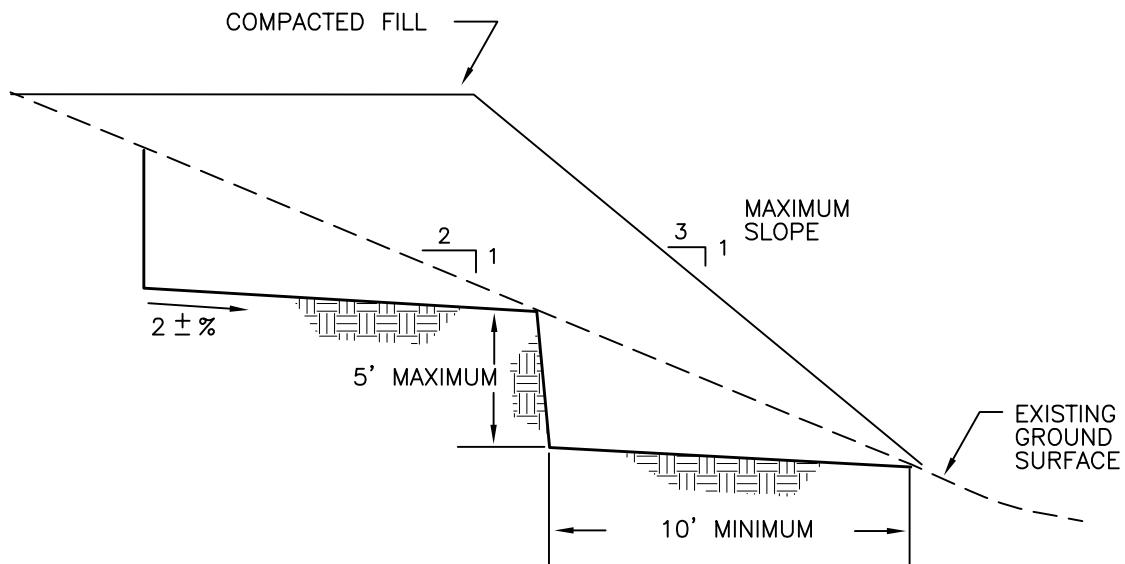
LEGEND:

- TH-1 ● APPROXIMATE LOCATION OF EXPLORATORY BORING
- LOW RISK (0 TO 2 INCHES)
- MODERATE RISK (2 TO 4 INCHES)
- HIGH RISK (MORE THAN 4 INCHES)



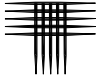
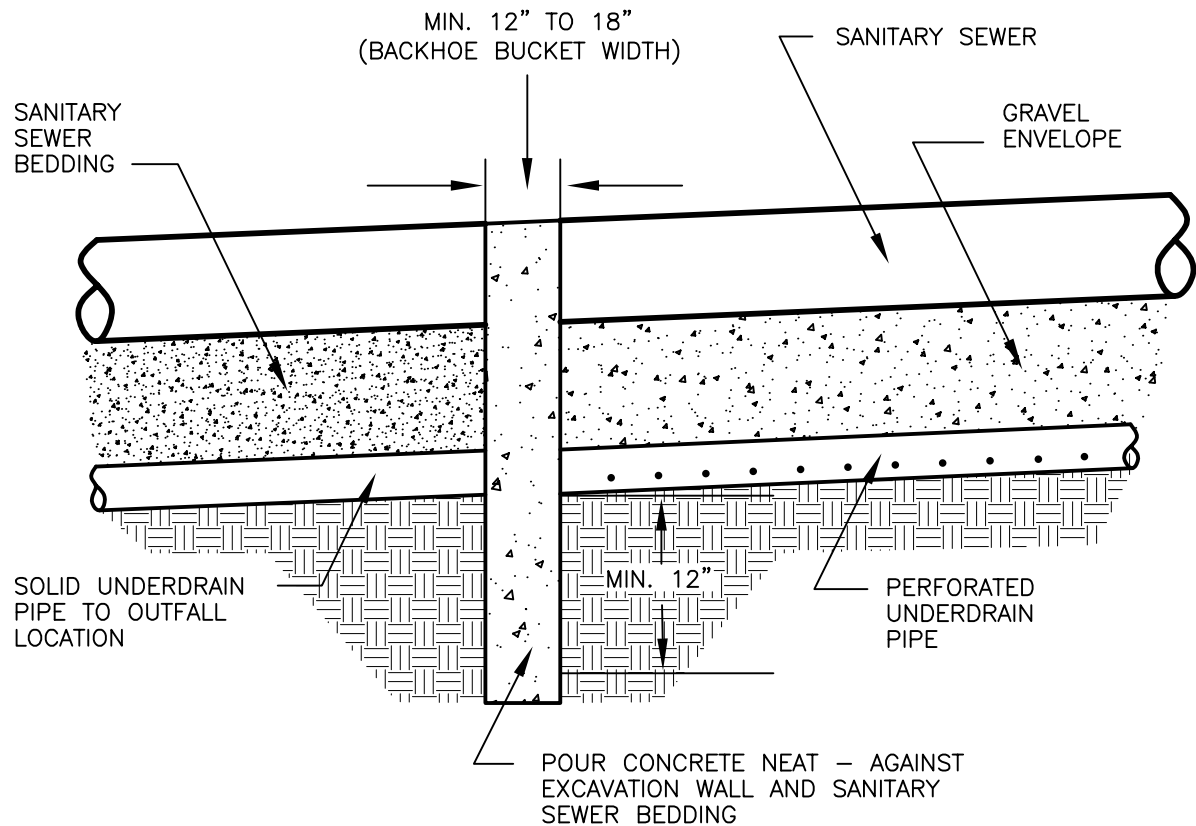


60-BENCHED-FILL_01

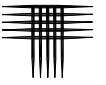
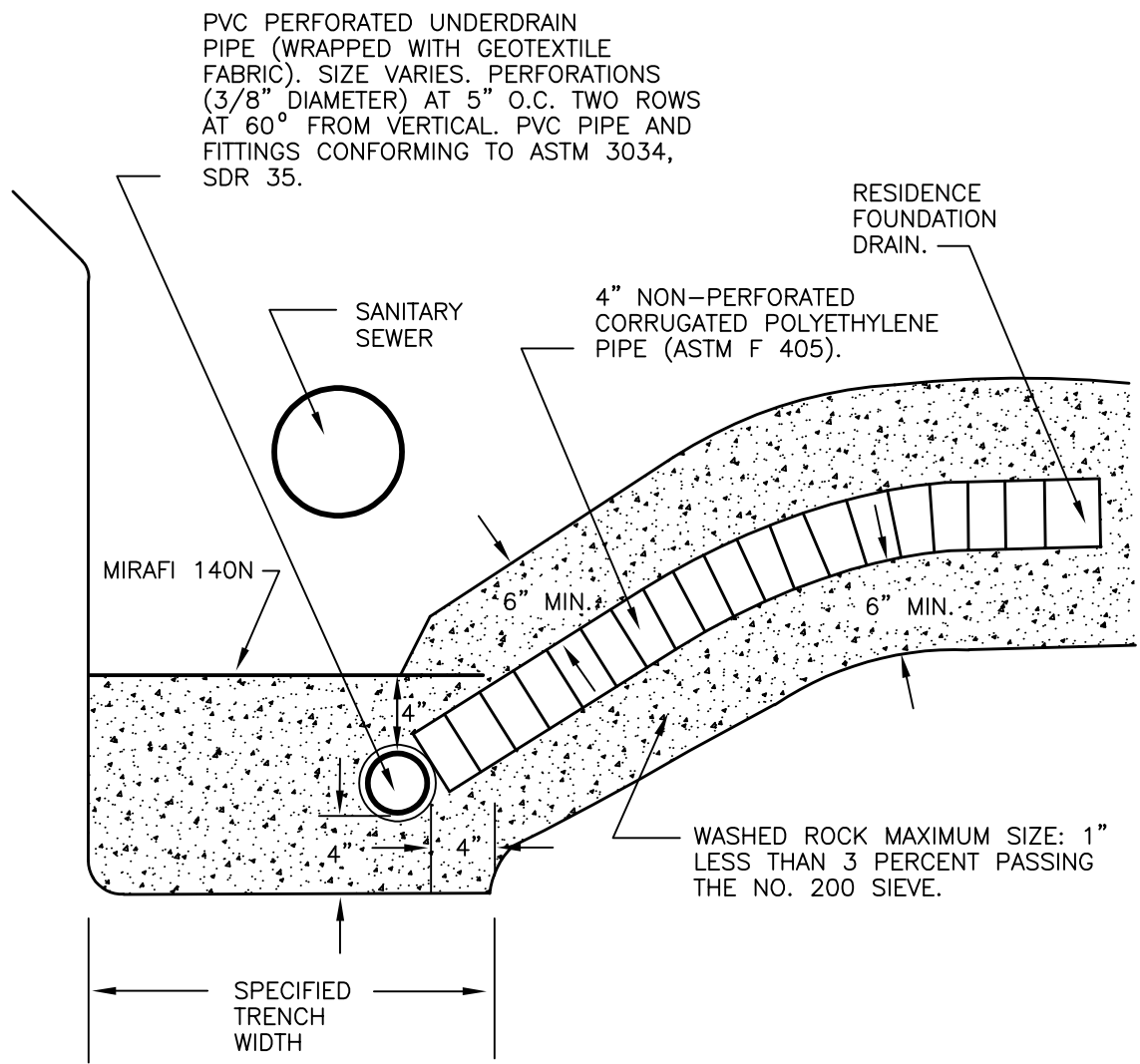


NOTES:

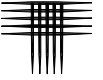
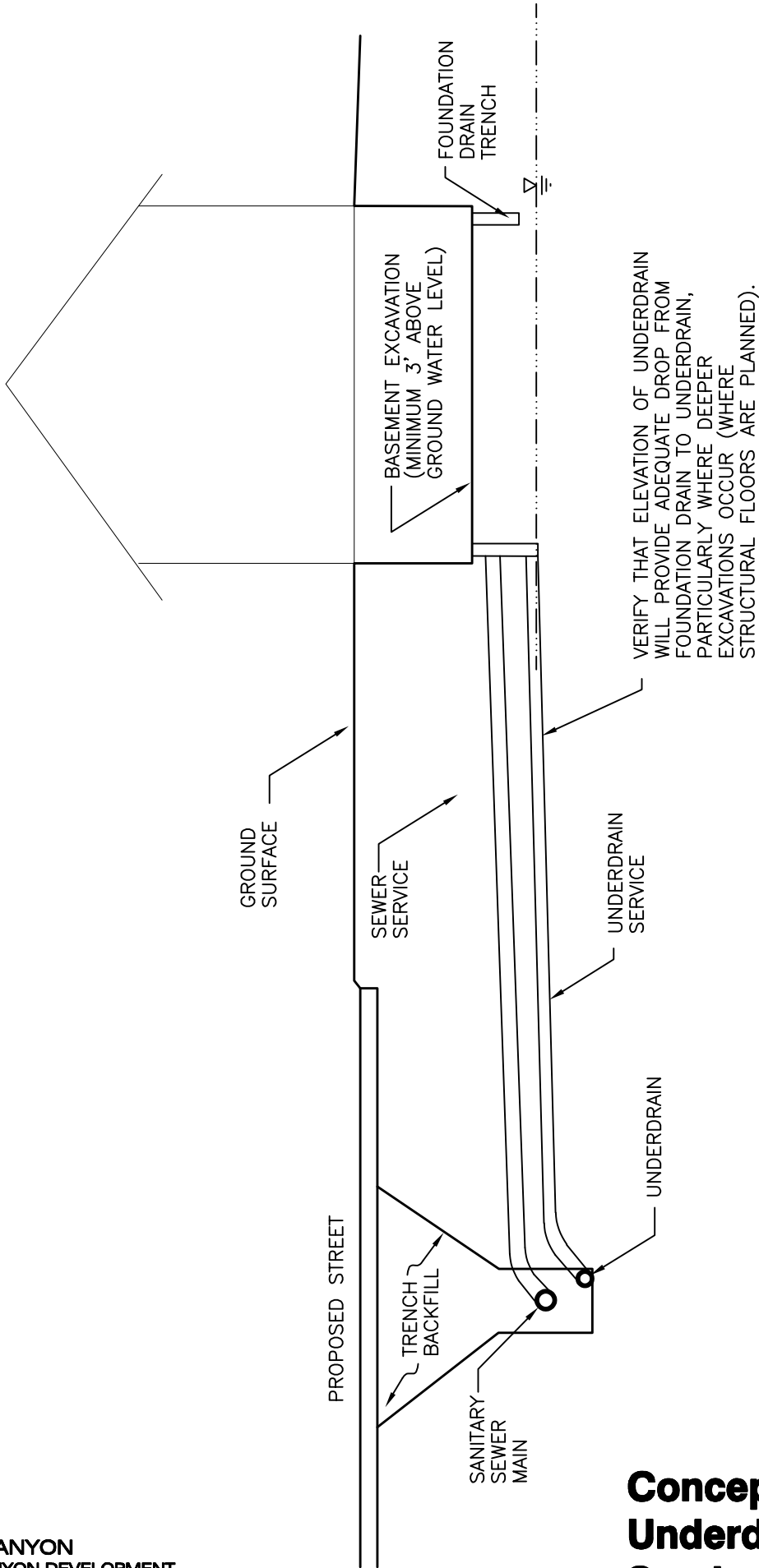
- 1) NATURAL SLOPES OF 20 PERCENT OR STEEPER ARE TO BE BENCHED PRIOR TO FILL PLACEMENT.
- 2) SLOPE BENCHES TO OUTSLOPE AT 2± PERCENT.



NOTE:
THE CONCRETE CUTOFF WALL SHOULD EXTEND INTO THE UNDISTURBED
SOILS OUTSIDE THE UNDERDRAIN AND SANITARY SEWER TRENCH A
MINIMUM DISTANCE OF 12 INCHES.



NOTE: NOT TO SCALE.

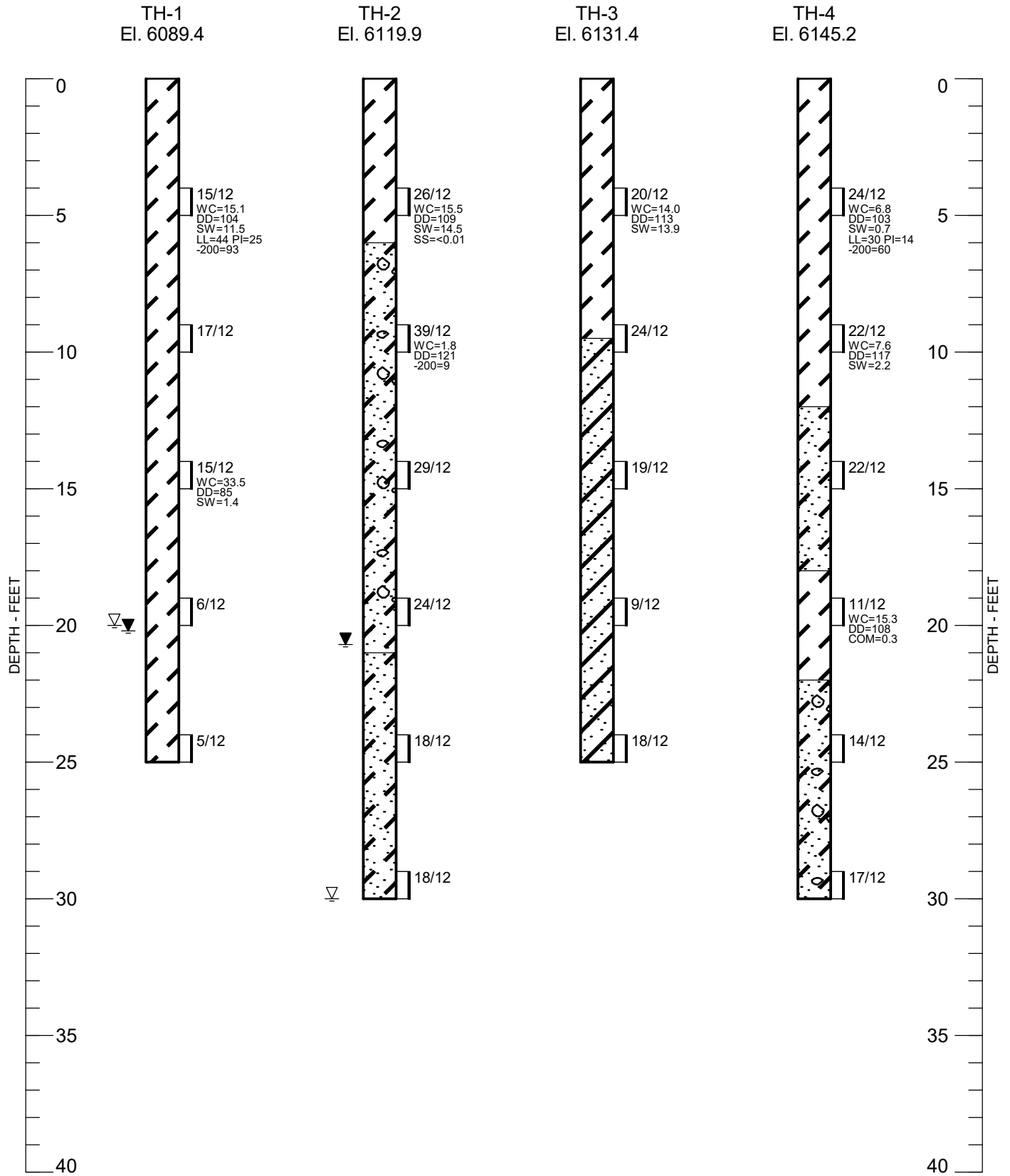


NOT TO SCALE

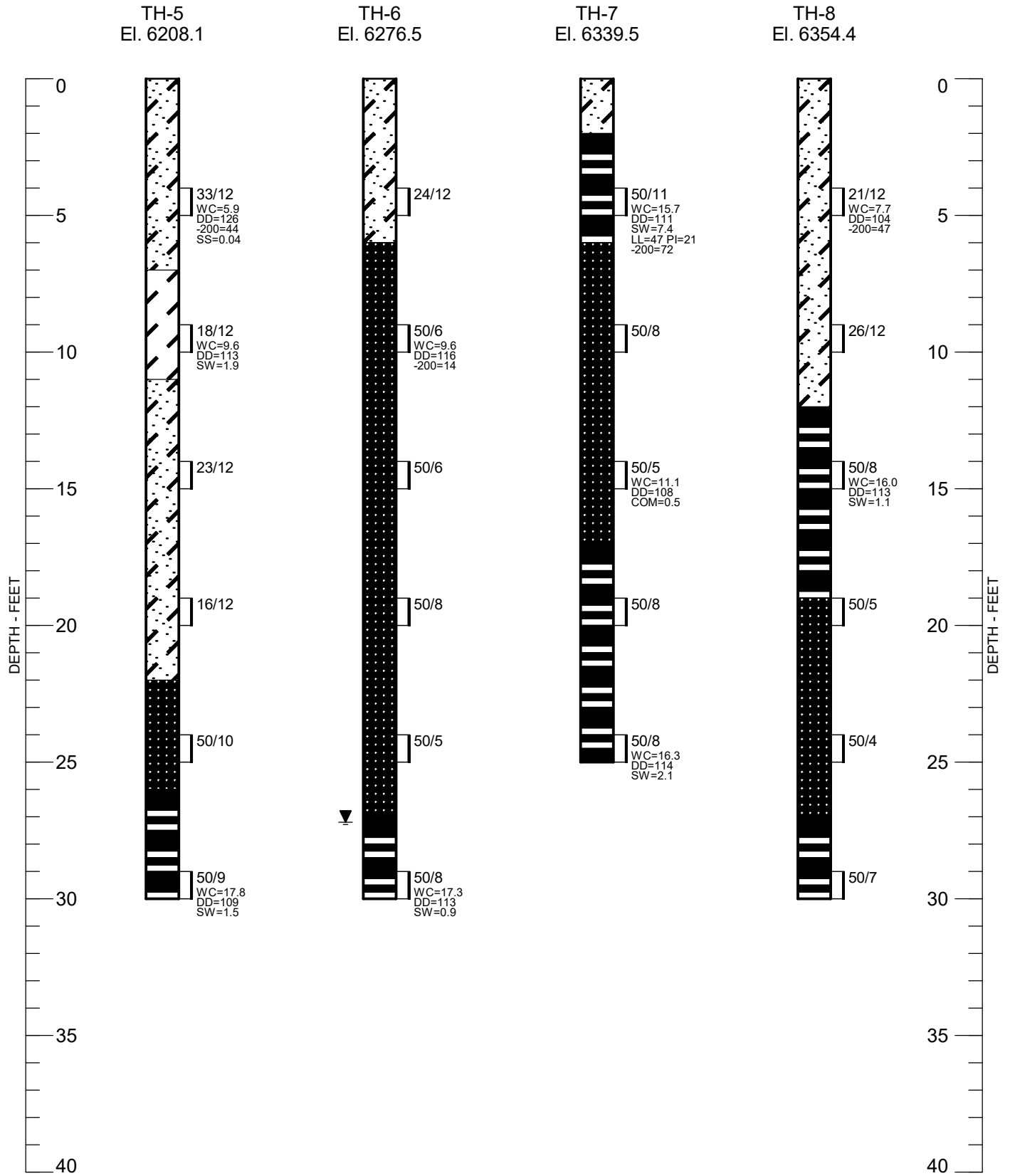


APPENDIX A

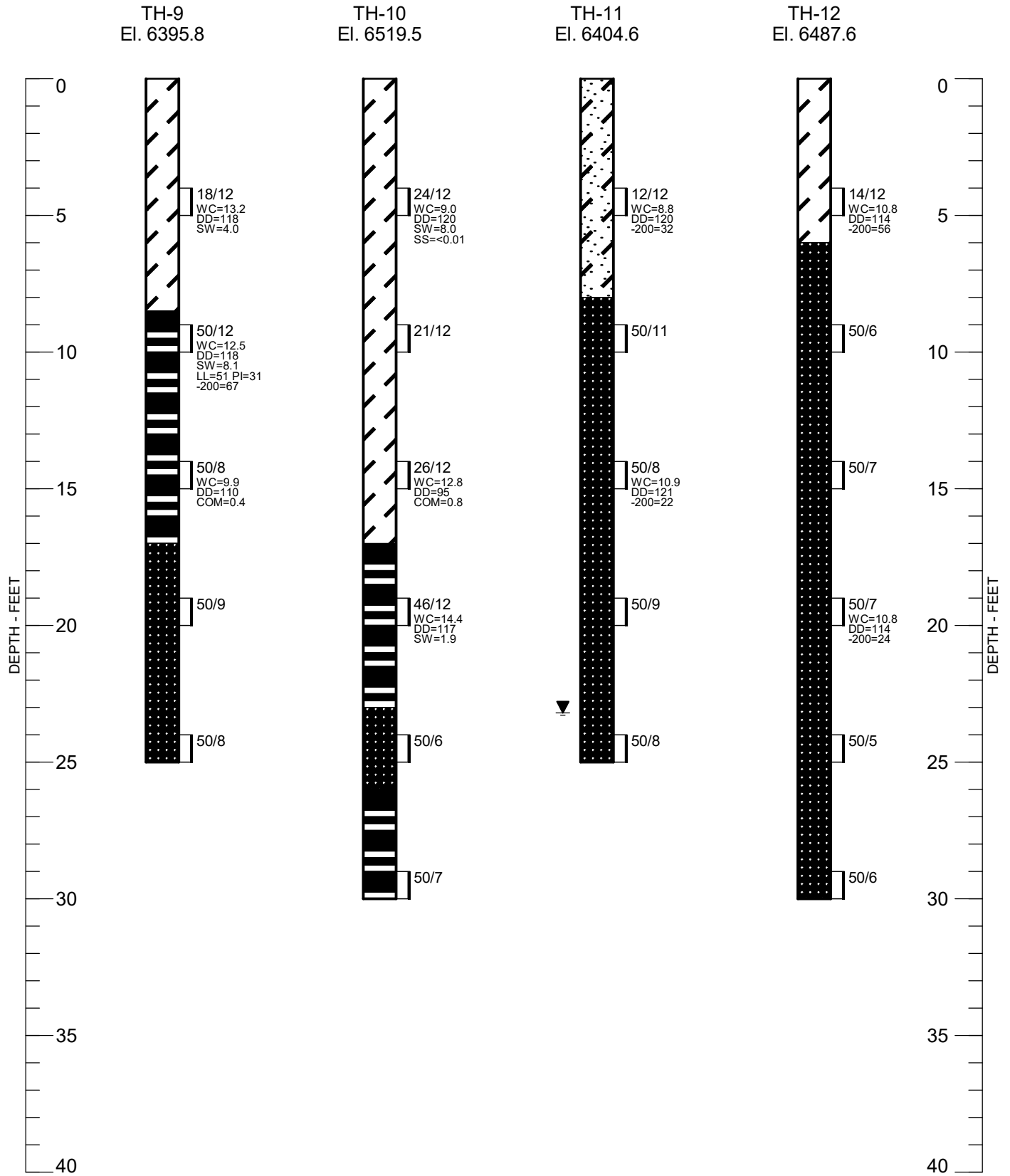
SUMMARY LOGS OF EXPLORATORY BORINGS



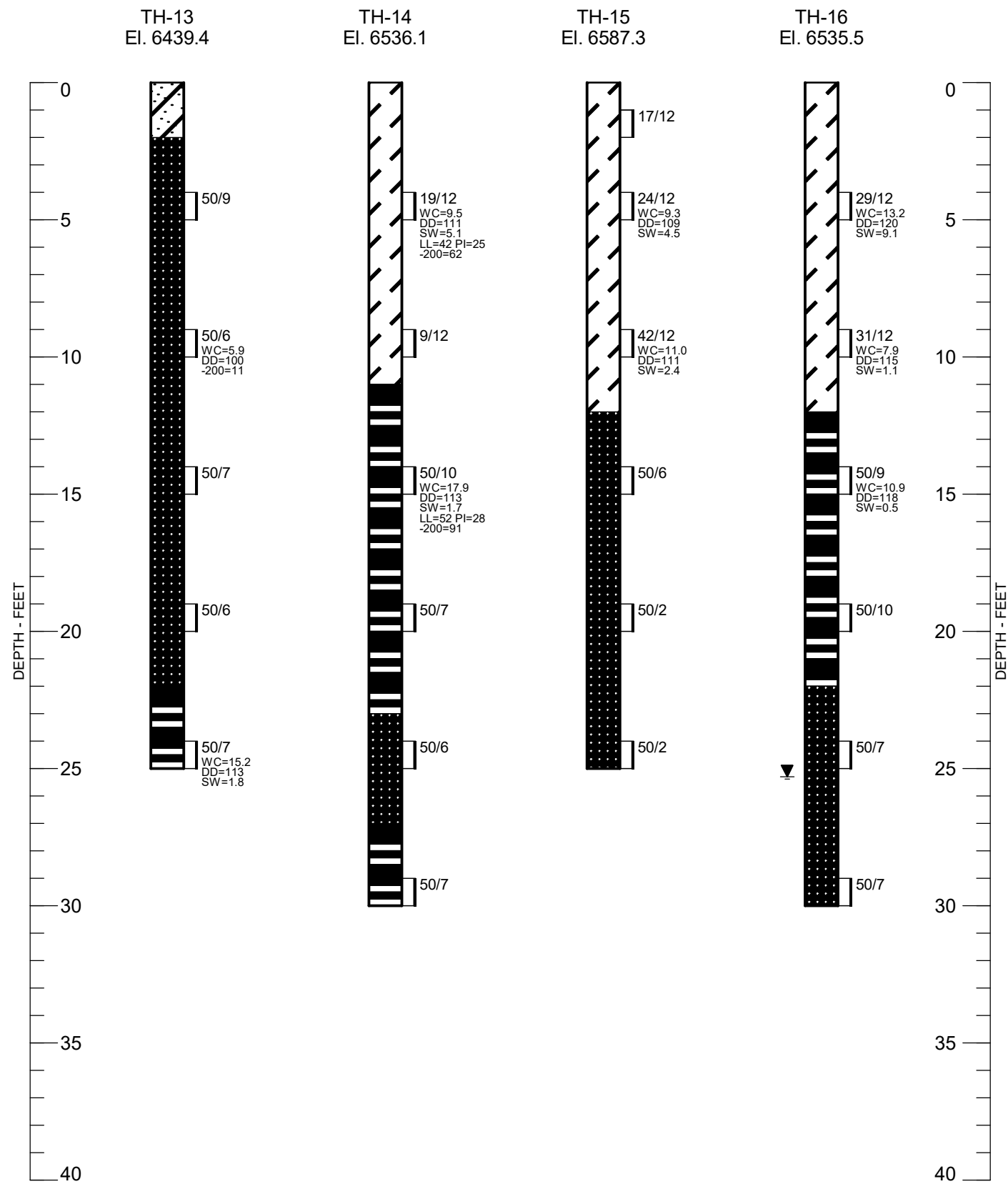
SUMMARY LOGS OF EXPLORATORY BORINGS



SUMMARY LOGS OF EXPLORATORY BORINGS



SUMMARY LOGS OF EXPLORATORY BORINGS



LEGEND:

- CLAY, SANDY, MEDIUM STIFF TO VERY STIFF, MOIST, BROWN, GRAY (CL).
- SAND, CLAYEY, MEDIUM DENSE, MOIST, BROWN, TAN (SC).
- SAND, SILTY, LOOSE TO MEDIUM DENSE, MOIST, BROWN, WHITE, OLIVE (SM).
- GRAVEL, SLIGHTLY SILTY TO CLAYEY, MEDIUM DENSE TO DENSE, MOIST, BROWN, GRAY (GP-GM, GC).
- BEDROCK, CLAYSTONE, SANDY, MEDIUM HARD TO HARD, MOIST, GRAY, WHITE.
- BEDROCK, SANDSTONE, CLAYEY, HARD TO VERY HARD, MOIST, GRAY, WHITE, BROWN.
- DRIVE SAMPLE. THE SYMBOL 15/12 INDICATES 15 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.
- WATER LEVEL MEASURED AT TIME OF DRILLING.
- WATER LEVEL MEASURED AFTER DRILLING ON JULY 27, 2021.

NOTES:

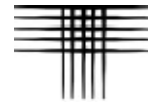
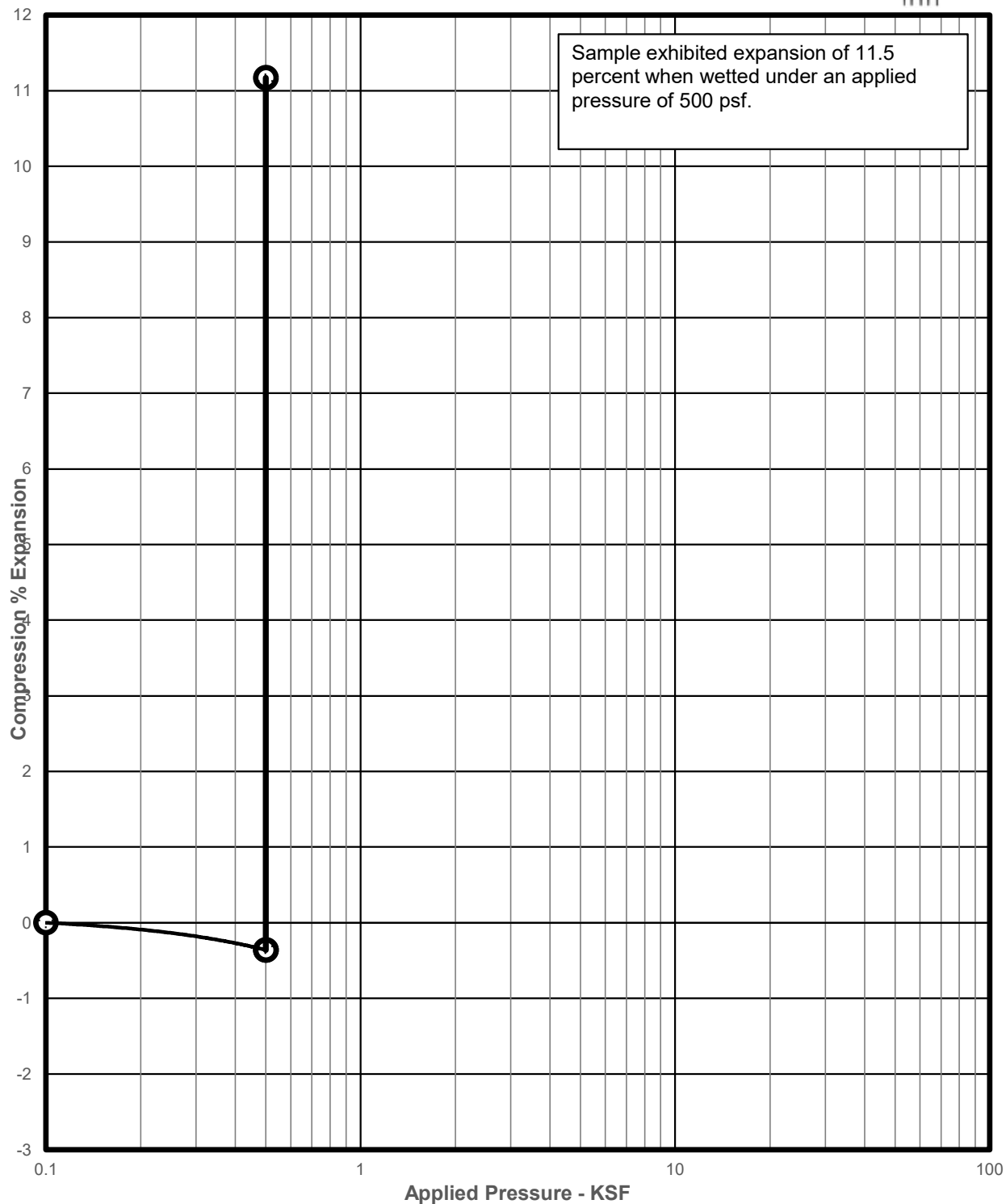
- THE BORINGS WERE DRILLED BETWEEN JULY 9 AND 25, 2021 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT SOLID-STEM AUGER AND TRUCK-MOUNTED CME-45 DRILL RIGS.
- BORING LOCATIONS AND ELEVATIONS ARE APPROXIMATE AND WERE DETERMINED BY A REPRESENTATIVE OF OUR FIRM USING A LEICA GS18 GPS UNIT REFERENCING THE NORTH AMERICAN DATUM OF 1983 (NAD 83).
- WC - INDICATES MOISTURE CONTENT (%).
DD - INDICATES DRY DENSITY (PCF).
SW - INDICATES SWELL WHEN WETTED UNDER APPROXIMATE OVERBURDEN PRESSURE (%).
COM - INDICATES COMPRESSION WHEN WETTED UNDER APPROXIMATE OVERBURDEN PRESSURE (%).
LL - INDICATES LIQUID LIMIT.
PI - INDICATES PLASTICITY INDEX.
-200 - INDICATES PASSING NO. 200 SIEVE (%).
SS - INDICATES WATER-SOLUBLE SULFATE CONTENT (%).
- THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.

SUMMARY LOGS OF EXPLORATORY BORINGS



APPENDIX B

LABORATORY TEST RESULTS AND TABLE B-I

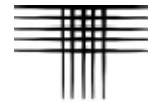
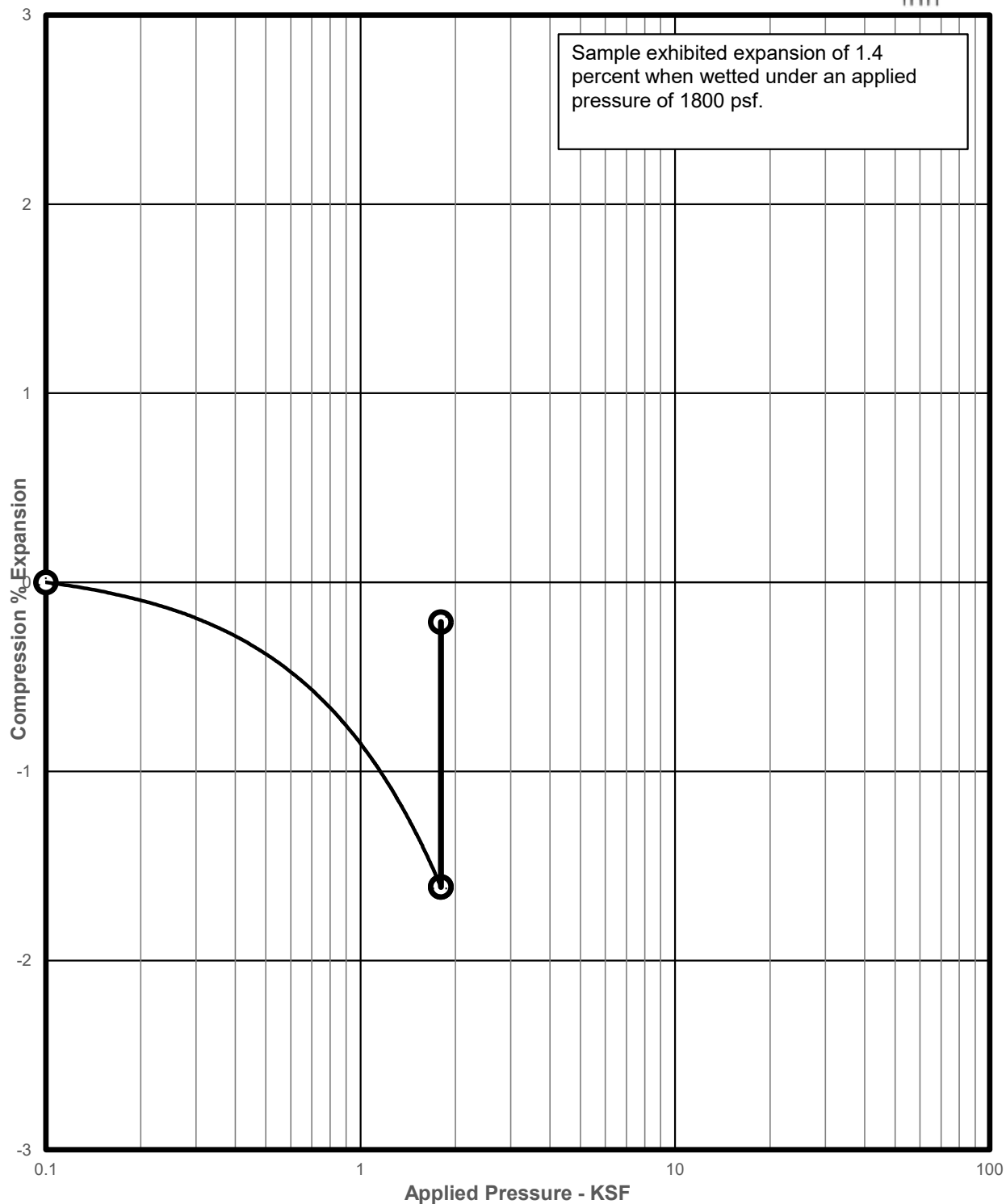


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-1 AT 4 FEET

DRY UNIT WEIGHT: 104 pcf
MOISTURE CONTENT: 15.1 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 1

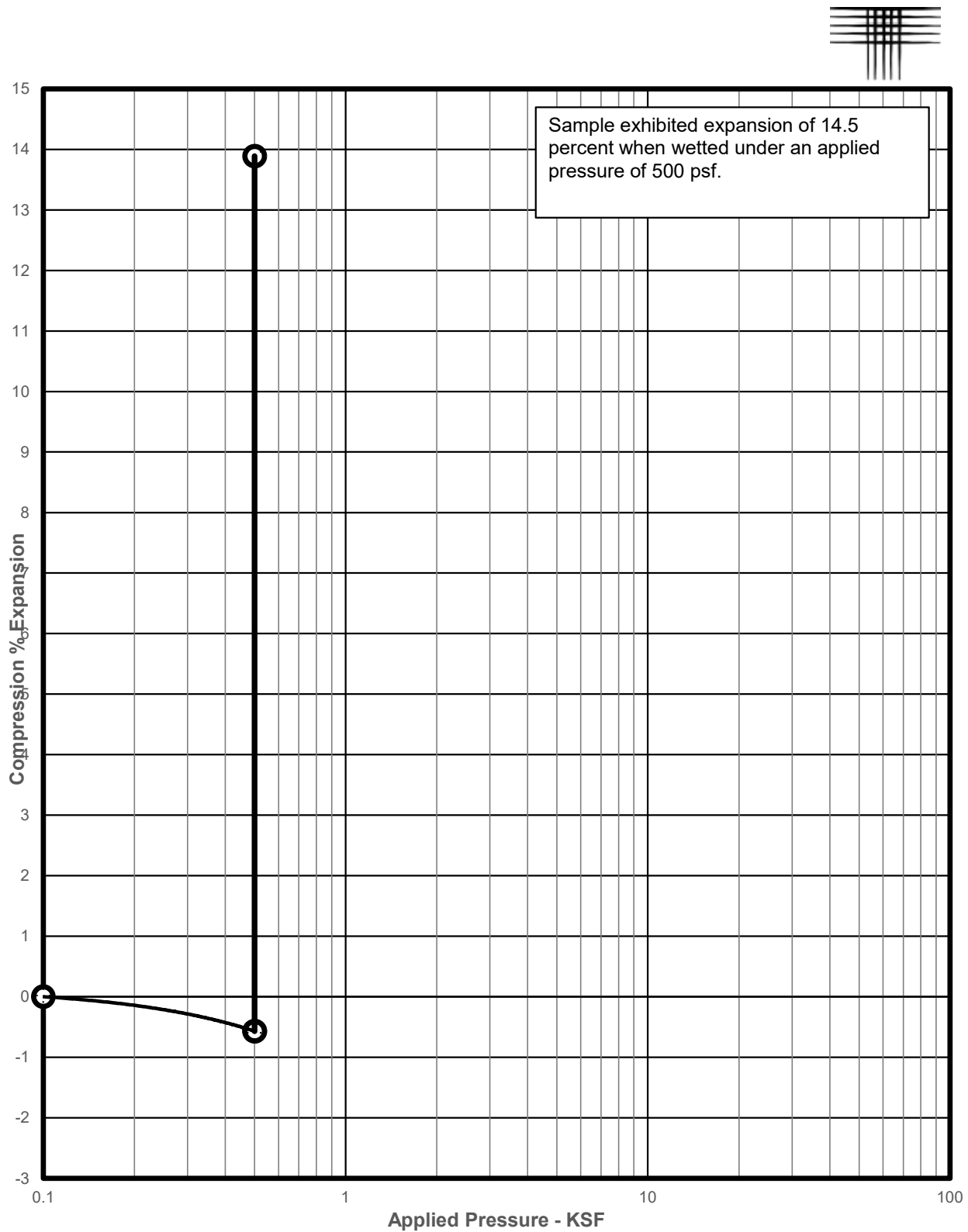


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-1 AT 14 FEET

DRY UNIT WEIGHT: 85 pcf
MOISTURE CONTENT: 33.5 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 2

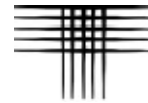
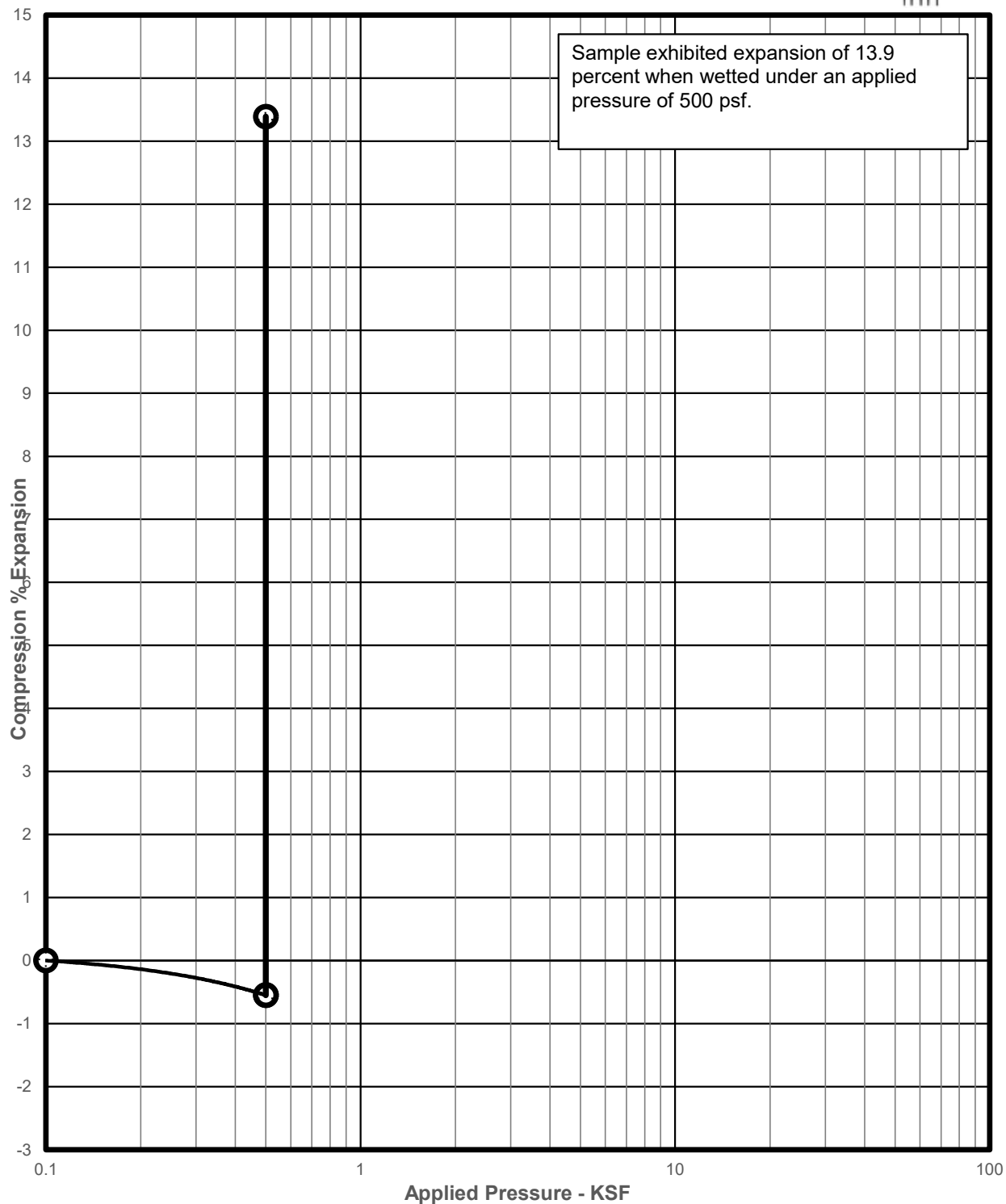


SAMPLE OF: CLAY, SANDY (CL)
 FROM: TH-2 AT 4 FEET

DRY UNIT WEIGHT: 109 pcf
 MOISTURE CONTENT: 15.5 %

PINE CANYON
 PINE CANYON DEVELOPMENT
 CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
 Test Results** FIG. B- 3

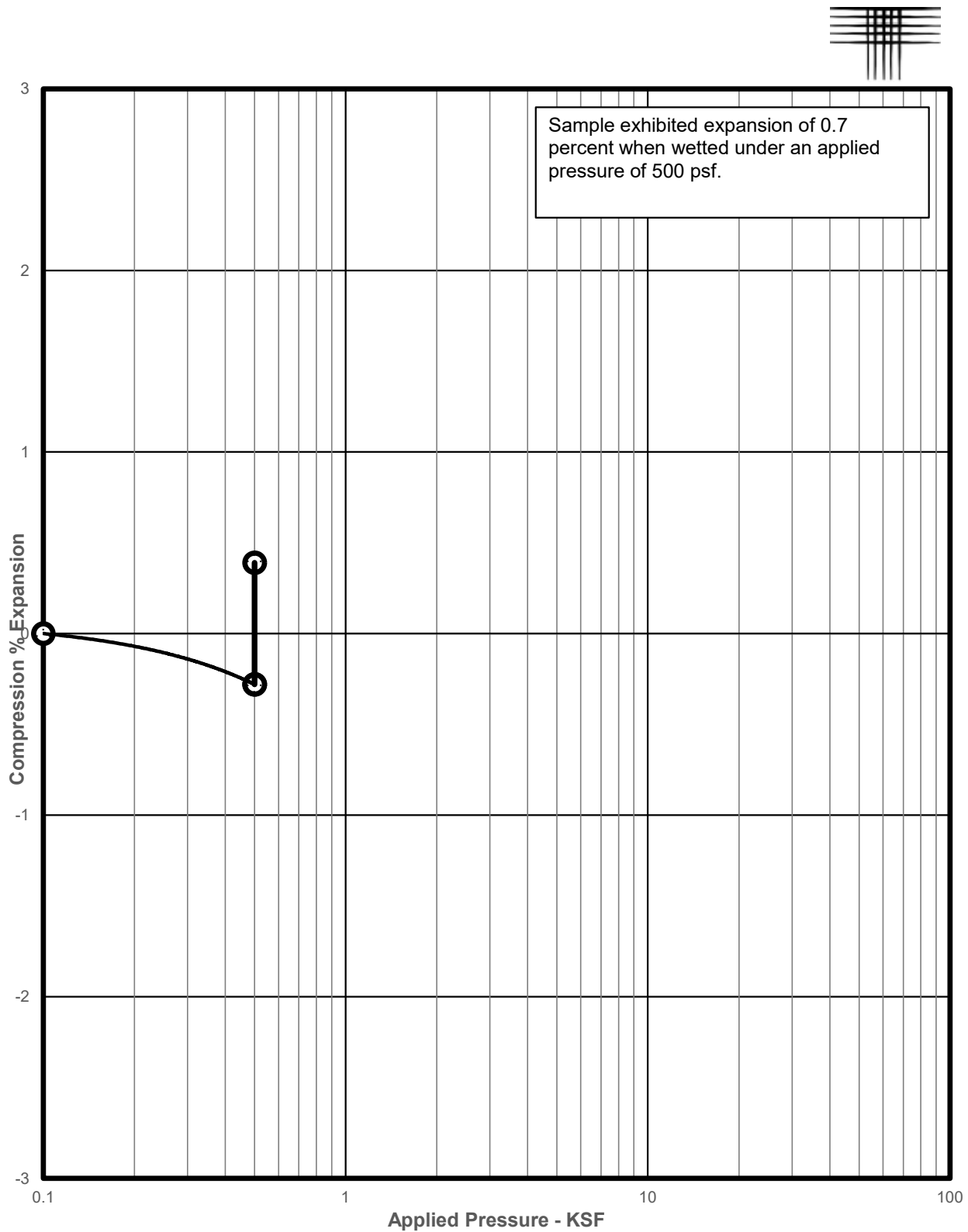


SAMPLE OF: SAND, CLAYEY (SC)
FROM: TH-3 AT 4 FEET

DRY UNIT WEIGHT: 113 pcf
MOISTURE CONTENT: 14.0 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 4

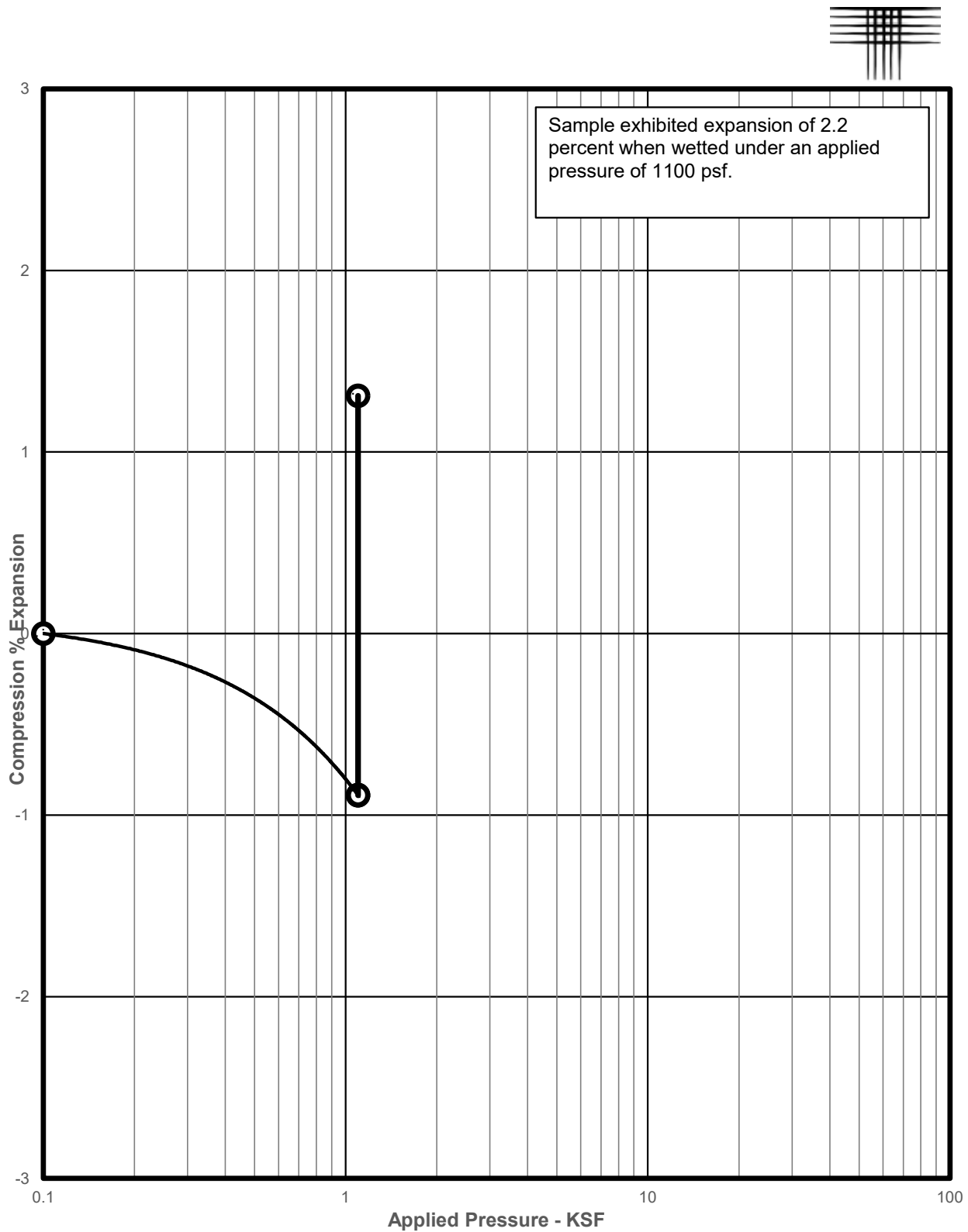


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-4 AT 4 FEET

DRY UNIT WEIGHT: 103 pcf
MOISTURE CONTENT: 6.8 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 5

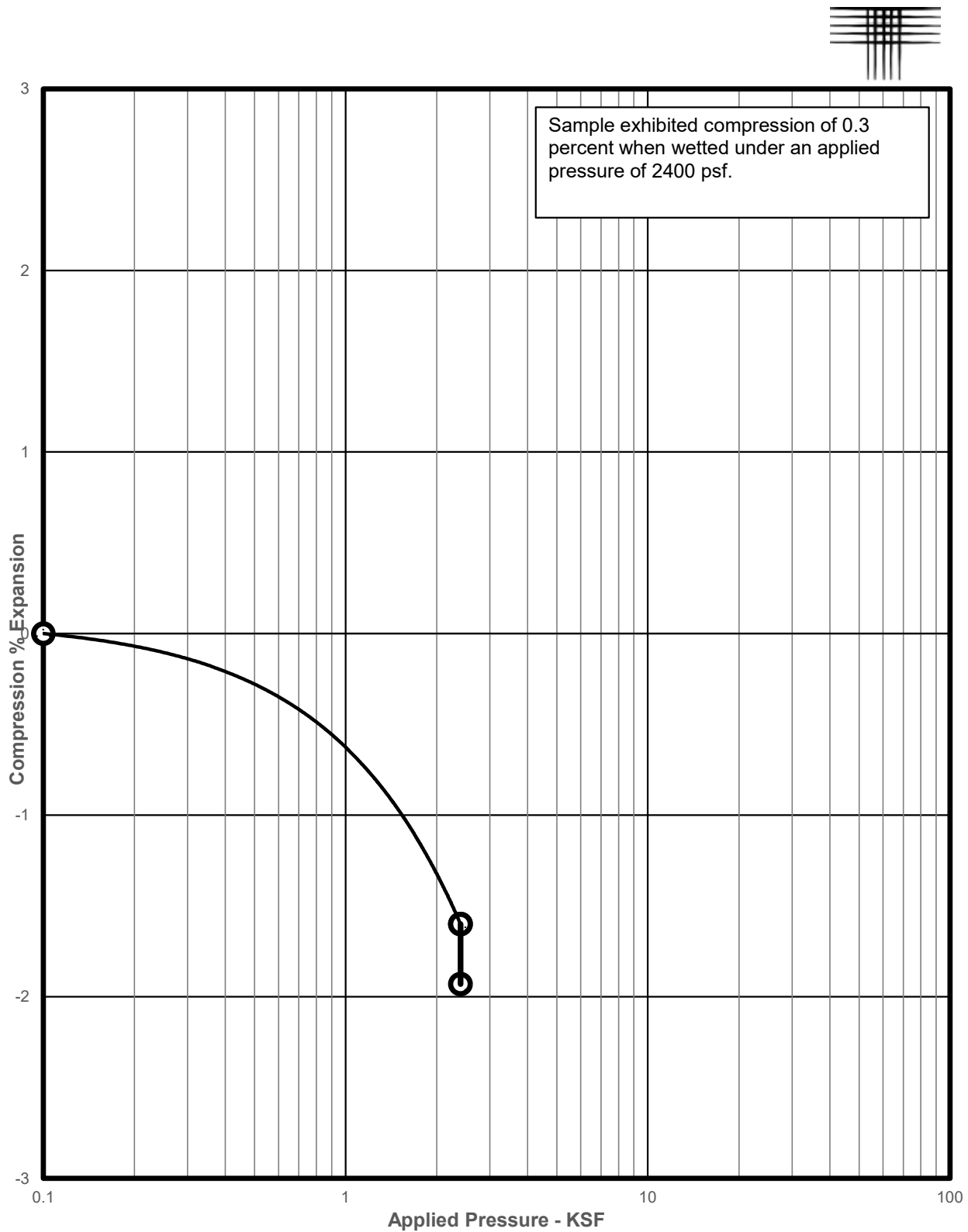


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-4 AT 9 FEET

DRY UNIT WEIGHT: 117 pcf
MOISTURE CONTENT: 7.6 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 6

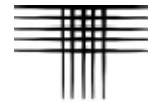
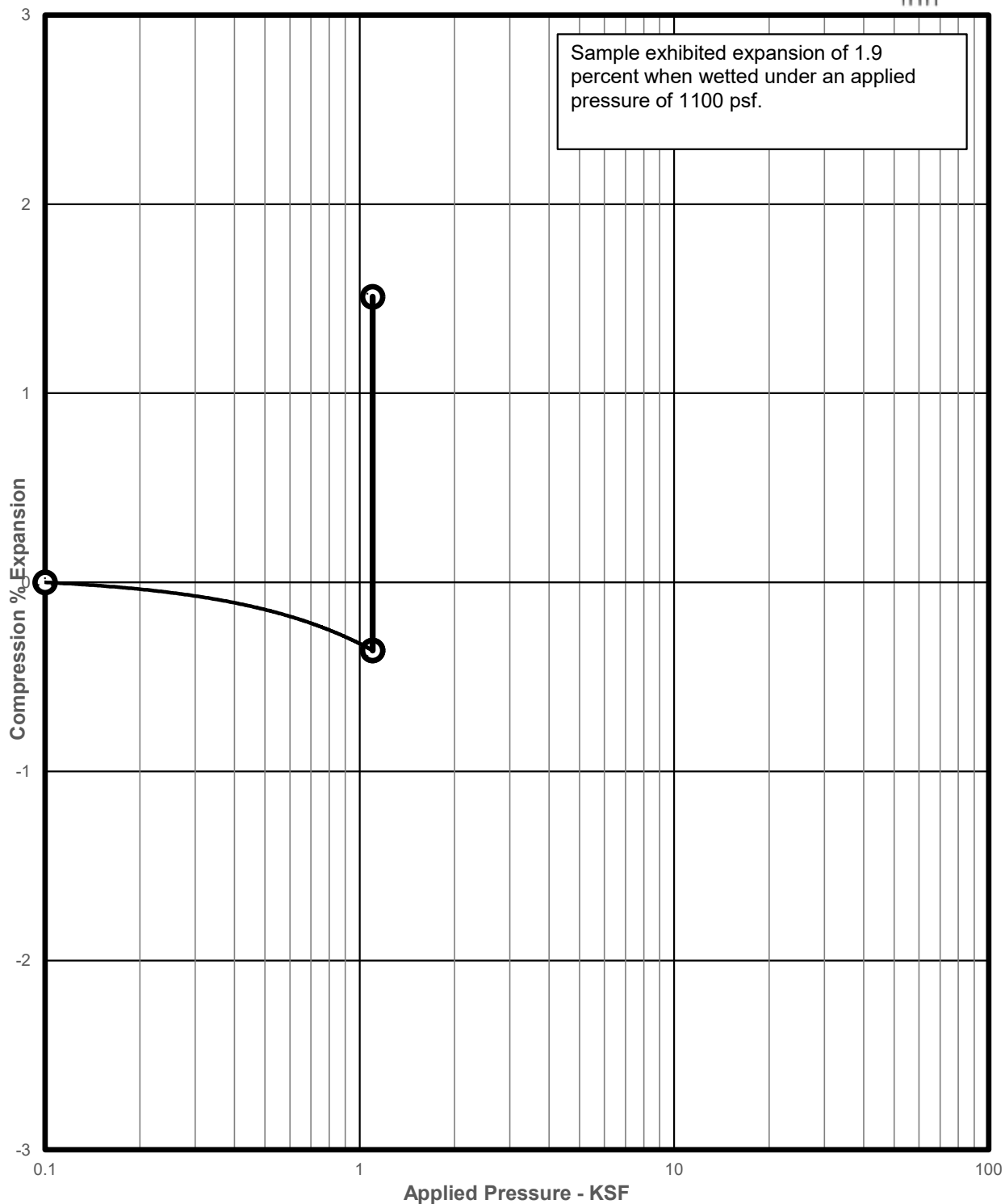


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-4 AT 19 FEET

DRY UNIT WEIGHT: 108 pcf
MOISTURE CONTENT: 15.3 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 7

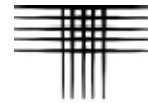
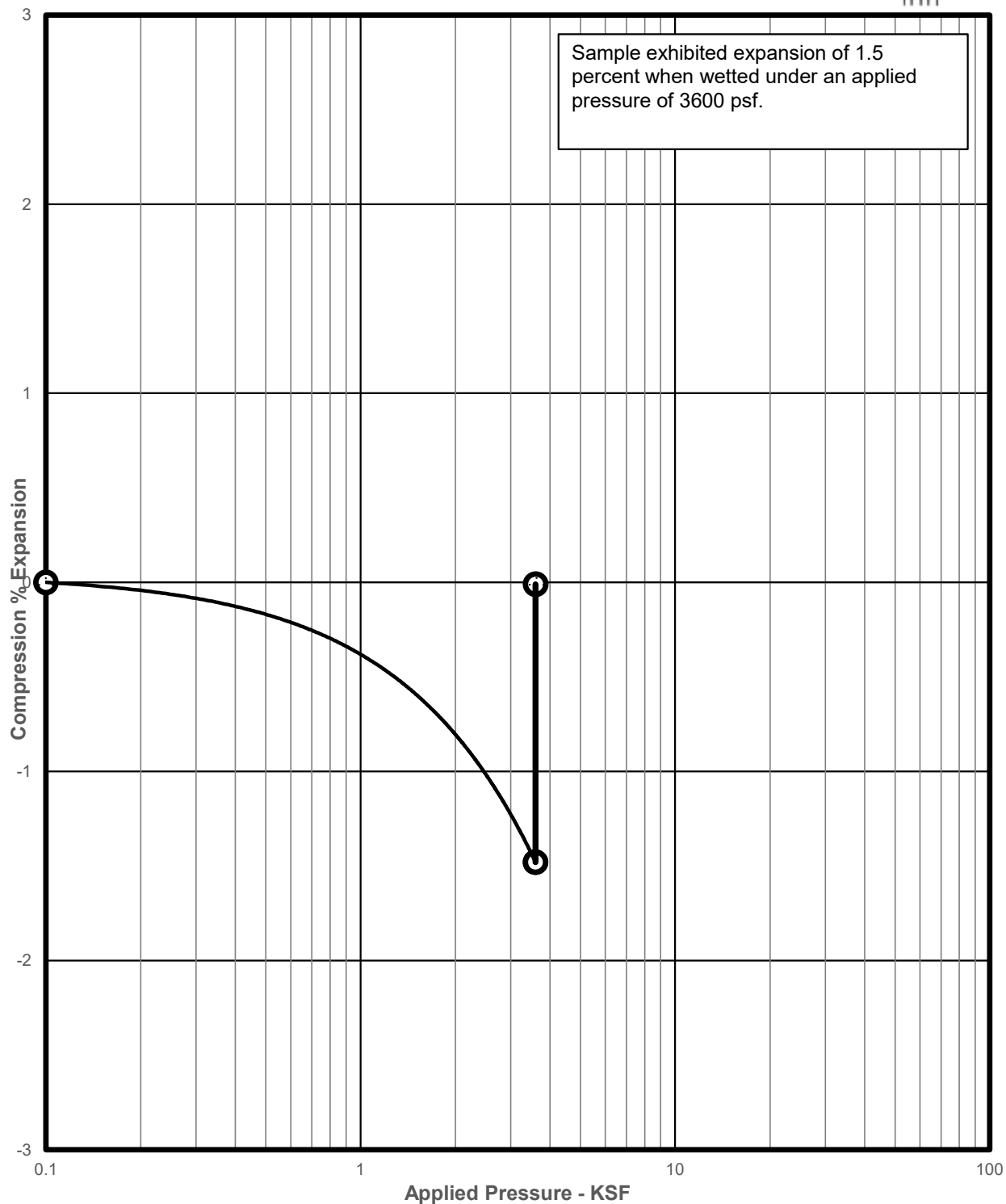


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-5 AT 9 FEET

DRY UNIT WEIGHT: 113 pcf
MOISTURE CONTENT: 9.6 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 8

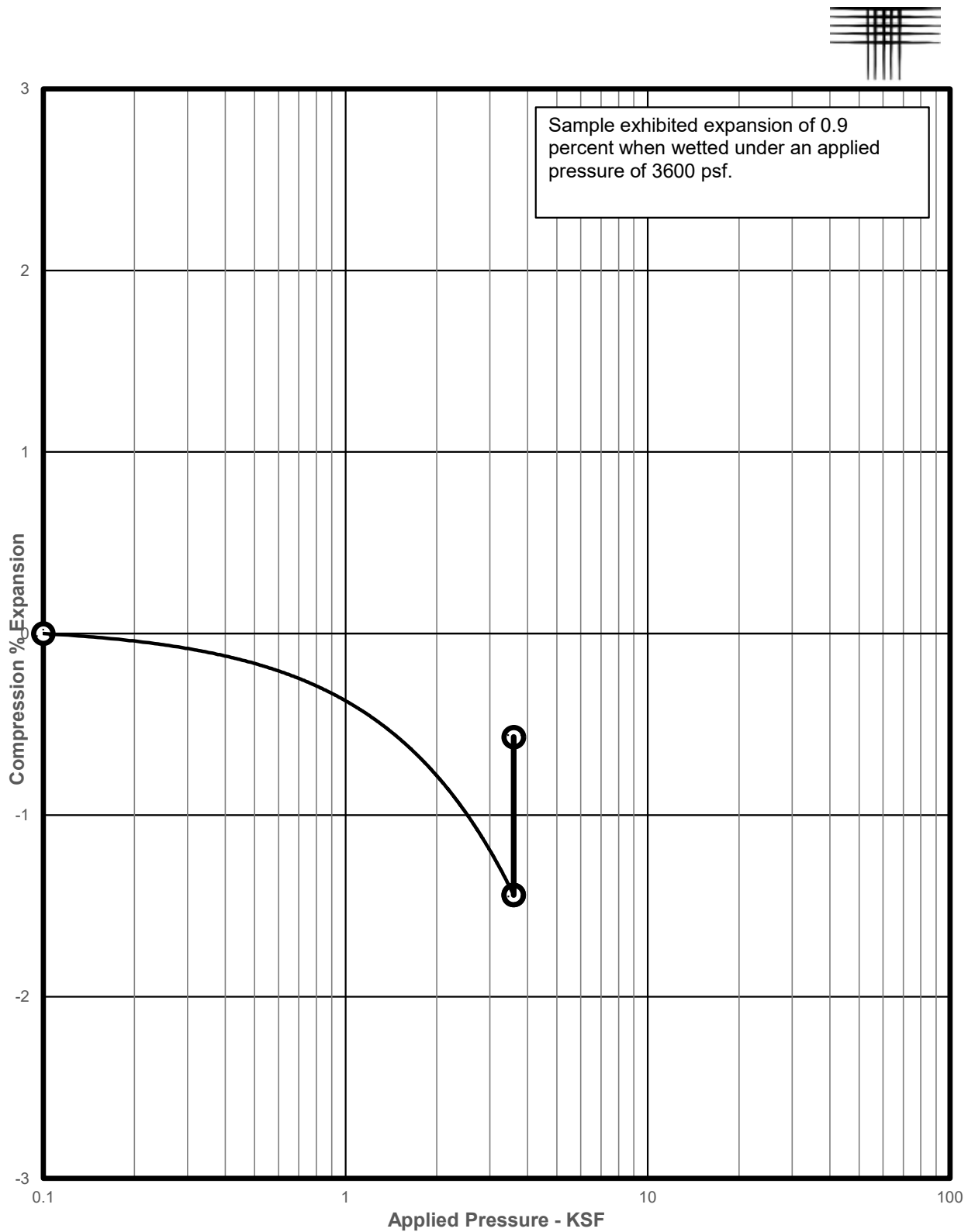


SAMPLE OF: CLAYSTONE
FROM: TH-5 AT 29 FEET

DRY UNIT WEIGHT: 109 pcf
MOISTURE CONTENT: 17.8 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 9

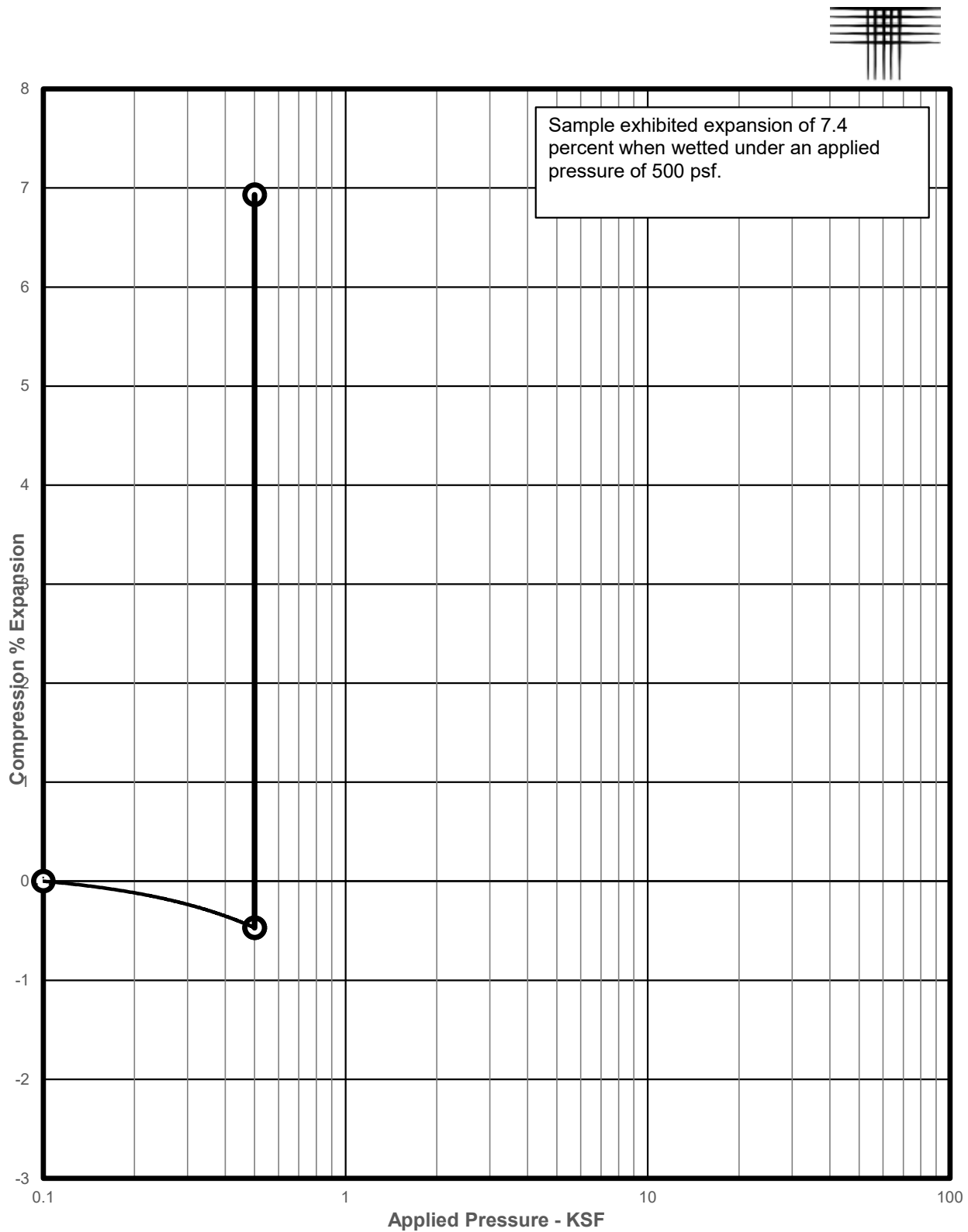


SAMPLE OF: CLAYSTONE
FROM: TH-6 AT 29 FEET

DRY UNIT WEIGHT: 113 pcf
MOISTURE CONTENT: 17.3 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 10

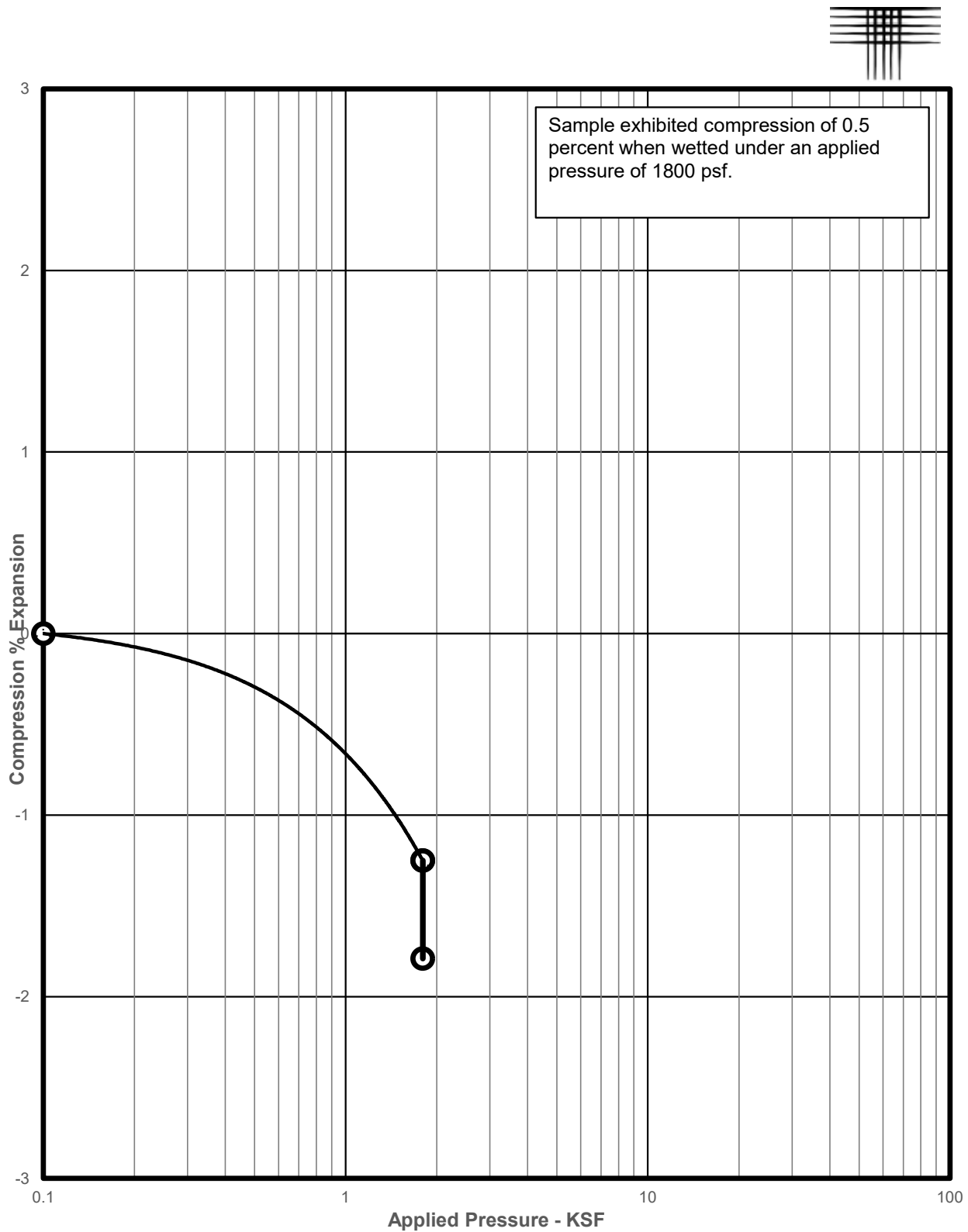


SAMPLE OF: CLAYSTONE
FROM: TH-7 AT 4 FEET

DRY UNIT WEIGHT: 111 pcf
MOISTURE CONTENT: 15.7 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 11

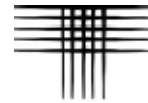
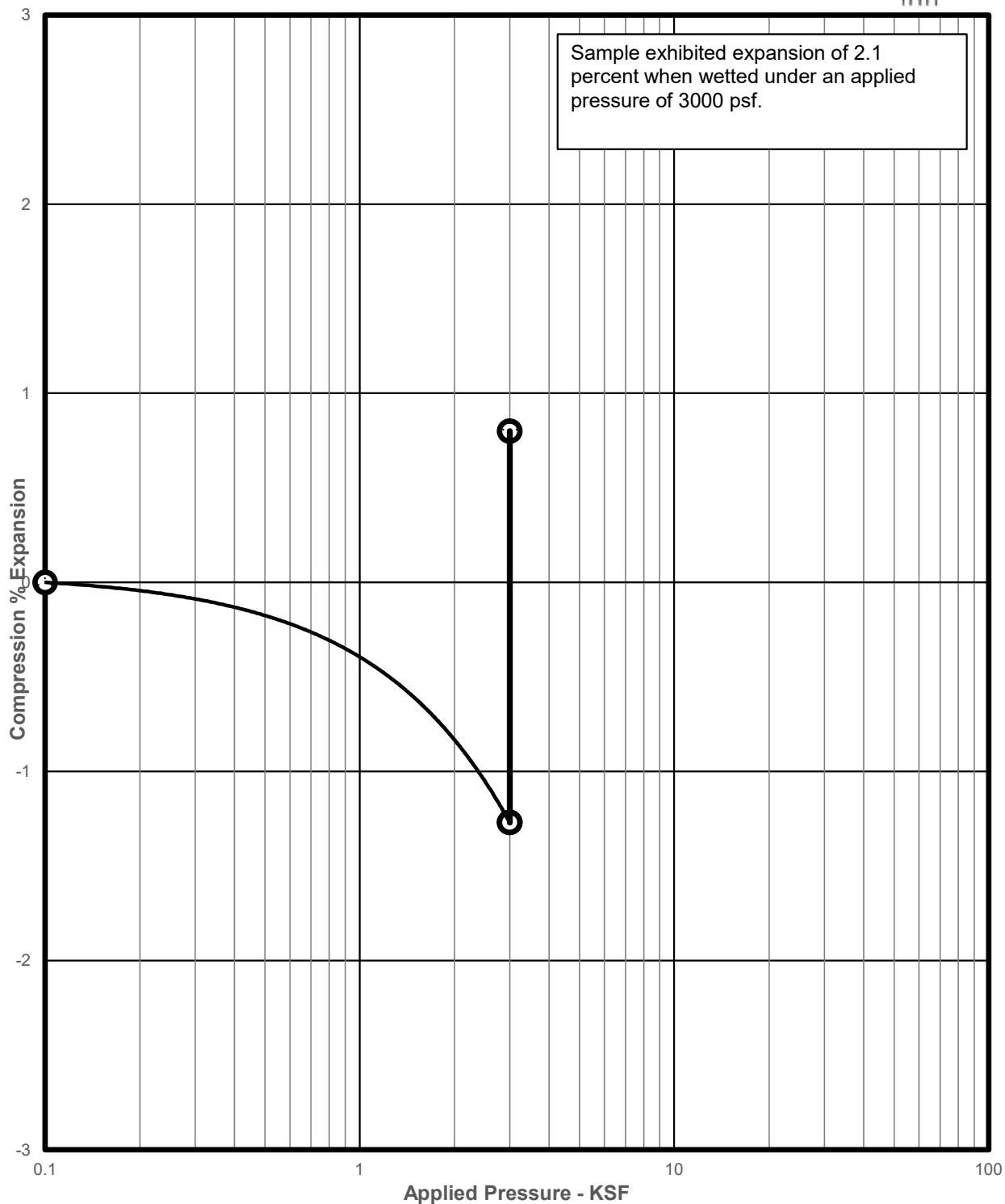


SAMPLE OF: SANDSTONE
FROM: TH-7 AT 14 FEET

DRY UNIT WEIGHT: 108 pcf
MOISTURE CONTENT: 11.1 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 12

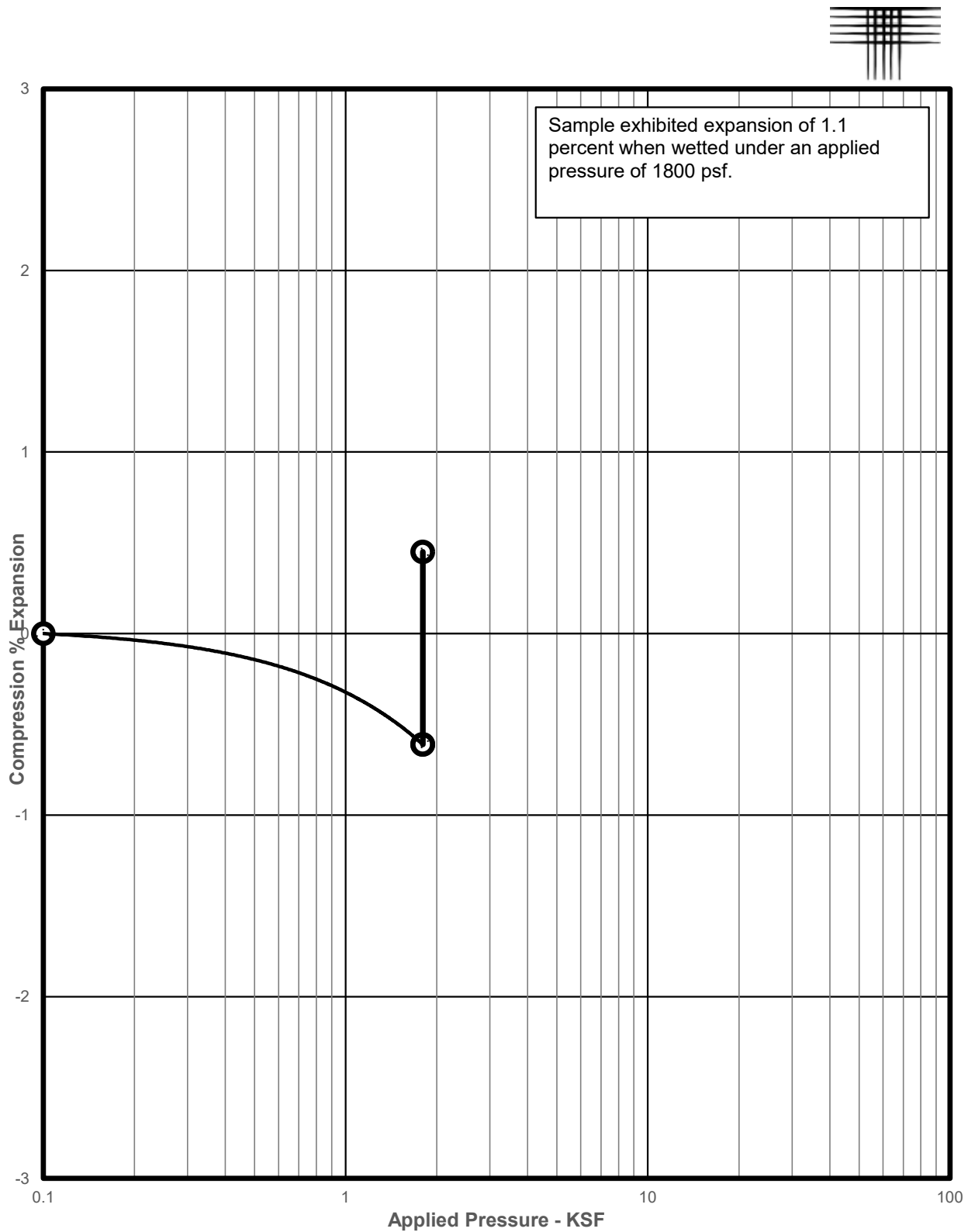


SAMPLE OF: CLAYSTONE
FROM: TH-7 AT 24 FEET

DRY UNIT WEIGHT: 114 pcf
MOISTURE CONTENT: 16.3 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 13

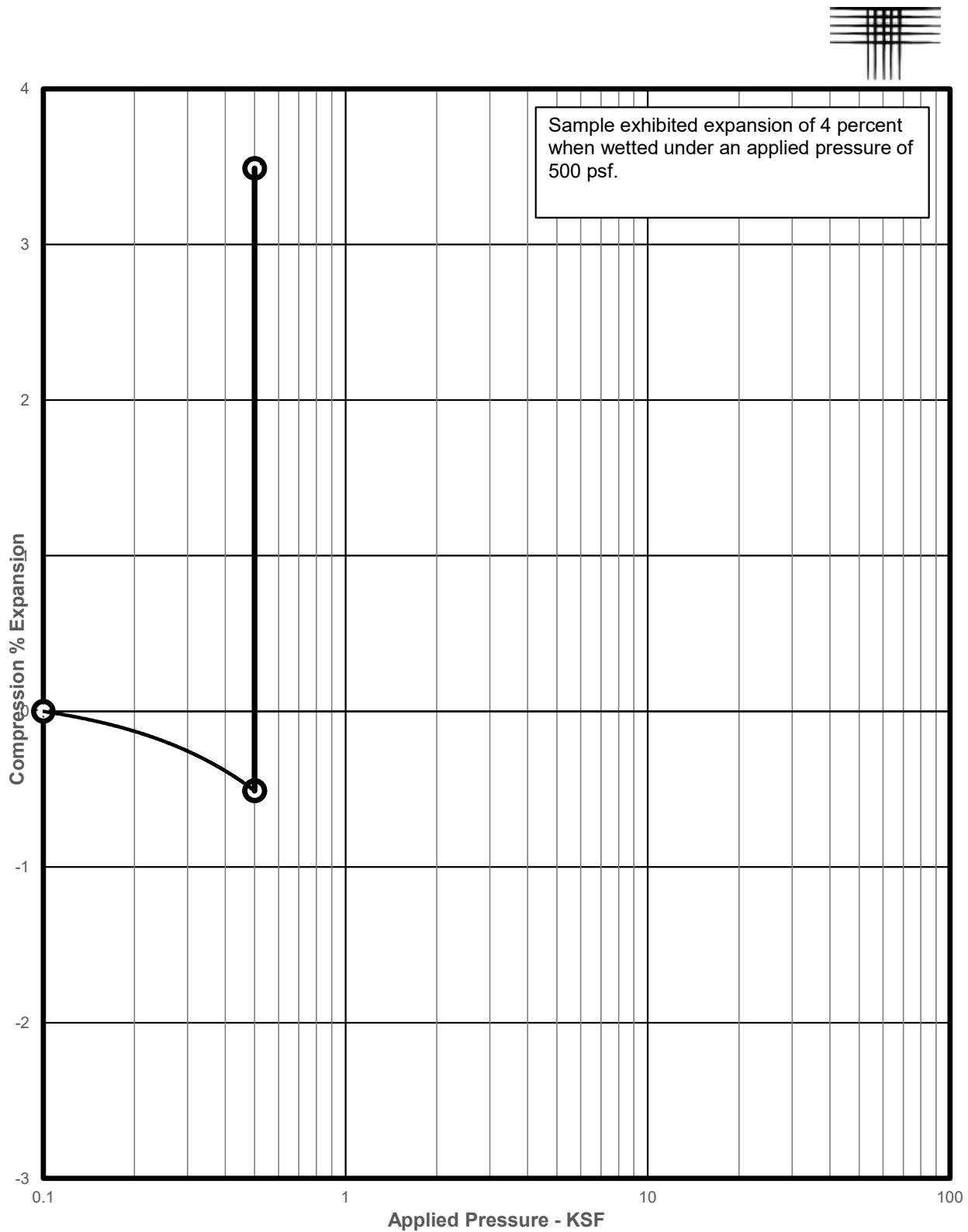


SAMPLE OF: CLAYSTONE
FROM: TH-8 AT 14 FEET

DRY UNIT WEIGHT: 113 pcf
MOISTURE CONTENT: 16.0 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 14

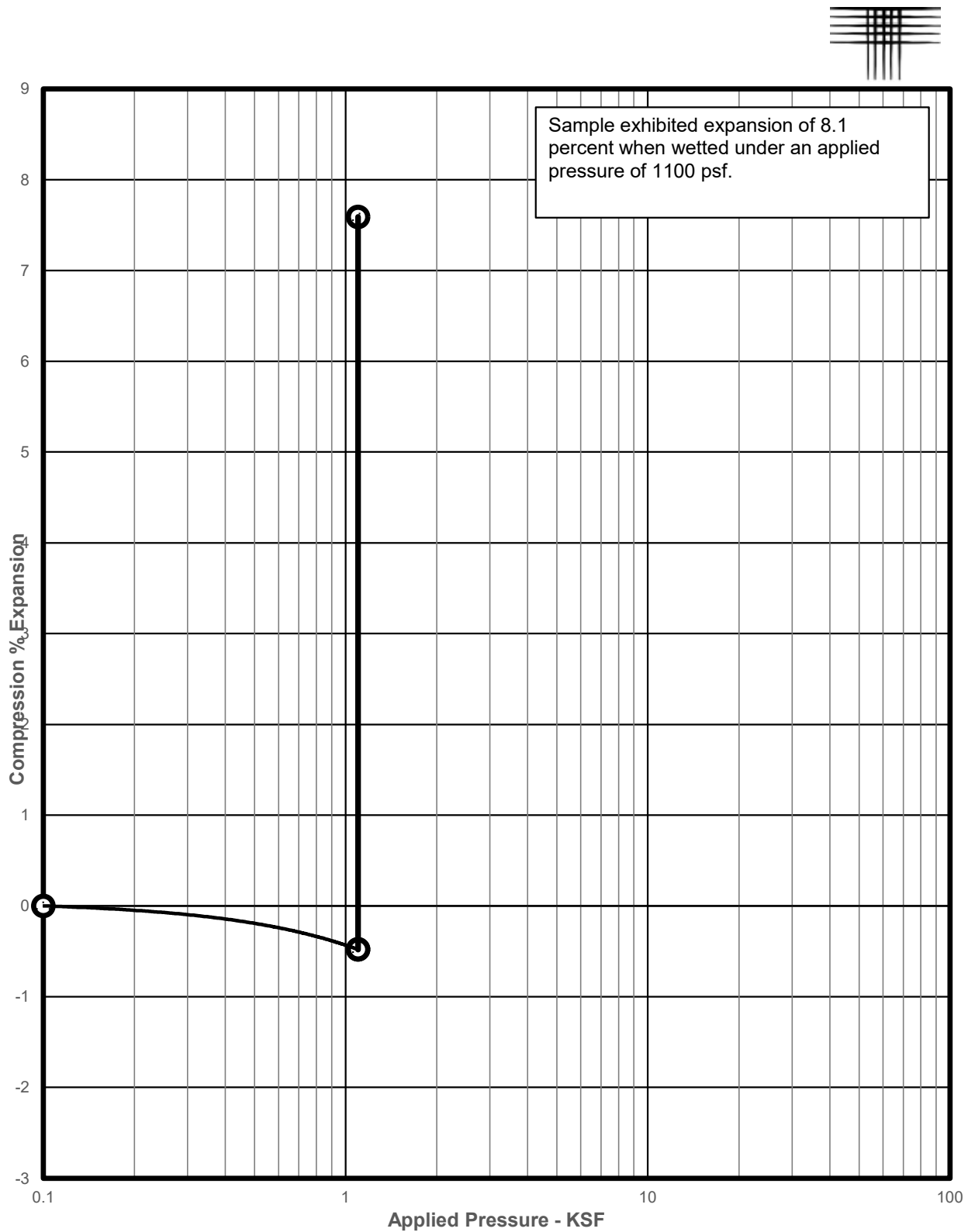


SAMPLE OF: CLAY, SANDY (CL)
 FROM: TH-9 AT 4 FEET

DRY UNIT WEIGHT: 118 pcf
 MOISTURE CONTENT: 13.2 %

PINE CANYON
 PINE CANYON DEVELOPMENT
 CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
 Test Results** FIG. B- 15

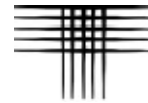
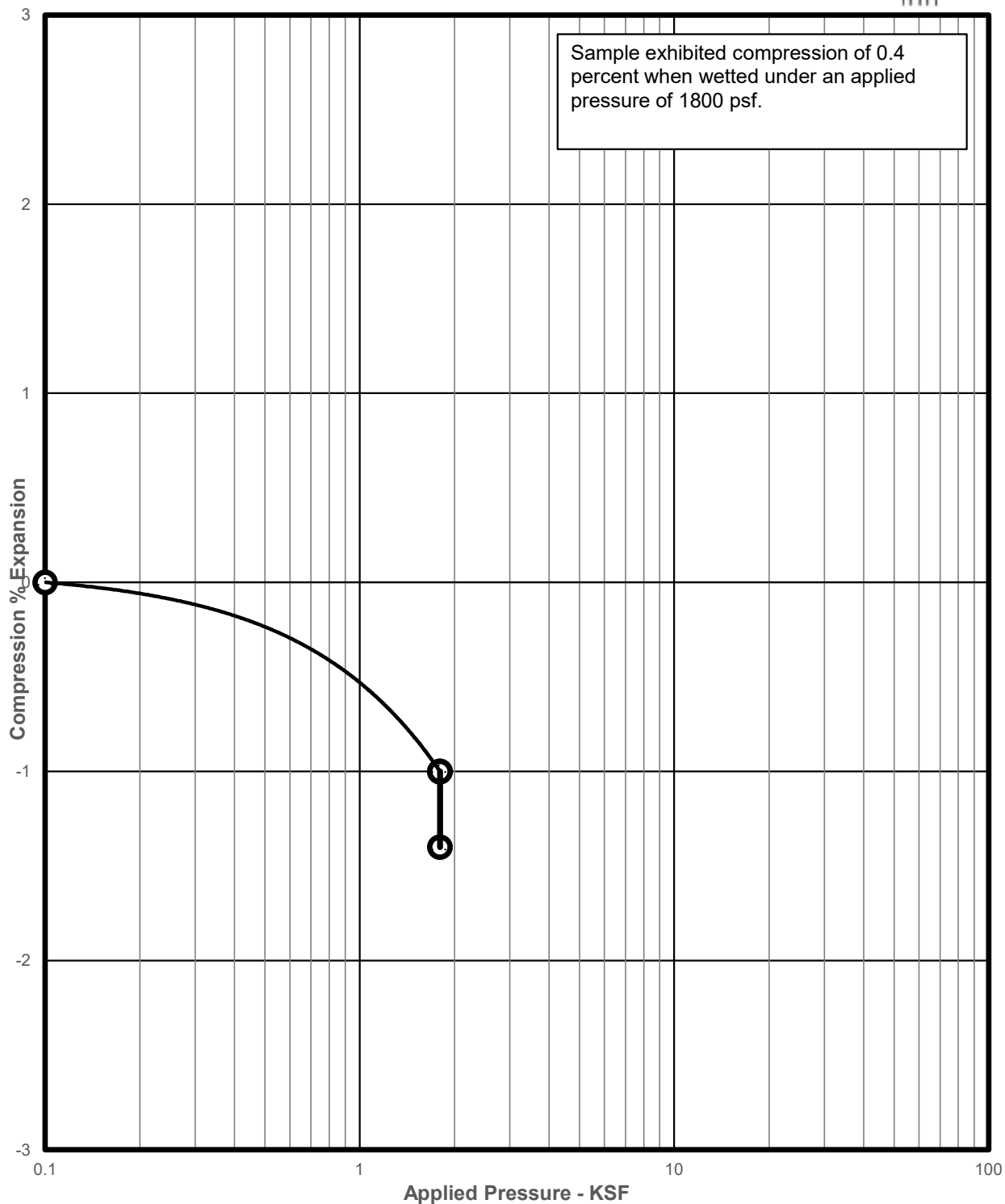


SAMPLE OF: CLAYSTONE
FROM: TH-9 AT 9 FEET

DRY UNIT WEIGHT: 118 pcf
MOISTURE CONTENT: 12.5 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 16

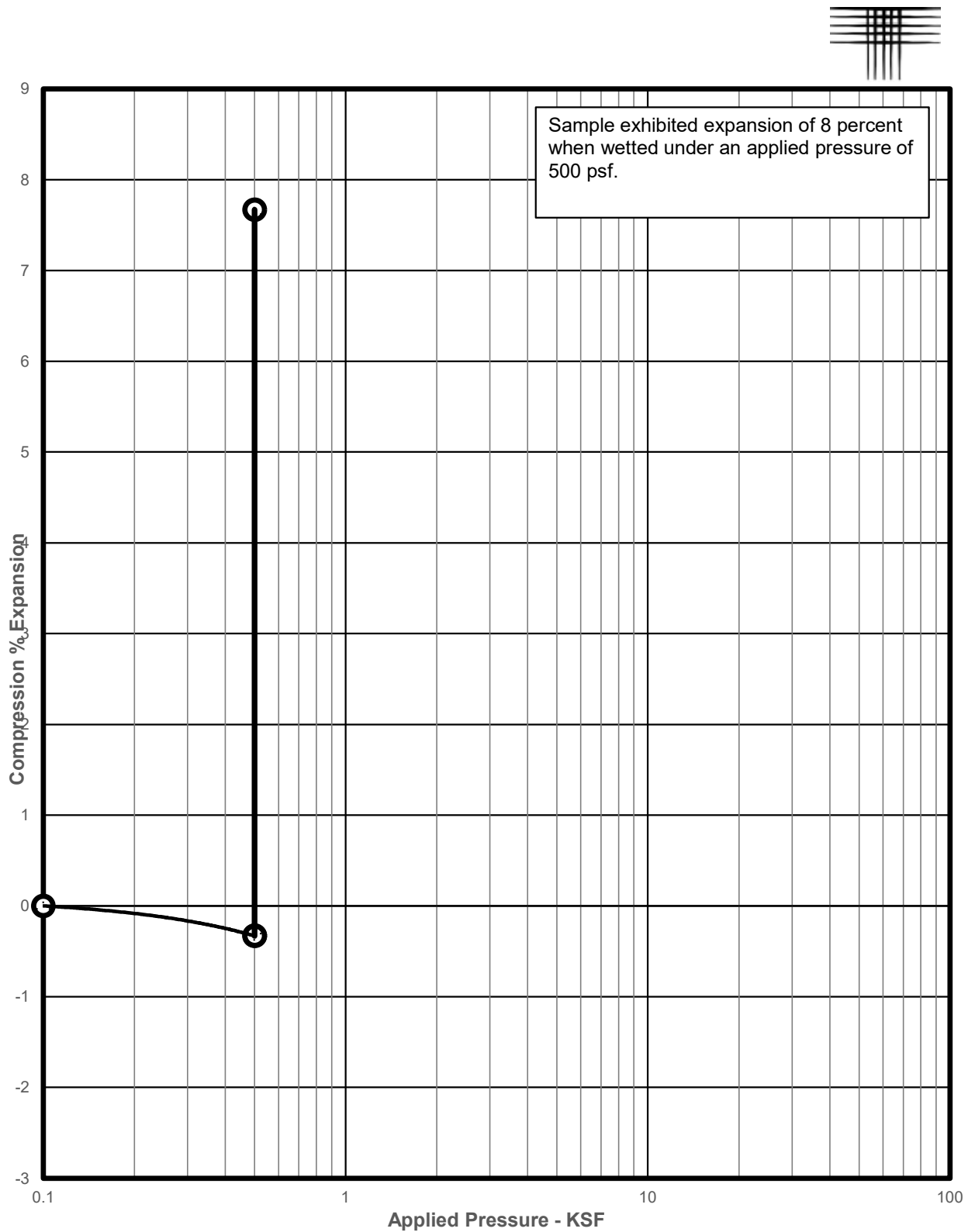


SAMPLE OF: CLAYSTONE
FROM: TH-9 AT 14 FEET

DRY UNIT WEIGHT: 110 pcf
MOISTURE CONTENT: 9.9 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 17

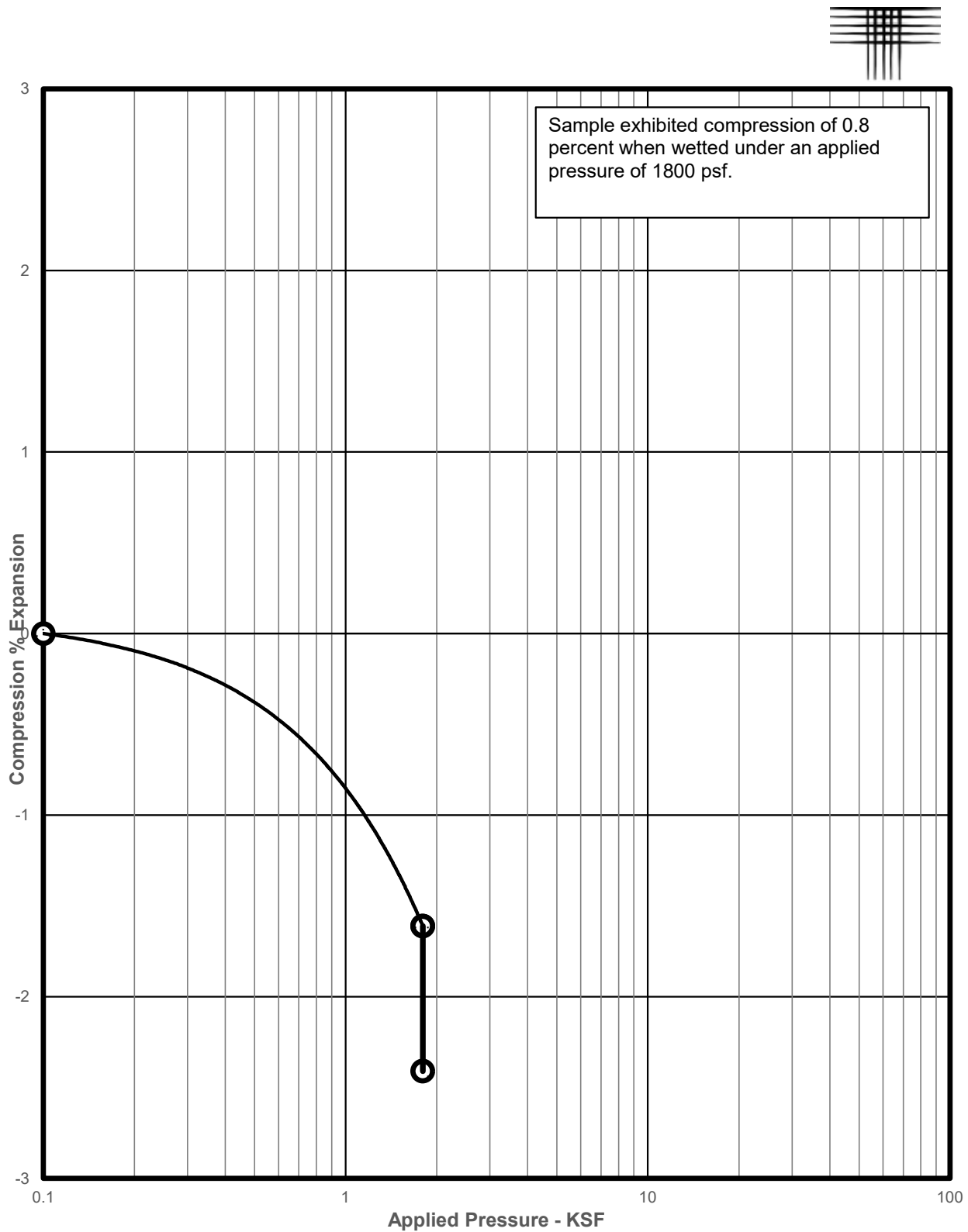


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-10 AT 4 FEET

DRY UNIT WEIGHT: 120 pcf
MOISTURE CONTENT: 9.0 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 18

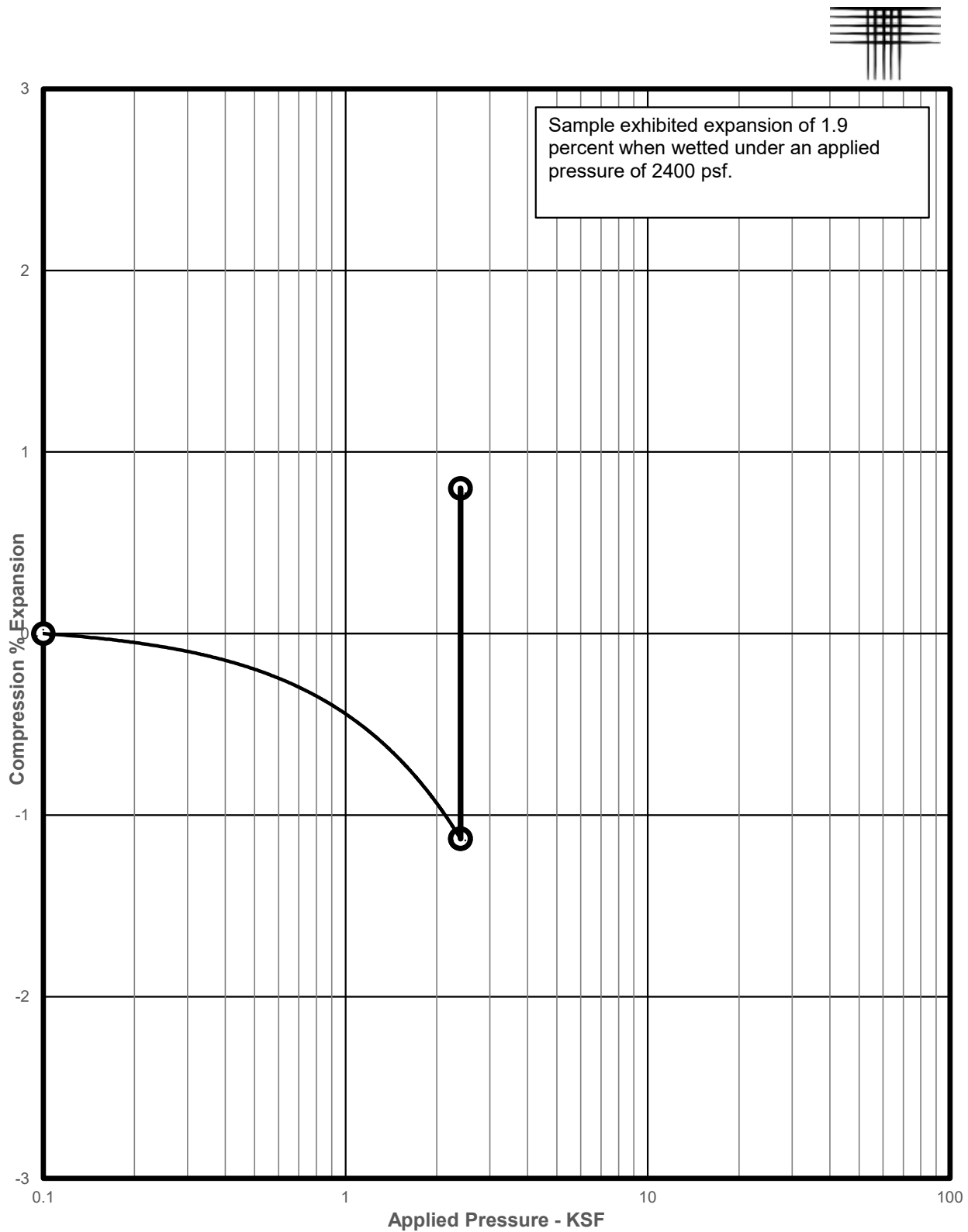


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-10 AT 14 FEET

DRY UNIT WEIGHT: 95 pcf
MOISTURE CONTENT: 12.8 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 19

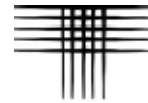
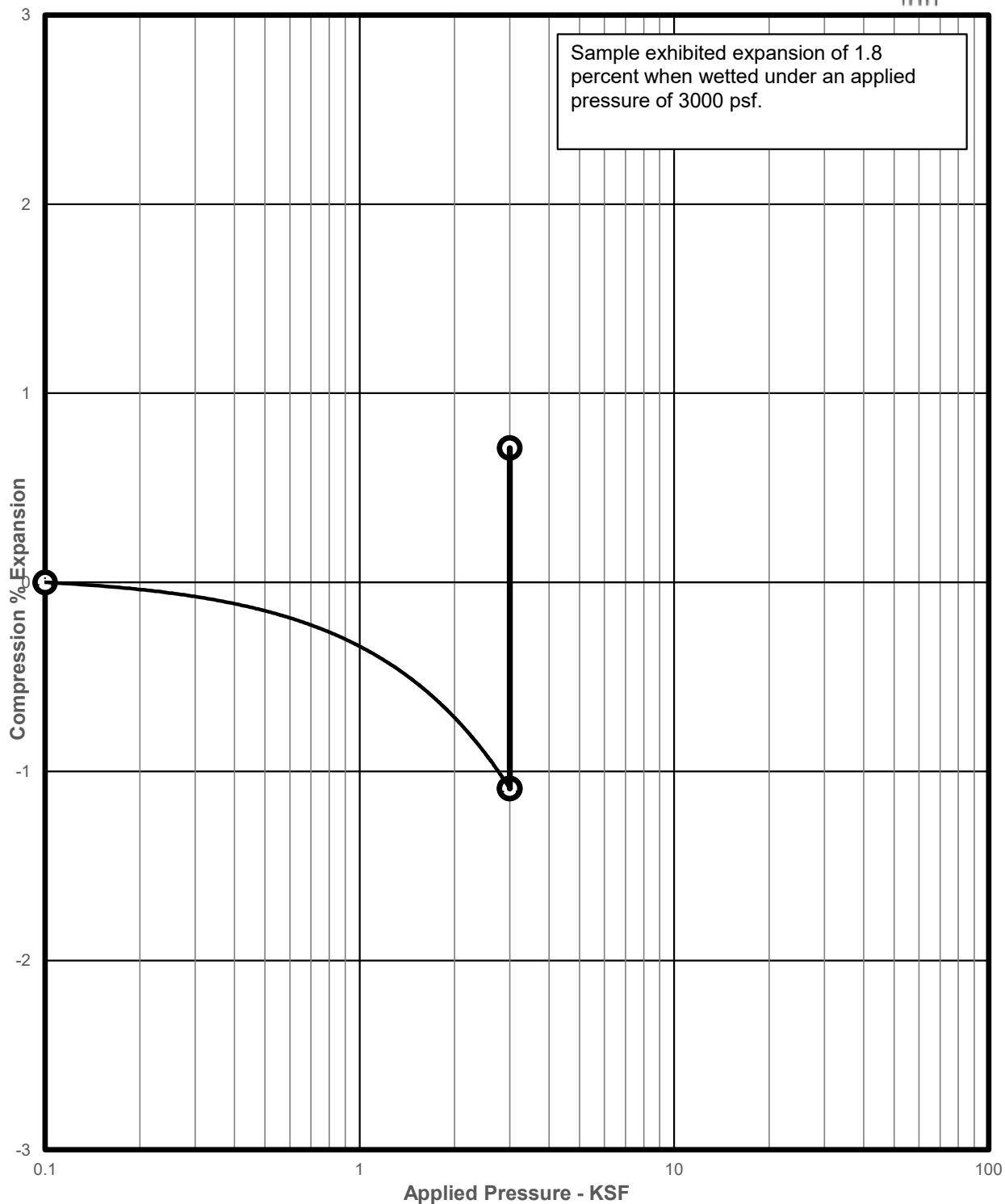


SAMPLE OF: CLAYSTONE
FROM: TH-10 AT 19 FEET

DRY UNIT WEIGHT: 117 pcf
MOISTURE CONTENT: 14.4 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 20

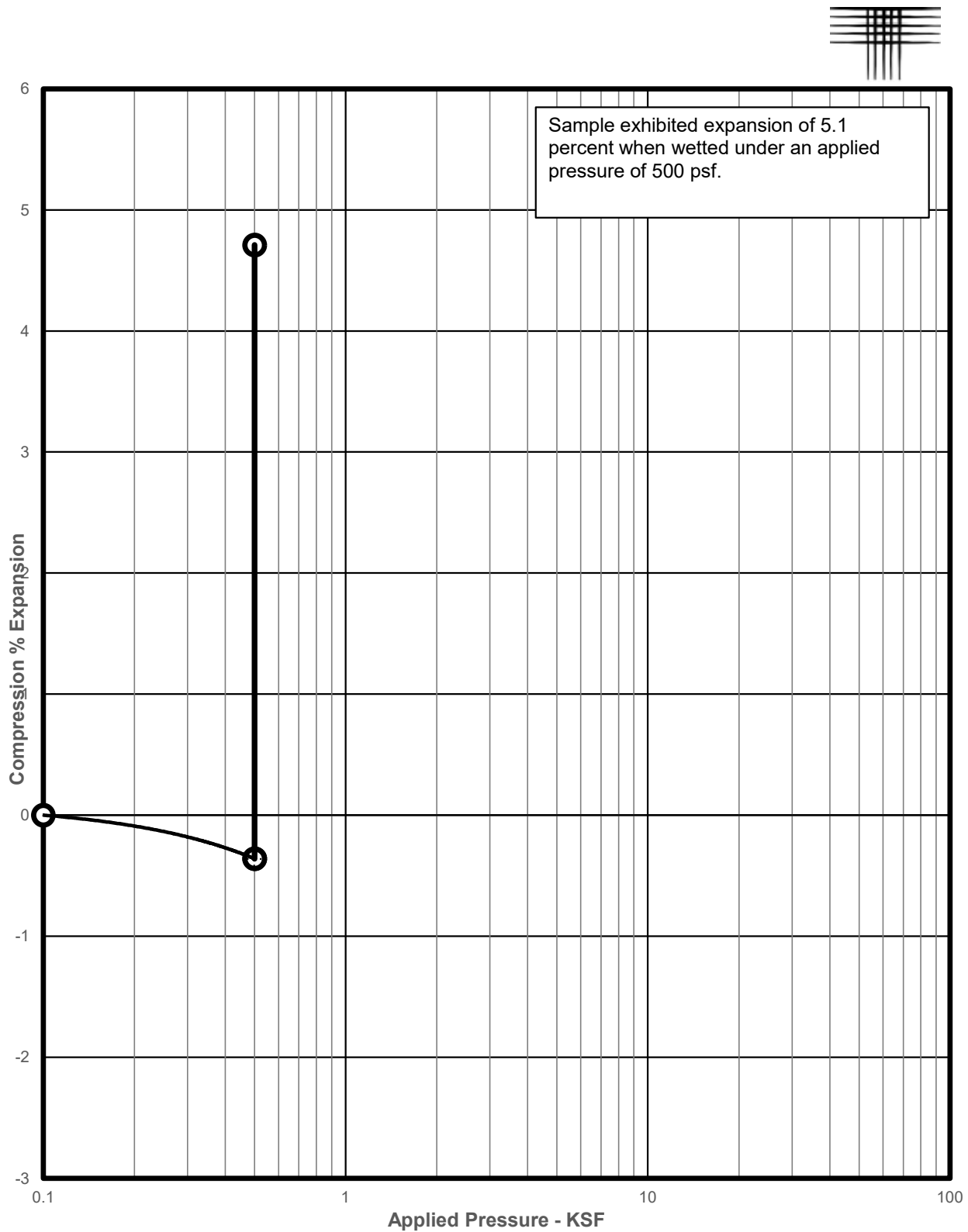


SAMPLE OF: CLAYSTONE
FROM: TH-13 AT 24 FEET

DRY UNIT WEIGHT: 113 pcf
MOISTURE CONTENT: 15.2 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 21

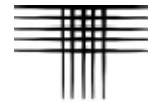
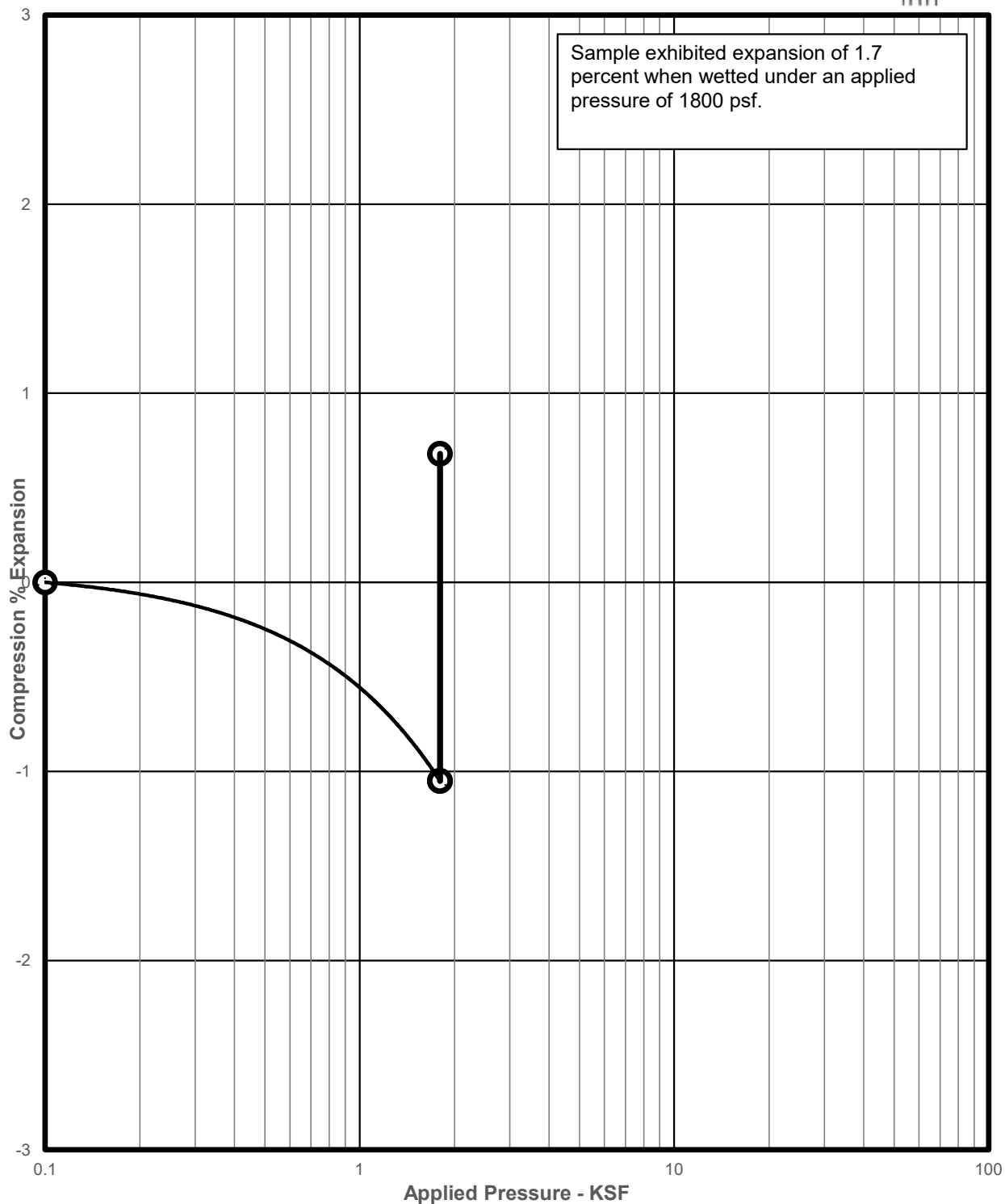


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-14 AT 4 FEET

DRY UNIT WEIGHT: 111 pcf
MOISTURE CONTENT: 9.5 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 22

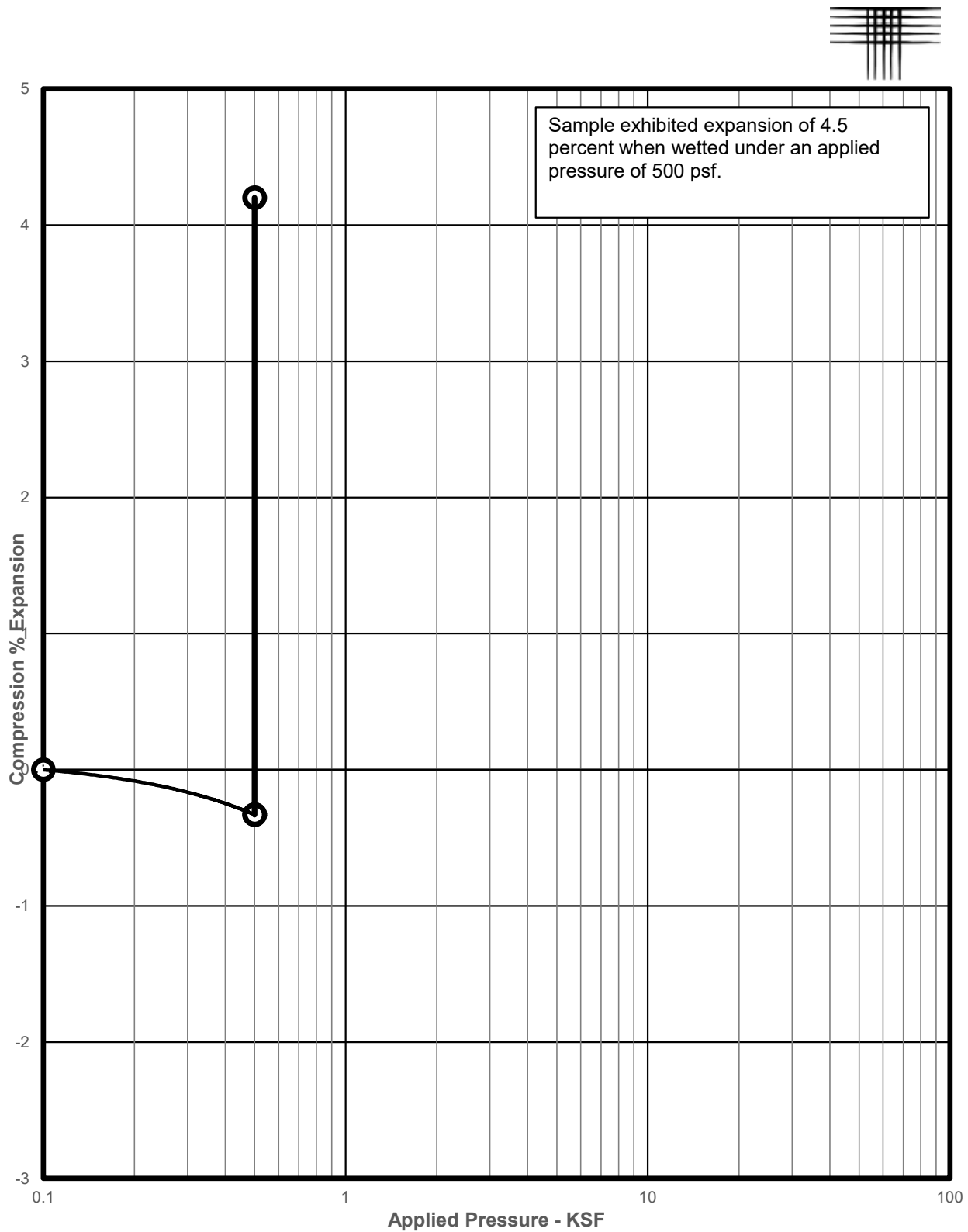


SAMPLE OF: CLAYSTONE
FROM: TH-14 AT 14 FEET

DRY UNIT WEIGHT: 113 pcf
MOISTURE CONTENT: 17.9 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 23

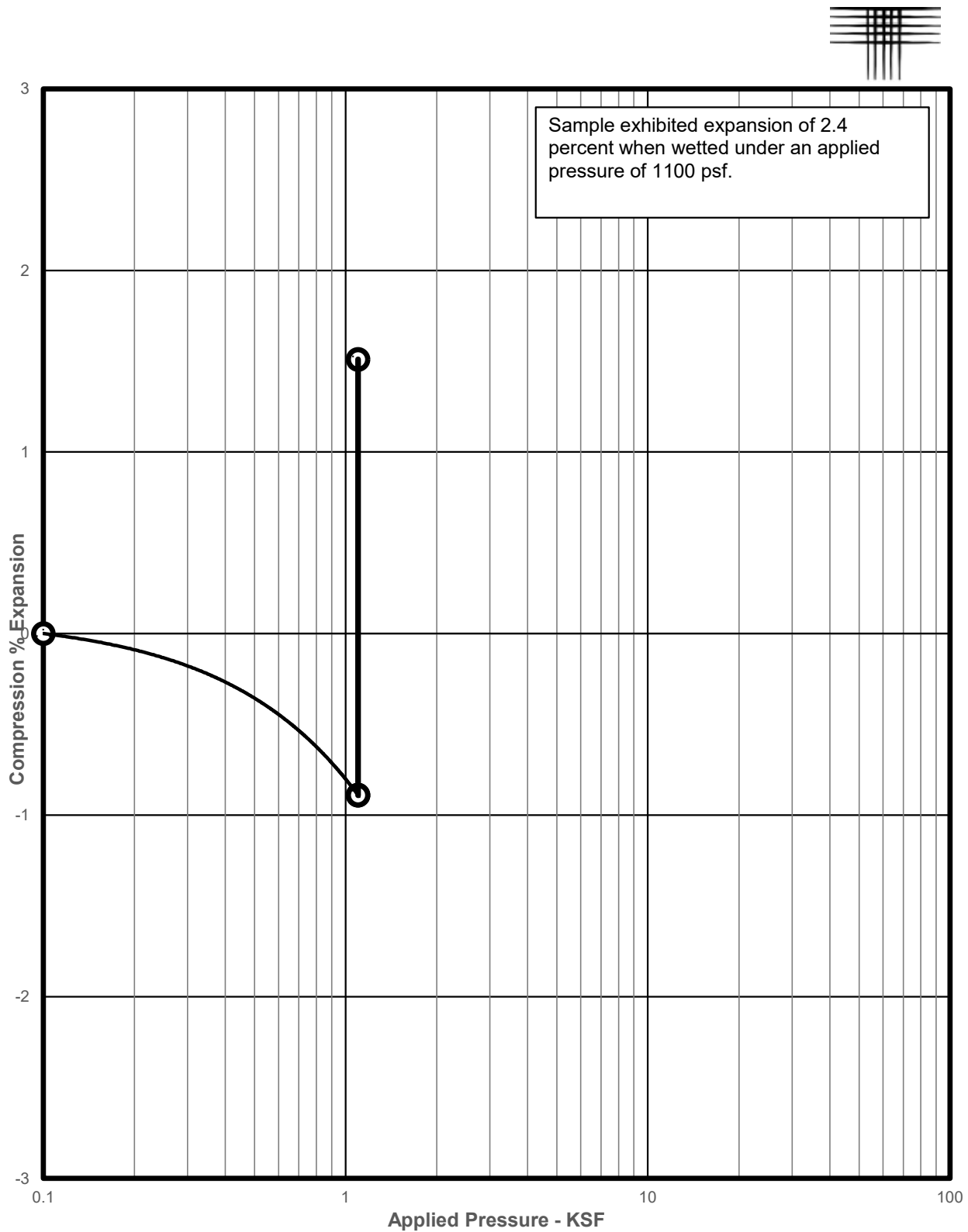


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-15 AT 4 FEET

DRY UNIT WEIGHT: 109 pcf
MOISTURE CONTENT: 9.3 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 24

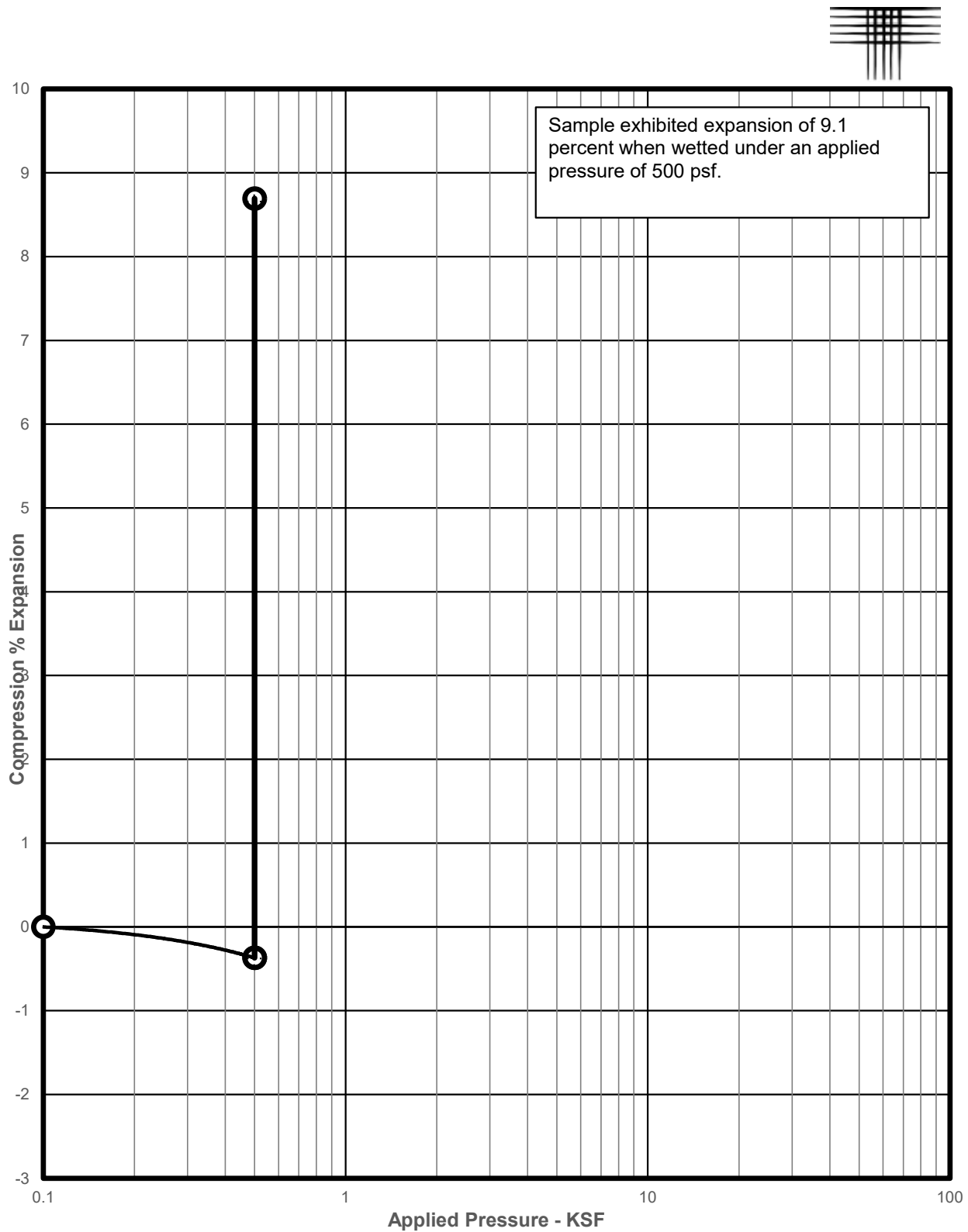


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-15 AT 9 FEET

DRY UNIT WEIGHT: 111 pcf
MOISTURE CONTENT: 11.0 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 25

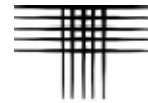
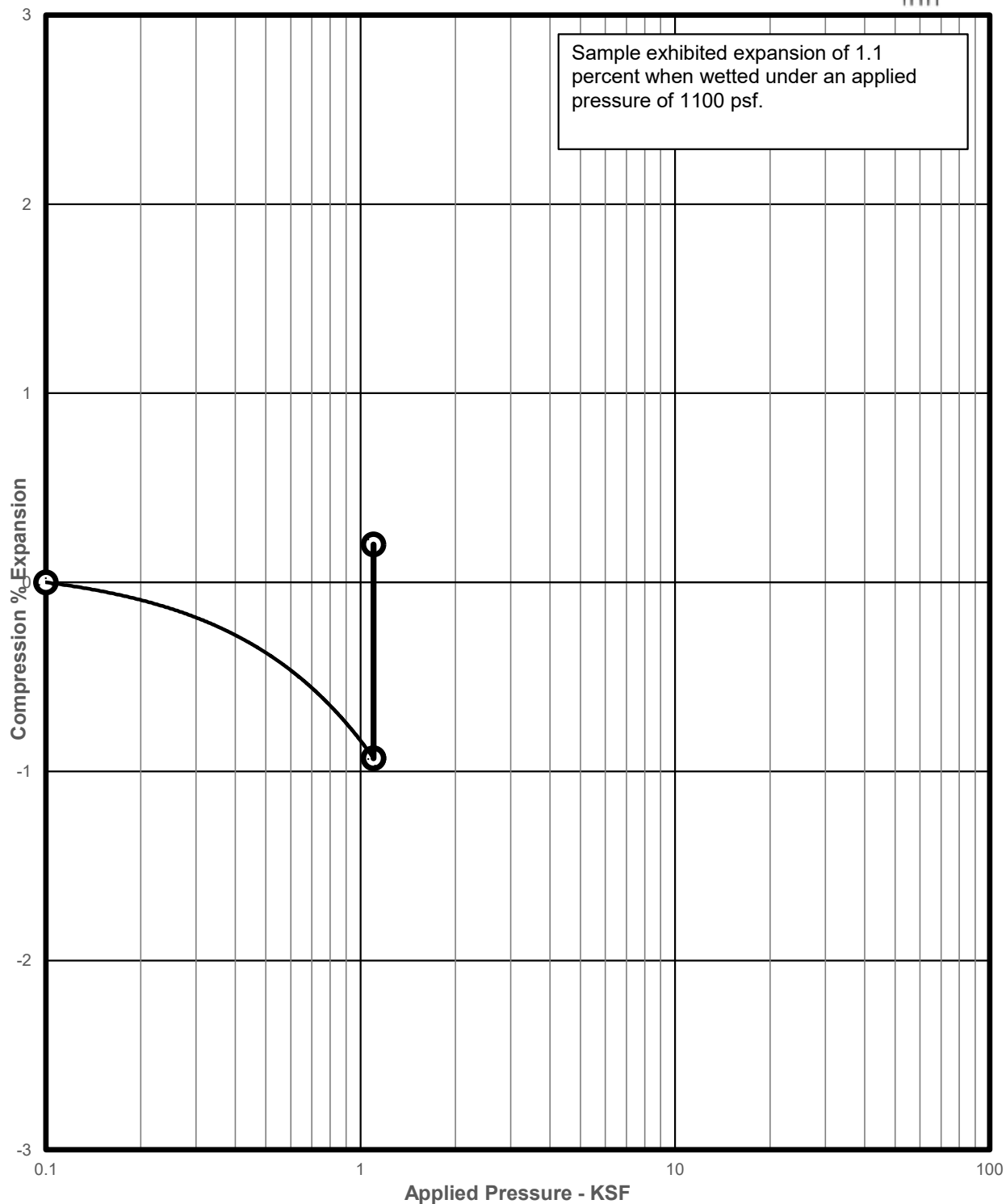


SAMPLE OF: CLAY, SANDY (CL)
 FROM: TH-16 AT 4 FEET

DRY UNIT WEIGHT: 120 pcf
 MOISTURE CONTENT: 13.2 %

PINE CANYON
 PINE CANYON DEVELOPMENT
 CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
 Test Results** FIG. B- 26

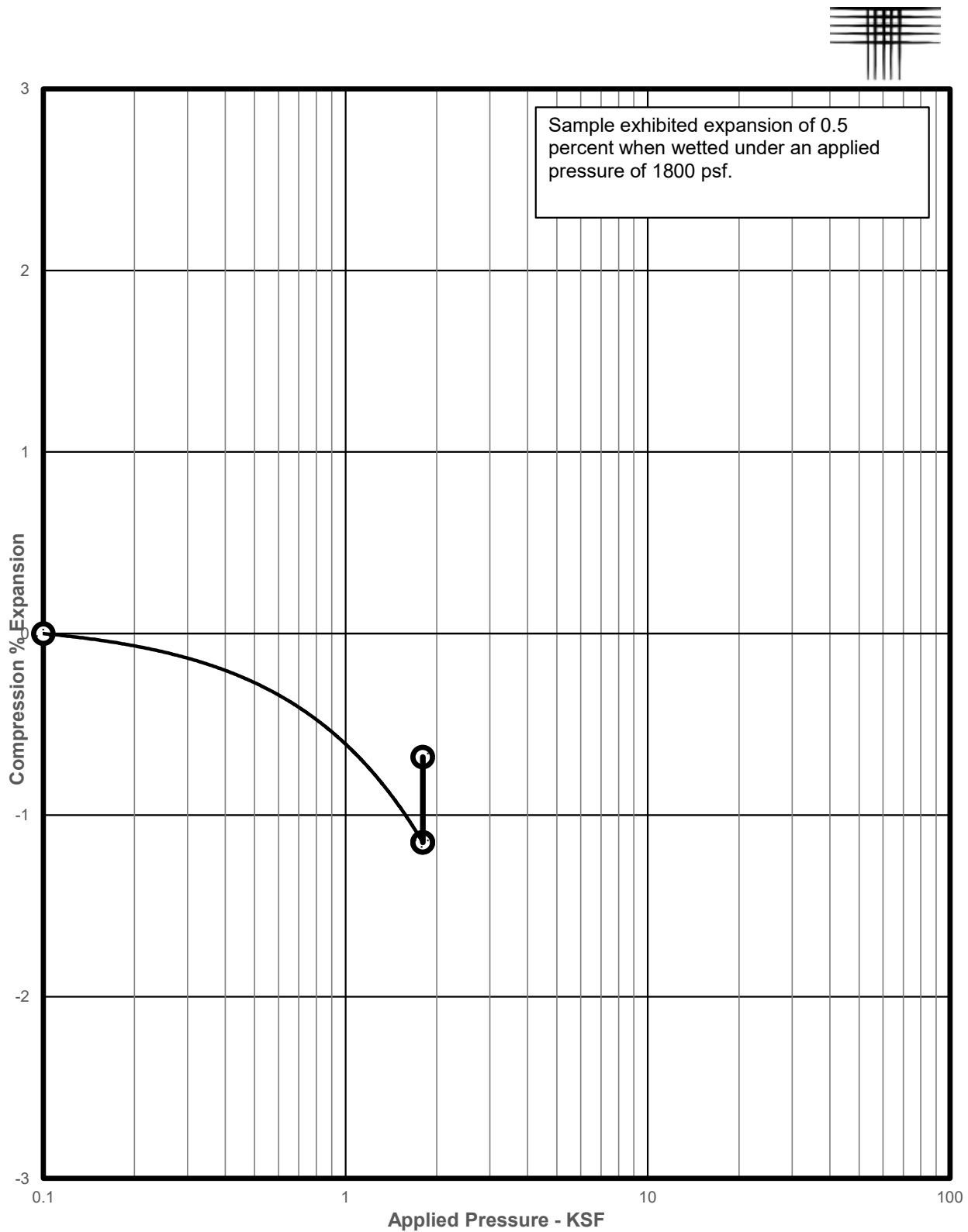


SAMPLE OF: CLAY, SANDY (CL)
FROM: TH-16 AT 9 FEET

DRY UNIT WEIGHT: 115 pcf
MOISTURE CONTENT: 7.9 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 27



SAMPLE OF: CLAYSTONE
FROM: TH-16 AT 14 FEET

DRY UNIT WEIGHT: 118 pcf
MOISTURE CONTENT: 10.9 %

PINE CANYON
PINE CANYON DEVELOPMENT
CTLJT PROJECT NO. DN51,162-115-R1

**Swell Consolidation
Test Results** FIG. B- 28

TABLE B - I

SUMMARY OF LABORATORY TEST RESULTS



BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL TEST DATA			ATTERBERG LIMITS		SOLUBLE SULFATE CONTENT (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
				SWELL (%)	COMPRESSION (%)	APPLIED PRESSURE (psf)	LIQUID LIMIT	PLASTICITY INDEX			
TH-1	4	15.1	104	11.5		500	44	25		93	CLAY, SANDY (CL)
TH-1	14	33.5	85	1.4		1,800					CLAY, SANDY (CL)
TH-2	4	15.5	109	14.5		500			<0.01		CLAY, SANDY (CL)
TH-2	9	1.8	121							9	GRAVEL, SLIGHTLY SILTY (GP-GM)
TH-3	4	14.0	113	13.9		500					CLAY, SANDY (CL)
TH-4	4	6.8	103	0.7		500	30	14		60	CLAY, SANDY (CL)
TH-4	9	7.6	117	2.2		1,100					CLAY, SANDY (CL)
TH-4	19	15.3	108		0.3	2,400					CLAY, SANDY (CL)
TH-5	4	5.9	126						0.04	44	SAND, CLAYEY (SC)
TH-5	9	9.6	113	1.9		1,100					CLAY, SANDY (CL)
TH-5	29	17.8	109	1.5		3,600					CLAYSTONE
TH-6	9	9.6	116							14	SANDSTONE
TH-6	29	17.3	113	0.9		3,600					CLAYSTONE
TH-7	4	15.7	111	7.4		500	47	21		72	CLAYSTONE
TH-7	14	11.1	108		0.5	1,800					SANDSTONE
TH-7	24	16.3	114	2.1		3,000					CLAYSTONE
TH-8	4	7.7	104							47	SAND, CLAYEY (SC)
TH-8	14	16.0	113	1.1		1,800					CLAYSTONE
TH-9	4	13.2	118	4.0		500					CLAY, SANDY (CL)
TH-9	9	12.5	118	8.1		1,100	51	31		67	CLAYSTONE
TH-9	14	9.9	110		0.4	1,800					CLAYSTONE
TH-10	4	9.0	120	8.0		500			<0.01		CLAY, SANDY (CL)
TH-10	14	12.8	95		0.8	1,800					CLAY, SANDY (CL)
TH-10	19	14.4	117	1.9		2,400					CLAYSTONE
TH-11	4	8.8	120							32	SAND, CLAYEY (SC)
TH-11	14	10.9	121							22	SANDSTONE
TH-12	4	10.8	114							56	CLAY, SANDY (CL)
TH-12	19	10.8	114							24	SANDSTONE
TH-13	9	5.9	100							11	SANDSTONE
TH-13	24	15.2	113	1.8		3,000					CLAYSTONE
TH-14	4	9.5	111	5.1		500	42	25		62	CLAY, SANDY (CL)
TH-14	14	17.9	113	1.7		1,800	52	28		91	CLAYSTONE
TH-15	4	9.3	109	4.5		500					CLAY, SANDY (CL)
TH-15	9	11.0	111	2.4		1,100					CLAY, SANDY (CL)
TH-16	4	13.2	120	9.1		500					CLAY, SANDY (CL)
TH-16	9	7.9	115	1.1		1,100					CLAY, SANDY (CL)
TH-16	14	10.9	118	0.5		1,800					CLAYSTONE



APPENDIX C

GUIDELINE SITE GRADING SPECIFICATIONS



GUIDELINE SITE GRADING SPECIFICATIONS

1. DESCRIPTION

This item shall consist of the excavation, transportation, placement and compaction of materials from locations indicated on the plans, or staked by the Engineer, as necessary to achieve preliminary street and overlot elevations. These specifications shall also apply to compaction of excess cut materials that may be placed outside of the subdivision and/or filing boundaries.

2. GENERAL

The Soils Representative shall be the Owner's representative. The Soils Representative shall approve fill materials, method of placement, moisture contents and percent compaction, and shall give written approval of the completed fill.

3. CLEARING JOB SITE

The Contractor shall remove all vegetation, trees, brush and rubbish before excavation or fill placement begins. The Contractor shall dispose of the cleared material to provide the Owner with a clean, neat appearing job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures of any kind.

4. SCARIFYING AREA TO BE FILLED

Topsoil and vegetable matter shall be substantially removed from the ground surface upon which fill is to be placed. The surface shall then be plowed or scarified to a depth of 8 inches, moisture treated to above optimum moisture content, and compacted until the surface is free from ruts, hummocks or other uneven features, which would prevent uniform compaction by the equipment to be used.

5. COMPACTING AREA TO BE FILLED

After the foundation for the fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods to a depth of 8 to 12 inches, brought to the proper moisture content (between optimum and 4 percent above optimum for clay and within 2 percent of optimum for sand) and compacted to not less than 95 percent of maximum density as determined in accordance with ASTM D 698. The foundation materials shall be worked, stabilized, or removed and replaced if necessary in accordance with the soils representative's recommendations in preparation for fill.

6. FILL MATERIALS

Fill soils shall be substantially free from vegetable matter or other deleterious substances, and shall not contain rocks having a diameter greater than six (6) inches and claystone pieces larger than three (3) inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer.



On-site materials classifying as CL, CH, SC, SM, SW, SP, GP, GC and GM are acceptable. Concrete, asphalt, organic matter and other deleterious materials or debris shall not be used as fill.

7. MOISTURE CONTENT

For fill material classifying as CH, CL or SC, the fill shall be moisture treated to between 1 and 4 percent above optimum moisture content. Soils classifying as SM, SW, SP, GP, GC and GM shall be moisture treated to within 2 percent of optimum moisture content as determined from Proctor compaction tests. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas.

The Contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Soils Representative, it is not possible to obtain uniform moisture content by adding water on the fill surface. The Contractor may be required to rake or disc the fill soils to provide uniform moisture content through the soils.

The application of water to embankment materials shall be made with any type of watering equipment approved by the Soils Representative, 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 washed out.

Should too much water be added to any part of the fill, such that the material is too wet to permit the desired compaction from being obtained, rolling and all 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 wet material in an approved manner to hasten its drying.

8. 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 shall be compacted to at least 95 percent of the maximum density as determined in accordance with ASTM D 698. At the option of the Soils Representative, soils classifying as SW, GP, GC, or GM may be compacted to 95 percent of maximum density as determined in accordance with ASTM D 1557 or 70 percent relative density for cohesionless sand soils. Fill materials shall be placed such that the thickness of loose materials does not exceed 8 inches and the compacted lift thickness does not exceed 6 inches.

Compaction as specified above shall be obtained by the use of sheepfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved for soils classifying as CL, CH, or SC. Granular fill shall be compacted using vibratory equipment or other approved equipment. 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. Compaction equipment shall make sufficient passes to ensure that the required density is obtained.



9. COMPACTION OF SLOPES

Fill slopes shall be compacted by means of sheepfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and there is not an appreciable amount of loose soils on the slopes. Compaction of slopes may be done progressively in increments of three to five feet (3' to 5') in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

10. PLACEMENT OF FILL ON NATURAL SLOPES

Where natural slopes are steeper than 20 percent in grade and the placement of fill is required, cut benches shall be provided at the rate of one bench for each 5 feet in height (minimum of two benches). Benches shall be at least 10 feet in width. Larger bench widths may be required by the Engineer. Fill shall be placed on completed benches as outlined within this specification.

11. DENSITY TESTS

Field density tests shall be made by the Soils Representative at locations and depths of his choosing. Where sheepfoot 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 that 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.

12. 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 Soils Representative indicates that the moisture content and density of previously placed materials are as specified.

13. NOTICE REGARDING START OF GRADING

The Contractor shall submit notification to the Soils Representative and Owner advising them of the start of grading operations at least three (3) days in advance of the starting date. Notification shall also be submitted at least 3 days in advance of any resumption dates when grading operations have been stopped for any reason other than adverse weather conditions.

14. REPORTING OF FIELD DENSITY TESTS

Density tests made by the Soils Representative, as specified under "Density Tests" above, shall be submitted progressively to the Owner. Dry density, moisture content, and percentage compaction shall be reported for each test taken.



15. DECLARATION REGARDING COMPLETED FILL

The Soils Engineer shall provide a written declaration stating that the site was filled with acceptable materials, and was placed in general accordance with the specifications.

FOREST MANAGEMENT PLAN

Pine Canyon Ranch
JRW Family Limited Partnership LLLP
5975 E. Jamison Place
Centennial, Colorado 80112
303.587.0102
Email: kurt@pinecanyonranch.com

This plan includes three parcels located in Douglas County of the State of Colorado. The parcels are located in the south $\frac{1}{2}$ of the southeast $\frac{1}{4}$ of Section 35; the south $\frac{1}{2}$ of Section 36; Township 7 south, Range 67 west; and the north $\frac{1}{2}$ of the northeast $\frac{1}{4}$ of Section 1; Township 8 south, Range 67 west, Sixth Principle Meridian.

The assessor identification codes are R0454211, R0484209, and R0436801.

Of the approximately 417.5 acres; 213 acres are forested.

Prepared by

William R. Williams
Forester, Double W Services, Inc.
Lakewood, Colorado 80214-5018
303-205-1915
Email: mbw9245@comcast.net

September 12, 2019

FOREST MANAGEMENT PLAN AGREEMENT

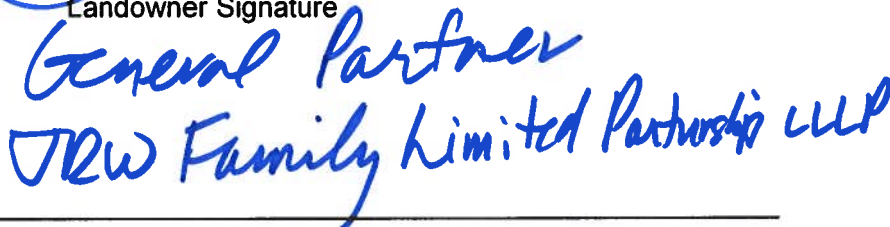
I have reviewed this plan, which has been prepared at my request to guide my stewardship management activities, and I will voluntarily apply the plan recommendations on my property for the health, vigor and beauty of the forest. I understand that it is my responsibility to comply with all relevant federal, state and local laws and regulations in the implementation of the management plan. I believe the management recommendations in this plan are appropriate to meet my stated goals and objectives. I agree to apply the recommended management practices provided in this plan and to follow the guidance for helping to create a productive forest and to ensure the sustainability of natural resources.



Landowner Signature



Date



General Partner
JRW Family Limited Partnership LLP

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Purpose, Goals, and Objectives

The purpose of this plan is to qualify the subject property for the Natural Resource Conservation Service Environmental Quality Incentives Program (EQIP). The plan focuses on management of the acres with woody vegetation cover including ponderosa pine, Gambel oak, and mountain mahogany.

The long-term management goals for the property are to

- Improve tree vigor and growth through silvicultural treatments,
- Manage the density of the Gambel oak,
- Reduce the risk of insect and disease on the forest,
- Reduce the risk from wildfire.

The ten-year plan objectives are to

- Thin the overstocked areas of ponderosa pine,
- Reduce the density of the Gambel oak,
- Annually monitor and treat weeds,
- Annually monitor the forest for insect and disease problems.

Property Location and Description

The property is north of downtown Castle Rock between Front Street on the west and Founders Parkway on the east (Figure 1).

There is a gate on Front Street north of Scott Boulevard and a gate at the southeast corner which is accessed from Founders Parkway.

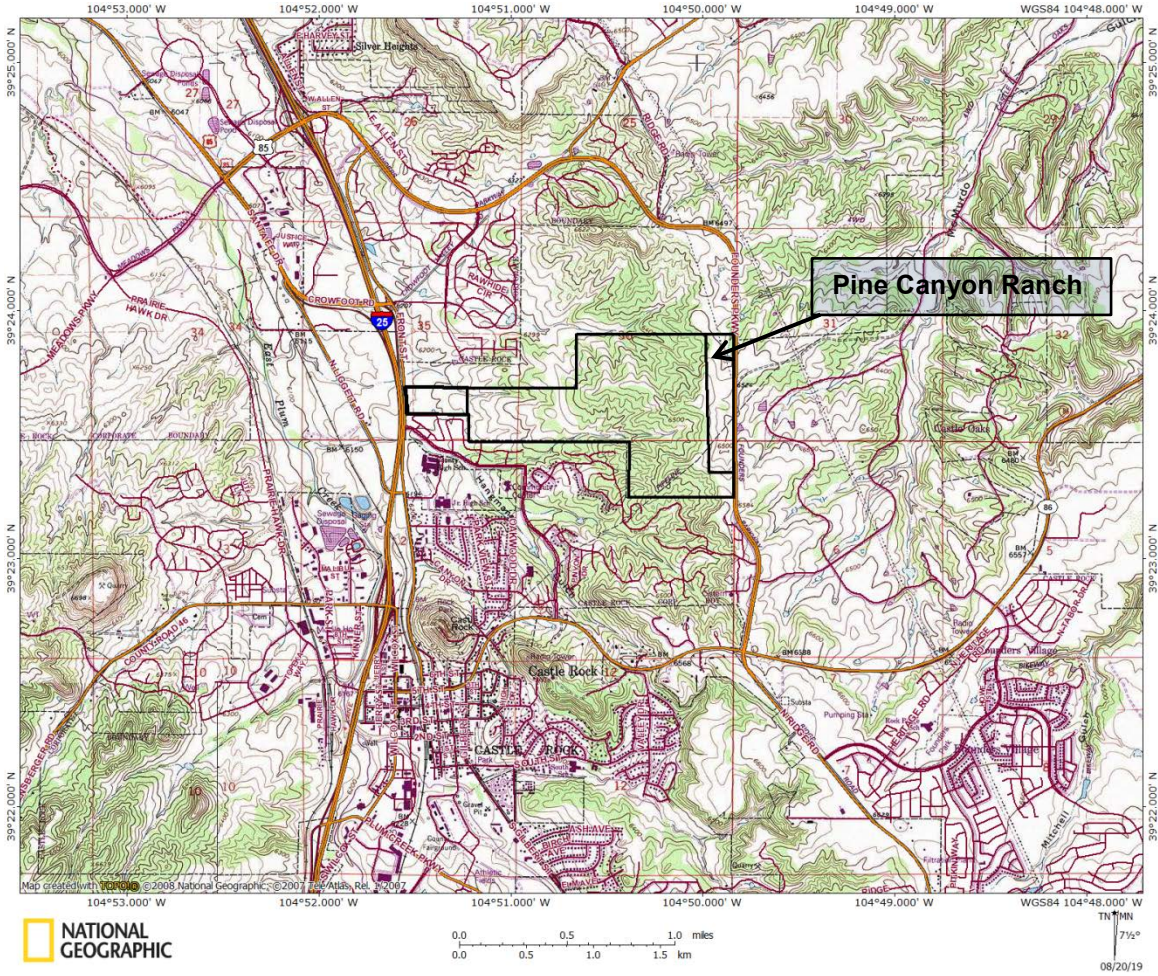
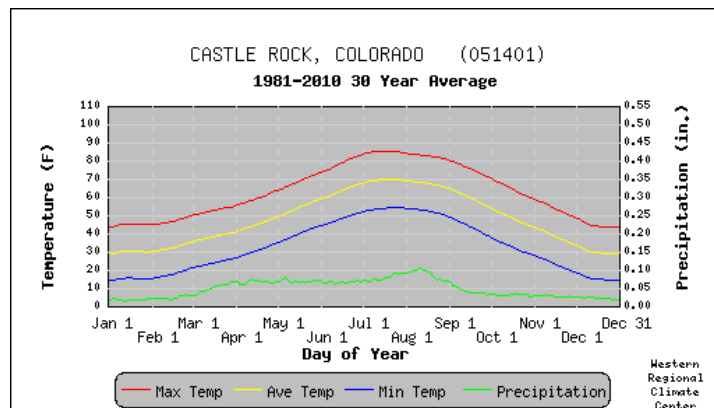


Figure 1 – Property Location

Topography and Climate

The annual precipitation is 17 to 21 inches, occurring as spring/summer thunderstorms and winter snow. The growing season is approximately 120 days, and the average air temperature is 43 degrees F as recorded at Castle Rock, Colorado.

Figure 2 – Temperature and Precipitation Average



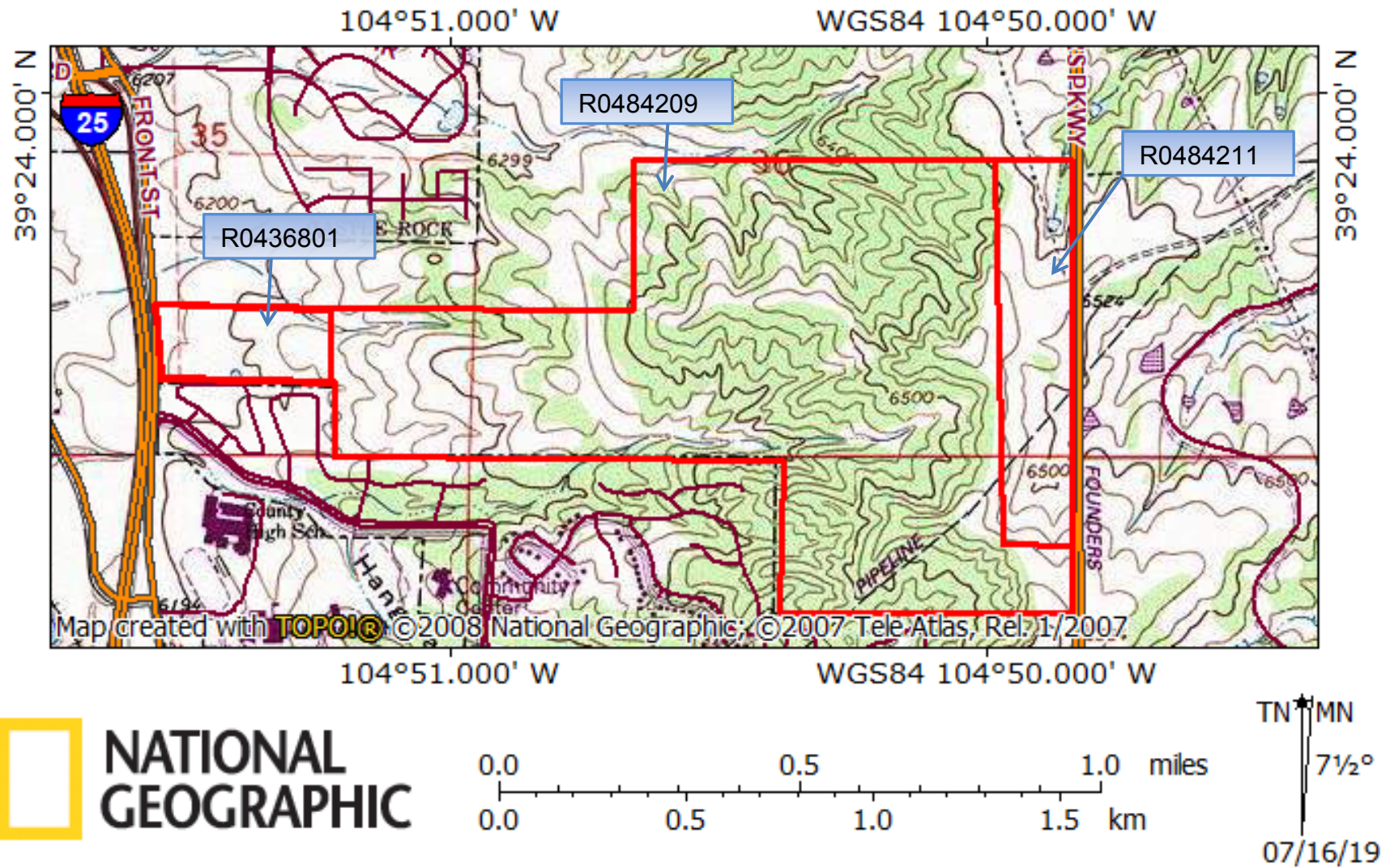


Figure 3 – Parcels and Topography

The elevation ranges from approximately 6180 feet on the west to approximately 6560 feet on the east side. The aspect is predominantly west; although, it changes to an east aspect on the east side. The area with ponderosa pine and Gambel oak has a series of ravines dropping to the west. Slopes range from 5 to 15 percent.

Current and Historic Land Use

The property was part of a larger ranch established in 1909. Historically the use was livestock grazing and agriculture. It is still used for livestock grazing.

Impact on Neighbors and Surrounding Community

There are homes immediately adjacent to the property along the entire south boundary. There are homes across Founders Parkway on the east. The north boundary is bordered by grassland and forest. To the west are Front Street and Interstate Highway 25.

Forest management activities will not adversely affect neighboring areas. There will be some noise from chainsaws and equipment but the distance to the residences makes it a minimal impact. Forest thinning and brush control, as prescribed in this plan, will improve the forest health and reduce fuel available to a wildfire. There will be no environmental impact from the forest management actions identified in this plan provided that soil disturbance is minimized.

Social and Economic Factors

Forest management activities and fuel reduction efforts are not currently profitable operations on the Colorado Front Range. There is a relatively small but regular market for firewood. Some costs of forest management can be recouped with aggressive firewood marketing.

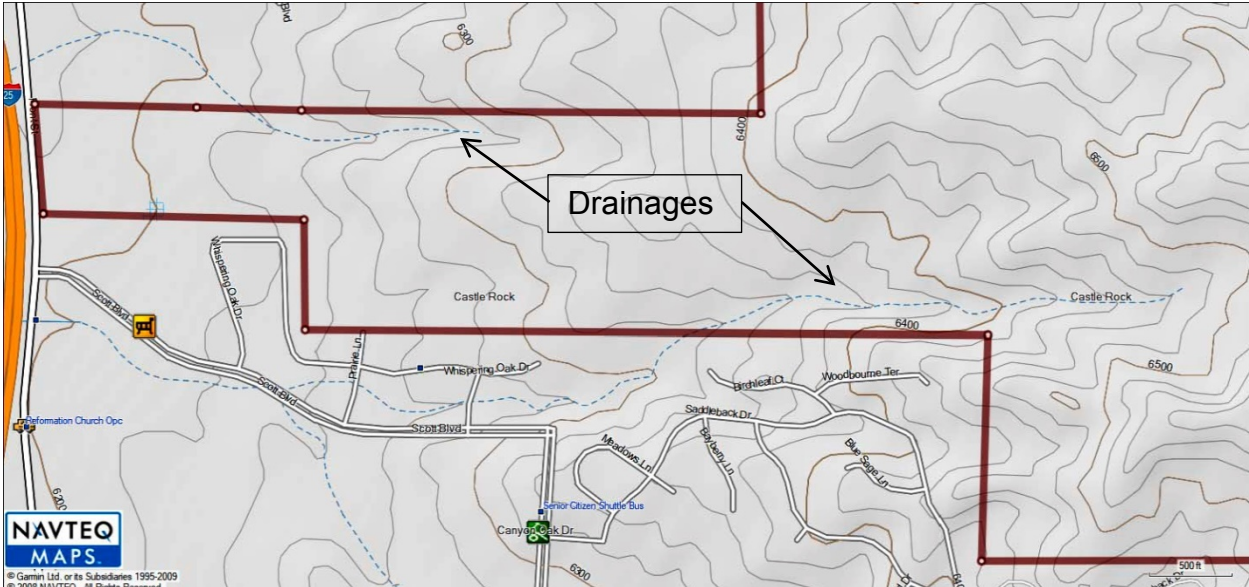
The economic return from the property is from livestock grazing. Livestock forage is limited by the dense tree and shrub cover. Reducing that cover, an objective of this plan, will increase forage production.

Recreation, Scenic, and Aesthetic Values

The property setting is pleasant with views of the mountains to the west. Even though it is bordered by residential development, there is potential for hiking or other recreational pursuits.

Wetland and Riparian Features

There are no streams or wetland areas and therefore no riparian areas. There are two defined drainages. They appear to run water only in heavy rainfall events.



Threatened and Endangered Species

A search of the Colorado Natural Heritage Web Site (www.cnhp.colostate.edu/heritage.html) tracking list shows one federally listed threatened species for the Castle Rock North U.S. Geological Survey quadrangle. A subspecies of the meadow jumping mouse is listed as threatened. There is no habitat for the mouse on the property.

The Douglas County pocket gopher, a subspecies of the Northern pocket gopher, has a “State critically imperiled” status. The property is possible habitat for the gopher. The Northern leopard frog is listed as “State rare or uncommon”. There is no habitat for the frog on the property.

Two vascular plants have a State listing. Narrow-leaved milkweed is “State imperiled”. Rocky Mountain sedge is considered “State critically imperiled”.

No survey for the listed species was done for this forest management plan. Forest management activities prescribed in this plan (reduction of the density of woody vegetation) will not have detrimental effect on listed species.

Archeological and Cultural Sites

No archeological or cultural observations were noted during the field survey.

Wildlife Habitat

Wildlife observations and signs observed during the forest inventory process included mule deer, turkey, black bear, cougar (single track), red-tailed hawk, magpie, black birds, Stellar's jay, sparrow, and Townsend's solitaire.

Wildlife habitat includes open grassland, shrubland, and ponderosa pine forest. There are standing dead trees that provide habitat "features" for perches for raptors and cavities for nesting. There are large down trees providing cover for burrowing species. Forest management activities will maintain the habitat currently present.

Non-native plants and noxious weeds

Noxious weeds are invasive, non-native plants whose control is mandated by law. They are a threat to native habitats and impact recreation and agriculture. Weeds observed include musk thistle, leafy spurge, diffuse knapweed, Canada thistle, and common mullien. Douglas County requires that all except common mullien be "contained, monitored, or suppressed." Figure 4 shows some locations of weeds.

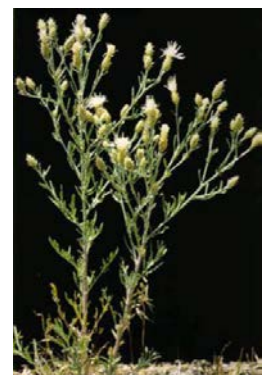
Musk thistle

A light to moderate infestation of musk thistle is present. Musk thistle is a biennial plant that reproduces by seed. Chopping, pulling or digging is an effective control method. The control effort should be done when the thistle is in bloom. The plants should be removed from the site to ensure that the blossoms do not dry and leave viable seed (Adams County Weed Department). Herbicide control is effective. See Appendix F for recommendations.



Diffuse knapweed

A heavy infestation of diffuse knapweed is present in the grass area. It is a non-native biennial forb that reproduces by seed. During the first year of growth, it appears as a rosette in spring or fall. During the second year in mid to late spring the stem bolts, flowers, sets seed, and the plant dies. It tends to invade disturbed, overgrazed areas. It is best controlled in the rosette stage. For small infestations, knapweed can be controlled by severing its taproot 1-2 inches below the ground. Control can be enhanced by a follow-up application of herbicides to the surviving rosettes.



Leafy spurge

There are patches of leafy spurge. It is a non-native deep-rooted perennial that spreads by seed and extensive, creeping roots. Where it becomes established; in rangeland, pasture, and riparian sites; it crowds out practically all other vegetation. The competitive, rapidly growing, and extensive root system makes leafy spurge very difficult to manage.

A combination of management methods in a long-term management plan is imperative. A sample plan for large infestations is to graze in the spring, release insects in the summer, apply herbicides in the fall, and reseed managed areas with desirable grasses. Flea beetles are effective control, especially when combined with grazing and/or herbicides.



Canada thistle

There is a light infestation of Canada thistle. It is a non-native deep-rooted perennial that spreads by seeds and aggressive, creeping, horizontal roots (rhizomes). It can infest many land types, from roadsides, ditch banks, riparian zones, pastures, irrigated cropland, and dryland cropland.

Cattle, goats, and sheep will graze on Canada thistle when the plants are young and succulent in the spring. Follow up grazing with a fall herbicide application. Mowing can be effective if done every 10 to 21 days throughout the growing season. Combining mowing with herbicides will further enhance control of Canada thistle



Common mullien

Common mullien is present in the grass areas. Douglas County leaves control of it up to the discretion of the landowner. It is a biennial plant; it completes its life cycle over two seasons. Mechanical control, pulling and removing the plant, is effective control for mullien (Colorado Department of Agriculture).

All of the weeds above are designated as a "B" list species in the Colorado Noxious Weed Act. Douglas County requires them to be "contained" when found.



Weed management publications are in Appendix F of this plan.



Figure 4 – Weed Locations

Purple shaded areas have a light infestation of musk thistle. Diffuse knapweed locations indicate patches of the weed.

M thistle = musk thistle

L spurge = leafy spurge

C thistle = Canada thistle

Knapweed = diffuse knapweed

Thistle locations are individual plants or small clusters of plants.

Insects and Diseases

No insect or disease problems were observed in the survey for this plan. The tree density and age make the forest susceptible for insect attacks

Soil Description

The soil survey report (U.S.D.A. Natural Resources Conservation Service) shows six soil map units for the property (See Figure 5.) Soil map units are complexes of soil types. The detailed soil report is in Appendix A. The discussion below is a general description of the soil properties and of the management interpretations of those properties.

The soils are generally a sandy loam. They are relatively shallow, mostly 32 to 36 inches to an impermeable layer or bedrock. They are well drained with low water holding capacity. This means that they dry out during periods of low precipitation, which can be a limiting factor for vegetation growth. There is potential for erosion on steeper slopes if vegetation cover is lost. The soils have limitations that preclude their use for commercial crop production and restrict their use to pasture or range, woodland, or wildlife food and cover.

Appendix A contains more detailed descriptions of the soil map units.

Soil Map Legend

Map Unit Symbol	Map Unit Name	Acres	Percent of Area
BrB	Bresser sandy loam, cool, 1 to 3 percent slopes	7.2	1.7%
FoD	Fondis clay loam, 3 to 9 percent slopes	17.4	4.2%
Fu	Fondis-Kutch association	42.8	10.3%
KtE	Kutch sandy loam, 5 to 20 percent slopes	133.9	32.3%
KwF	Kutch-Newlin-Stapleton complex, 8 to 40 percent slopes	178.1	42.9%
SsE	Stapleton loamy sand, 6 to 30 percent slopes	35.5	8.6%
Totals for Area		415.0	100.0%

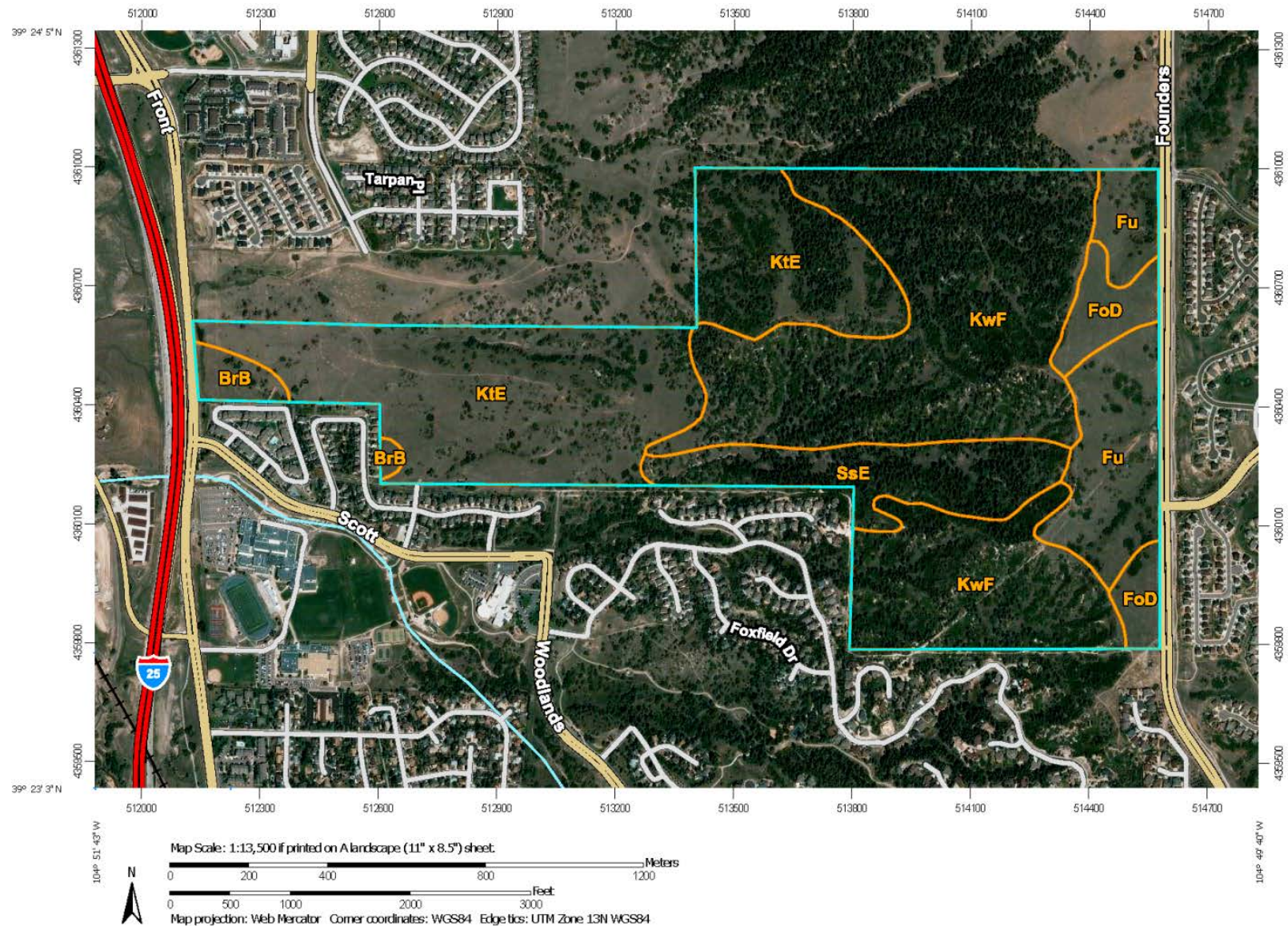


Figure 5 – Soil Map

Vegetation Types

Figure 6 shows the vegetation type map for the property. The types are defined based on the spatially dominate vegetation. There are four mapped vegetation types.

Vegetation Type	Area
Grass - forb	159
Gambel oak	46
Gambel oak – ponderosa pine	157
Ponderosa pine	56

The grass and forb type is, or was, native short-grass prairie. It shows signs of past heavy grazing. The dominant species is cheatgrass, based on visual observation. Native weeds are present in abundance. There are large patches of Gambel oak. Management of the grass-forb communities will not be directly addressed in this plan. There are approximately 159 acres of grass-forb type.



The Gambel oak type has an almost continuous cover of oak and mountain mahogany. There are grass openings between the oak clumps; some grass areas are fairly large. The canopy cover exceeds fifty percent. The type covers approximately 46 acres.



The Gambel oak - ponderosa pine type has enough ponderosa pine to classify it as forest land. Gambel oak and mountain mahogany are the dominant species using canopy cover as the measure. The combined cover of shrubs and trees is estimated at greater than 80 percent. There are approximately 157 acres of the type.



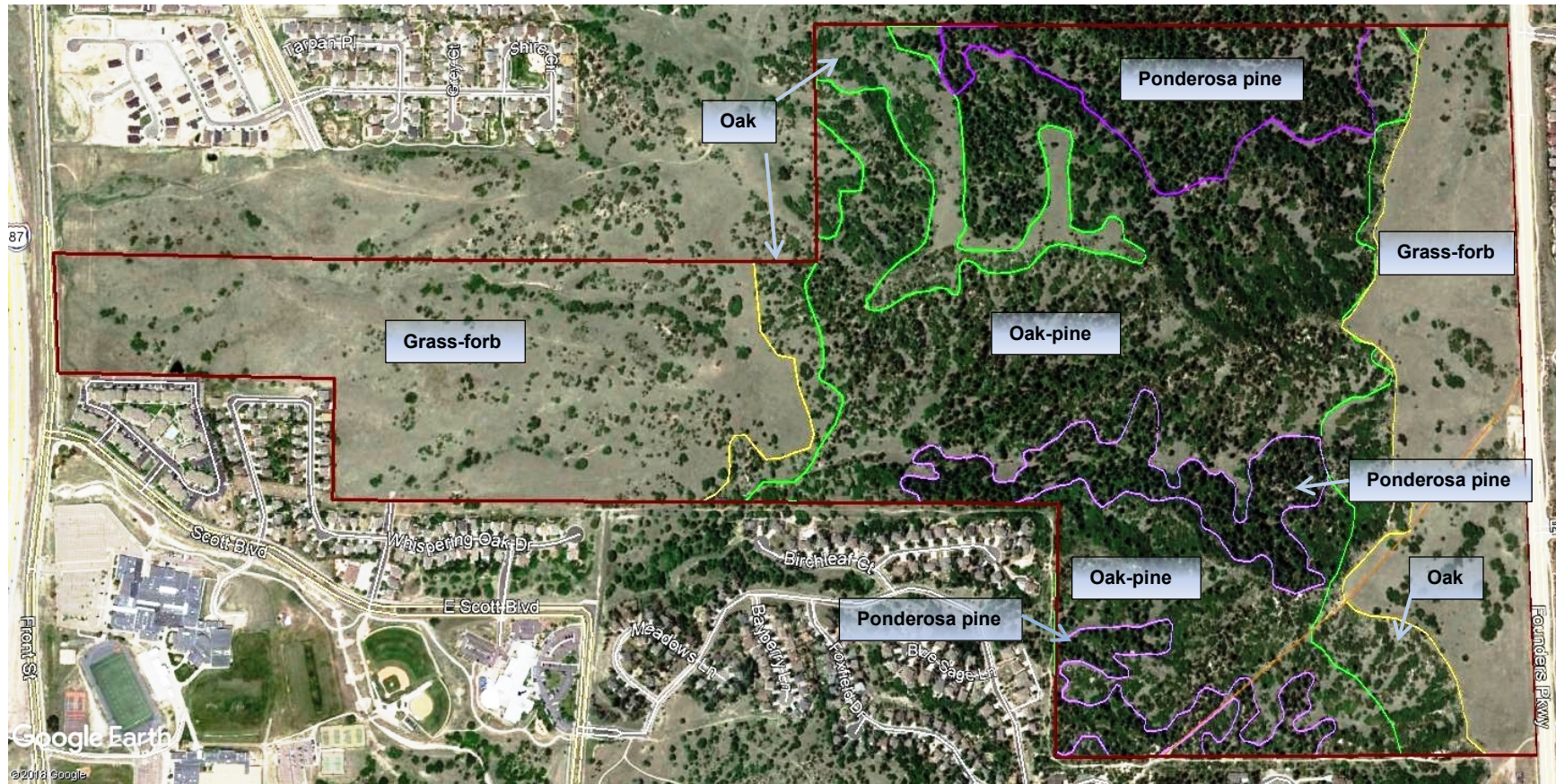


Figure 6- Vegetation Types

Yellow lines separate the grass-forb type from the oak and oak-pine types.
Green lines separate the oak type from the oak-pine type.
Purple lines outline the ponderosa pine type.

The ponderosa pine type has a dense understory of Gambel oak. There are grass openings and oak clumps between the pines. There are approximately 56 acres in the type.

Rocky Mountain juniper is present throughout the forested areas. It is not numerous enough to show in the forest inventory. Douglas-fir is present, but is very rare.



Forest Inventory

An inventory (stand examination) was done for the Ponderosa Pine type and the Gambel oak – Ponderosa pine type. They were sampled and compiled as two separate inventories. The Forest Vegetation Simulator modeling system (Dixon, 2007) was used to compile the inventory statistics.

The table below has statistics from the inventory. Appendix B describes the inventory process and has detailed inventory tables.

Inventory Summary Statistics – Per Acre Averages

Vegetation type	Site Index Species	Site Index*	Trees per Acre	Basal Area	Tree Diameter**	Tree Height	Stand Density Index	Dominant Diameter ***	Cubic-foot Volume
Oak-Pine	PP	50	120	18	5.2	20	42	16.8	307
Ponderosa pine	PP	50	188	60	7.7	49	123	17.1	1093

PP = ponderosa pine

*Site Index is defined in Appendix D (also see Minor, 1964).

**Tree Diameter is the average diameter of all trees.

*** Dominant Diameter is the average diameter of the upper-most canopy layer.

The site index for the property is estimated at 50. Site index is a measure of productive capability of the forest. The index is a function of tree height and tree age; better sites will produce taller trees. The index is based on the age of two sample trees.

Gambel oak-ponderosa pine

There are an estimated 120 ponderosa pine trees per acre; of those, 106 are seedlings and saplings. The sample does not have any trees in the three to nine inch diameter range. There were some observed but they are not numerous and did not fall in the inventory plots.

There are two measures of stocking (site occupancy or inter-tree competition), stand basal area (BA) and stand density index (SDI). The average estimated basal area for the Gambel oak-ponderosa pine type is estimated at 18 square feet. The calculated

stand density index is 42. Potentially there could be many more ponderosa pine trees per acre and still have a healthy forest.

No attempt was made to count Gambel oak stems and the effect of the oak on tree growth is not estimated. The oak stands are very dense. The assumption is that the oak does affect the growth of ponderosa pine where it surrounds the tree.

Ponderosa pine type

There are an estimated 188 ponderosa pine trees per acre; of those, 113 are seedlings and saplings. There are trees as large as 24 inches in diameter.

The estimated average basal area is 60 square feet. That is a good number for the site to maintain good tree vigor and reduce potential wildfire severity. The calculated stand density index is 123. An SDI below 200 is desired for optimum tree growth. Again, those numbers only consider the number of ponderosa pines; the effect of the oak on tree growth is not estimated.

Fire Risk Assessment

Fire hazard rating, or fire risk evaluation, is based on a combination of factors including the probability of a fire igniting, weather, topography, types of fuel, and amount of available fuel. The probability of a fire igniting and the weather conditions when a fire starts are factors independent of forest and vegetation management. Weather at the time of a fire, specifically relative humidity and wind speed, affect how rapidly a fire spreads. Topography is a site factor which influences fire behavior. Fire burns faster going uphill and is more likely to burn into the forest canopy on steep slopes.

The amount of fuel, the type of fuel, and the moisture content of the fuel affects the intensity of a fire. In a dense forest, with a high number of trees per acre and a large amount of dead material on the ground, the risk of a high intensity fire increases. Forest and vegetation management can play a role by reducing the amount of fuel for a wildfire.

Historically fires in ponderosa pine forests were relatively frequent. They were usually low intensity ground fires which did not kill larger trees and kept the forest relatively free of shrubs and dense thickets of young trees.

Fuel models attempt to predict the behavior and effects of a wildfire. Fuel models for the property are defined in U.S. Forest Service publication RMRS-GTR 153 (Scott.)

The fuel model for the grass – forb type is GR4. The primary carrier of a fire is grass. Fire flame length and rate of spread are directly related to wind speed. Rate of spread is expected to be moderate with wind below ten miles per hour. Above ten the spread rate may be very high.

The fuel model for the Gambel oak type and the Gambel oak – ponderosa pine type is SH5. Gambel oak does not burn readily except during a drought or perhaps in the fall or early spring when vegetation dries out. Late spring frosts that kill the leaves can cause extreme fire behavior later in the summer; the dead leaves have a tendency to cling to the stem and act as dry aerial fuels. Under certain conditions, fires in oak brush can spread quickly and fire behavior can be similar to fuel models in southern California. (Colorado State University Extension, 7/08). The rate of spread is expected to be low with wind speed of five miles per hour. The flame length is expected to be high due to the amount of fuel and the height of the oak.

The model for the ponderosa pine type is TU2. The dense Gambel oak understory provides the fuel for a fire. Under dry conditions and moderate wind speeds the flame length and rate of spread are expected to be low. Under very dry conditions and with moderate wind speeds the flame length and rate of spread will increase.

Forest Management Units

Management units are identified for each year over the ten years included in this plan. The units are shown in Figure 7. The units are based on treating a target of ten acres per year and the need to accomplish wildfire mitigation along the south boundary. Units include a mix of the three primary vegetation types.

Recommended Treatments

The treatments will reduce the number of ponderosa pine trees, where needed, and will reduce the density of Gambel oak. The treatment for each vegetation type is described below.

Gambel oak type and Gambel oak – Ponderosa pine type

The Gambel oak and Gambel oak-Ponderosa pine treatment will break up the continuous canopy of oak. Gaps will be created between oak clumps. The target space between oak clumps is 2.5 times the height of the oak in the clump. The target diameter of the clumps of oak left is 2 times the height of the oak. All oak under ponderosa pine trees will be removed by mastication unless the ground slope prevents equipment operation.

The conservation practice is **Brush Management (Practice 314)**. The cost scenario is “Mechanical, Large Shrubs, and Heavy Infestation”.

Appendix F contains the publication “Gambel Oak Management” (Colorado State University Extension).

Ponderosa Pine Type

The treatments for the ponderosa pine type will improve the forest condition by reducing the tree density and the amount of Gambel oak. The growth rate of the trees left in the forest will increase and they will be less susceptible to insect attack. The fuel load that might carry a wildfire will be lowered.

The silvicultural method used to select trees to remove is “thinning-from-below”. In that method, small diameter trees, over-topped trees, and trees with poor form are selected for cutting. Small trees are left if they are not over-topped by larger trees, have good form and crown, and are spaced properly. The objective is to reduce the basal area to an average 50 square feet per acre. If trees were evenly spaced the tree spacing target would be 30 feet. The trees are not evenly distributed and clumps of large trees may be left with spacing of less than 30 feet.

A thinning simulation, using FVS, was done. The thinning parameters were a target BA of 50 square feet per acre and leaving at least 25 percent of the trees in each two-inch diameter class. The result was to remove 120 trees per acre, mostly less than 5.0 inches in diameter. The simulation calculates an average of 127 cubic feet of merchantable wood per acre (approximately one cord) will be removed.

The Environmental Quality Incentives Program (EQIP) treatment is **Forest Stand Improvement (Practice 666)**. The cost scenario is “Uneven-aged Silvicultural Rx Using Hand and Light Mechanized Equipment on Slopes Less than 25%”.

Slash will be treated with a masticator or will be chipped. The EQIP conservation practice is **Woody Residue Treatment (Practice 384)**. The cost scenario is “Forest Slash Treatment – Heavy”.

The Gambel oak density will be reduced mechanically using mastication equipment. Treatment specifications are described in the publication “Gambel Oak Management” (Colorado State University Cooperative Extension, 7/08). The primary objective is to reduce ladder fuels by removing oak growing under the tree canopies. Oak clumps not under trees will be reduced in size; gaps will be created between oak clumps.

The EQIP conservation practice is **Brush Management (Practice 314)**. The cost scenario is “Mechanical, Large Shrubs, and Heavy Infestation”.

Cost and Revenue estimates

Forest management activities and fuel reduction efforts are not currently profitable operations. The market for posts and poles directly from the forest is limited, as is the market for sawtimber. Wood products produced will be primarily firewood. The estimated yield is one cord per acre. There is a relatively small market for firewood. The estimated value of processed firewood is \$180.00 per cord.

The estimated contract cost for the work is \$2,000.00 per acre.

10-year Plan Implementation Schedule

Insect and Disease monitoring

Each year the forest will be monitored for insect and disease problems.

Weed control

Each year weed control work will be done as needed.

Brush Management (Practice 314)

The plan includes ten acres per year for ten years.

Forest Stand Improvement (NRCS Practice 666)

A total of 24 acres will be treated. The number of acres thinned varies each year. The schedule of acres treated is shown in the table below.

Woody Residue Treatment (NRCS Practice 384)

Mastication and chipping are the primary slash treatments. Slash can be strategically piled to provide hiding cover for wildlife. The number of acres treated is shown in the table below.

YEAR	TREATMENT	ACRES
2020	Practice 314 Brush Control – Mechanical, Large Shrubs, Heavy Infestation	10
2021	Practice 314 Brush Control – Mechanical, Large Shrubs, Heavy Infestation	10
2021	Practice 666 Forest Stand Improvement Uneven-aged Silvicultural Rx Using Hand and Light Mechanized Equipment on Slopes Less than 25%	4
2021	Practice 384 Woody Residue Treatment Forest Slash Treatment – Heavy	4
2022	Practice 314 Brush Control – Mechanical, Large Shrubs, Heavy Infestation	10
2022	Practice 666 Forest Stand Improvement Uneven-aged Silvicultural Rx Using Hand and Light Mechanized Equipment on Slopes Less than 25%	4
2022	Practice 384 Woody Residue Treatment Forest Slash Treatment – Heavy	4

2023	Practice 314 Brush Control – Mechanical, Large Shrubs, Heavy Infestation	10
2023	Practice 666 Forest Stand Improvement Uneven-aged Silvicultural Rx Using Hand and Light Mechanized Equipment on Slopes Less than 25%	6
2023	Practice 384 Woody Residue Treatment Forest Slash Treatment – Heavy	6
2024	Practice 314 Brush Control – Mechanical, Large Shrubs, Heavy Infestation	10
2024	Practice 666 Forest Stand Improvement Uneven-aged Silvicultural Rx Using Hand and Light Mechanized Equipment on Slopes Less than 25%	4
2024	Practice 384 Woody Residue Treatment Forest Slash Treatment – Heavy	4
2025	Practice 314 Brush Control – Mechanical, Large Shrubs, Heavy Infestation	10
2026	Practice 314 Brush Control – Mechanical, Large Shrubs, Heavy Infestation	10
2027	Practice 314 Brush Control – Mechanical, Large Shrubs, Heavy Infestation	10
2028	Practice 314 Brush Control – Mechanical, Large Shrubs, Heavy Infestation	10
2028	Practice 666 Forest Stand Improvement Uneven-aged Silvicultural Rx Using Hand and Light Mechanized Equipment on Slopes Less than 25%	7
2028	Practice 384 Woody Residue Treatment Forest Slash Treatment – Heavy	7
2029	Practice 314 Brush Control – Mechanical, Large Shrubs, Heavy Infestation	10
2029	Practice 666 Forest Stand Improvement Uneven-aged Silvicultural Rx Using Hand and Light Mechanized Equipment on Slopes Less than 25%	2
2029	Practice 384 Woody Residue Treatment Forest Slash Treatment – Heavy	2

The implementation schedule will be reviewed and revised as needed. Natural events (insect activity, fire, blowdown, etc.) could necessitate changing the location of treatments.

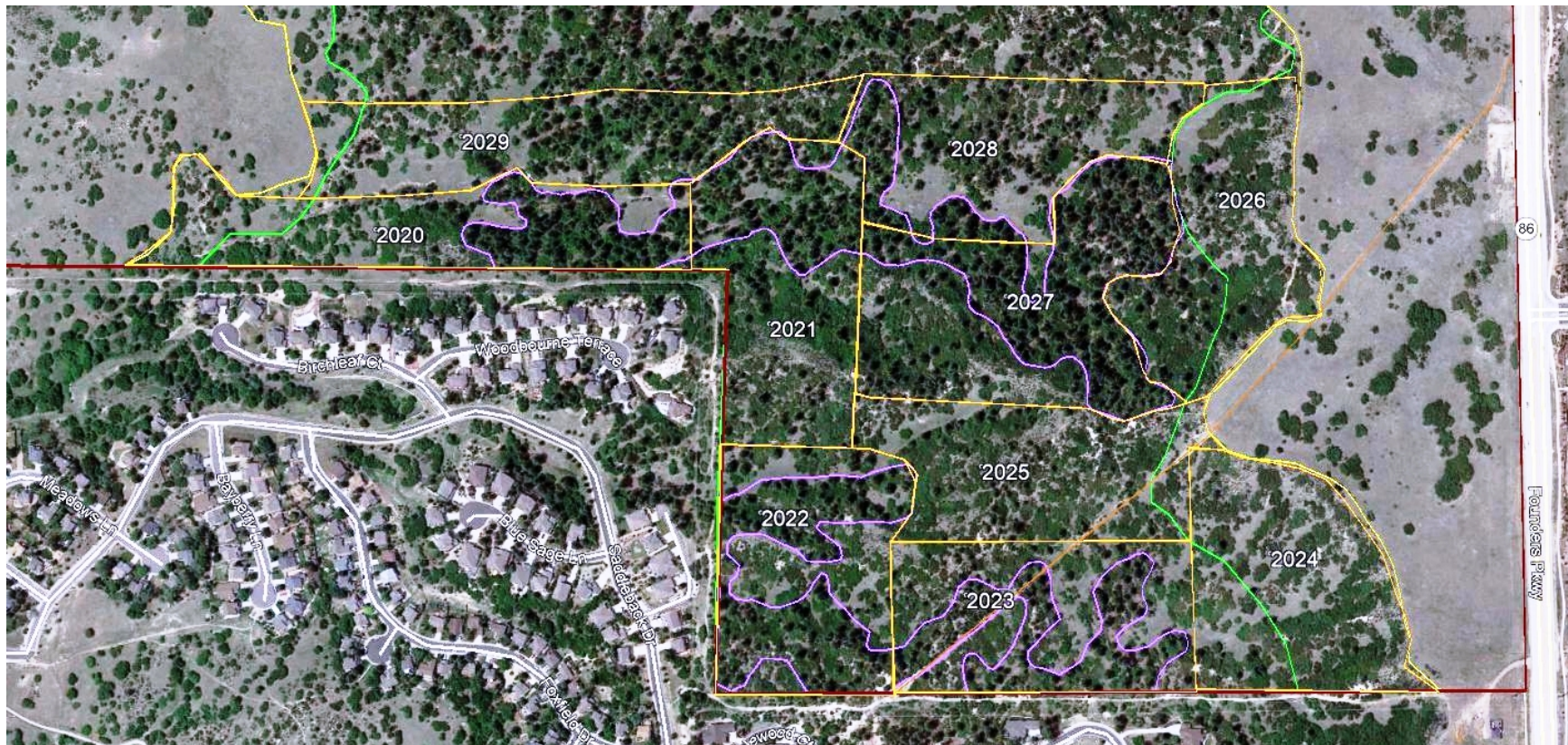


Figure 7 – Treatment Units by Year



Consultants in Natural Resources and the Environment

Natural Resources Assessment Pine Canyon Douglas County, Colorado

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May 12, 2023

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Executive Summary

JRW Family Limited Partnership LLLP retained ERO Resources Corporation (ERO) to provide an updated natural resources and wildlife habitat assessment for the Pine Canyon property east and west of Interstate 25 on the north end of Castle Rock, Douglas County, Colorado (project area). ERO conducted a natural resources and wildlife habitat assessment of the project area, which included identifying potential federally and state-listed threatened, endangered, and candidate (T&E) species habitat; Colorado Parks and Wildlife (CPW) High Priority Habitat (HPH); potential wetlands and open water; and other natural resources that might affect the project. Below is a summary of the resources found at the project area and recommendations or future actions necessary based on the current site conditions and federal, state, and local regulations.

The natural resources and associated regulations described in this report are valid as of the date of this report and may be relied upon for the specific use for which it was prepared by ERO under contract to JRW Family Limited Partnership LLLP. Because of their dynamic natures, site conditions and regulations should be reconfirmed by a qualified consultant before relying on this report for a use other than that for which ERO was contracted.

Wetlands and Other Waters of the U.S. – East Plum Creek and two unnamed drainages tributary to the creek (Tributary 1 and Tributary 2) occur in the project area. East Plum Creek and its abutting wetlands are considered jurisdictional waters of the U.S. by the U.S. Army Corps of Engineers (Corps). Wetland 2 appears to have a potential connection to Tributary 2 and, thus, may be considered a jurisdictional water of the U.S. Two wetland areas (Wetlands 1 and 3) and a stock pond also occur in the project area, but do not appear to have surface water connections to a known jurisdictional water of the U.S. and would likely be considered isolated and nonjurisdictional. ***If any work is planned in the tributaries, Wetlands 1 through 3, or the stock pond in the project area, a jurisdictional determination should be requested from the Corps.*** If these areas are considered jurisdictional and work is planned in any of these areas, or in East Plum Creek and its associated wetlands, a Section 404 permit would be required from the Corps for the placement of dredged or fill material in wetlands, below the ordinary high water mark, or in wetlands. If no work is planned in any of these areas, no Corps action is necessary.

Federally Threatened and Endangered Species – The project area does not contain suitable habitat for a majority of the federally listed T&E species potentially occurring in Douglas County, Colorado. East Plum Creek and the surrounding riparian vegetation communities have suitable habitat for Preble's meadow jumping mouse, a federally listed threatened species. As such, this species has the potential to occur in or adjacent to the project area. Should the project involve habitat-disturbing activities, consultation with the U.S. Fish and Wildlife Service (Service) would be required.

State Threatened and Endangered Species and Species of Special Concern – The project area contains potential habitat for black-tailed prairie dog, western burrowing owl, common garter snake, northern leopard frog, common shiner, and Iowa darter. Activities in the project area could potentially affect common garter snake, northern leopard frog, common shiner, or Iowa darter if work is conducted in the wetland areas along East Plum Creek, primarily due to displacement from suitable habitat during construction. ERO recommends implementing Conservation Measures (CMs) and Best Management Practices (BMPs) to avoid habitat and incidental take of these species.

Prairie Dogs – No black-tailed prairie dogs or burrows were observed in the project area during the 2023 site visit. ***If black-tailed prairie dog remove becomes necessary, CPW recommends removing prairie dogs in a humane manner before any earthwork or construction takes place.*** Although prairie dogs are not protected under the Endangered Species Act, CPW recommends attempting to

remove or exterminate prairie dogs prior to bulldozing an active prairie dog town for humane reasons. Currently, Douglas County does not have a prairie dog management plan or policy for private properties.

Burrowing Owls – Burrowing owls could be impacted by the project if work would occur within the CPW-recommended 1/8-mile (660-foot) buffer of any prairie dog burrow (CPW 2020). ***If work would occur within the recommended buffer of any burrow during the March through October breeding season, a burrowing owl survey should be conducted.*** If owls are present in the project area, activities should be restricted within 660 feet of nest burrows until the owls have migrated from the site, which can be determined through monitoring.

Critical Wildlife Habitats and Corridors – CPW released a HPH table that identifies species and habitats, as well as recommendations to avoid and minimize impacts on wildlife from land use development (CPW 2021). The Aquatic Native Species Conservation Waters HPH occurs in the project area along East Plum Creek. ***For any work conducted in areas mapped in the Aquatic Native Species Conservation Waters HPH area associated with East Plum Creek, ERO recommends contacting the local CPW district manager.*** No other HPH areas are identified in the project area; however, elk, mule deer, and white-tailed deer overall ranges overlap the project area (CPW 2021). Black bear and mountain lion overall range also overlaps the project area (CPW 2021). Wildlife, including elk, mule deer, white-tailed deer, black bear, and mountain lion, could be temporarily displaced from the project area during construction; however, the project is unlikely to have a long-term adverse effect on HPH areas.

East Plum Creek has been designated as a wildlife movement corridor in the Douglas County 2040 Comprehensive Master Plan (CMP; Douglas County 2019). No highway crossings have been identified in the Douglas County 2040 CMP in or near the project area, and the remainder of the project area is mapped as having low or moderate habitat value (Douglas County 2019).

Migratory Birds – ERO observed one unoccupied raptor nest in the project area during the 2023 site visit. This nest and any other raptor nests occupied during the nesting season in or near the project area could be impacted by the project if there would be human encroachment activities or a physical object or structure is proposed within the CPW-recommended buffer permanently or for a significant amount of time (CPW 2020). The best way to avoid impacting migratory birds is to conduct ground-clearing activities and construction activities during the nonnesting season. The Eastern Colorado Field Office of the Service (Service 2022) and Colorado Department of Transportation (Colorado Department of Transportation 2011) have identified the primary nesting season for migratory birds in eastern Colorado as occurring from April 1 to August 31. However, some birds (e.g., eagles, owls, and red-tailed hawks) can nest as early as February or March. Because of variability in the breeding seasons of various bird species, additional nest surveys during the nesting season may also be warranted. ***ERO recommends that a nest survey be conducted within one week prior to construction to determine if any active nests are present in or near the project area so they can be avoided.*** Additional surveys may also be warranted to identify active nesting species that could affect project timing (e.g., eagles or red-tailed hawks). If active nests are found, any work that would destroy the nests should not be conducted until the birds have vacated the nests. If possible, ground-clearing activities should occur outside of the migratory bird breeding season, generally April 1 through August 31.

Natural Resources Assessment

Pine Canyon

Douglas County, Colorado

May 4, 2023

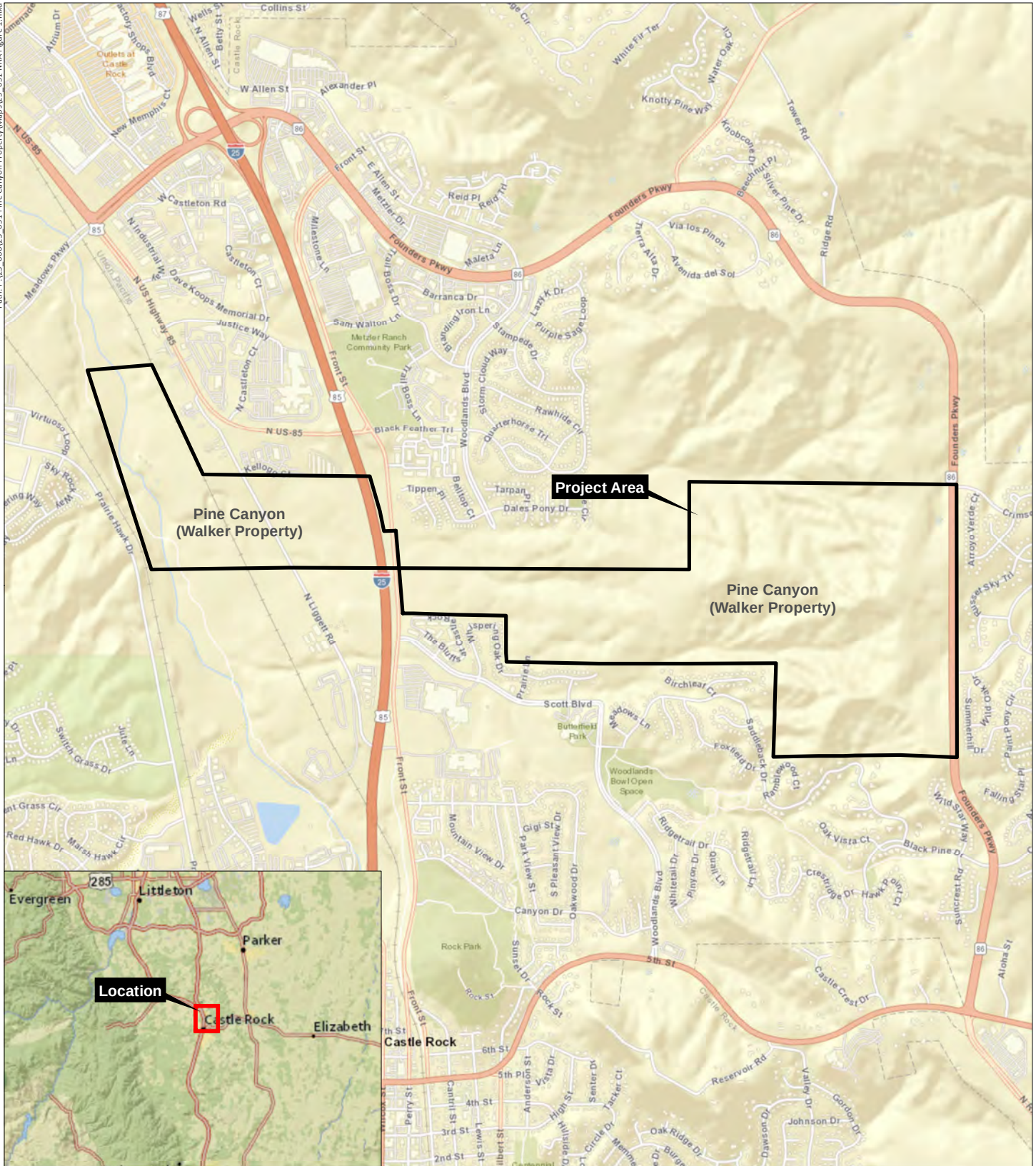
Introduction

JRW Family Limited Partnership LLLP retained ERO Resources Corporation (ERO) to provide an updated natural resources and wildlife habitat assessment for the Pine Canyon property east and west of Interstate 25 (I-25) on the north end of Castle Rock in Douglas County, Colorado (project area; Figure 1). On March 20, 2023, Courtney Marne, a biologist with ERO, assessed the project area for natural resources (2023 site visit). The purpose of the survey was to identify areas where wildlife resources could occur, including habitat for federally listed threatened, endangered, and candidate (T&E) species and other species of special concern, raptor nests, important big game habitat and movement corridors, and other significant wildlife resources that might be affected by development in the project area. The project area includes an approximately 152-acre parcel west of I-25 and 426-acre parcel east of I-25 in a primarily undeveloped portion of Douglas County, Colorado that is planned for residential development with dedicated agricultural and open space areas. This report provides information on existing site conditions and resources, as well as current regulatory guidelines related to those resources. ERO assumes the landowner is responsible for obtaining all federal, state, and local permits for construction of the project.

The natural resources and associated regulations described in this report are valid as of the date of this report and may be relied upon for the specific use for which it was prepared by ERO under contract to JRW Family Limited Partnership LLLP. Because of their dynamic nature, site conditions and regulations should be reconfirmed by a qualified consultant before relying on this report for a use other than that for which ERO was contracted.

Project Location

The project area is an approximately 578-acre parcel in Sections 34 through 36, Township 7 South, Range 67 West; and Sections 1 and 2, Township 8 South, Range 67 of the 6th Principal Meridian in Douglas County, Colorado (Figure 1). The UTM coordinates of the approximate center of the project area are 512793mE, 4360589mN, Zone 13. The longitude/latitude of the project area is 104.850994°W/39.394380 °N. The elevation of the project area ranges from 6,070 to 6,540 feet above sea level. Photo points of the project area are shown on Figure 2a and Figure 2b, and the photo log is in Appendix A.



Pine Canyon Property

Sections 34-36, T7S, R67W; Sections 1-2, T8S, R67W; 6th PM

UTM NAD 83: Zone 13N; 512793mE, 4360589mN

Longitude 104.850994°W, Latitude 39.394380°N

USGS Castle Rock North, CO Quadrangle

Douglas County, Colorado

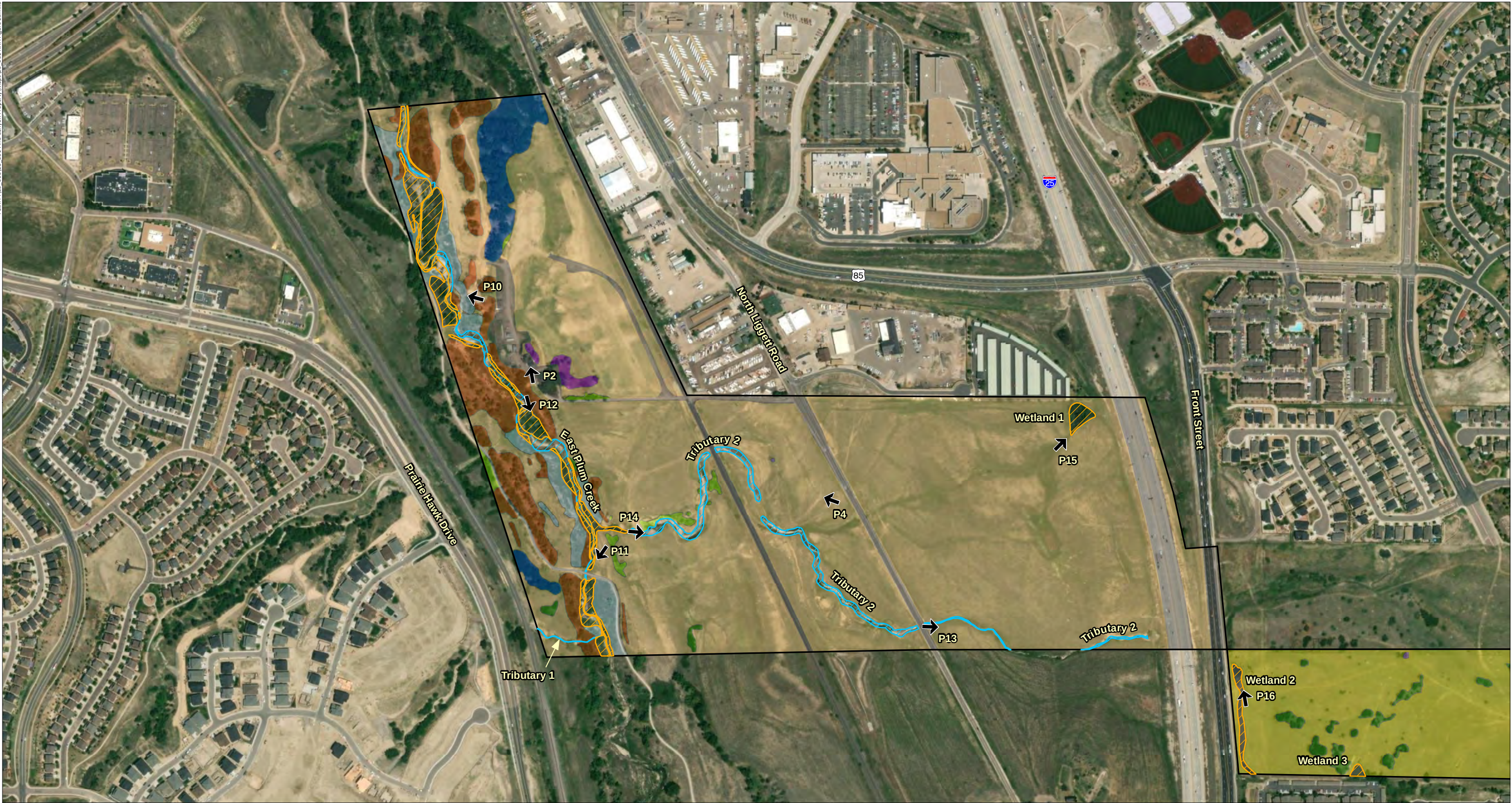
Figure 1
Vicinity Map

Prepared for: Pine Canyon
File: 23_051 NRA Figure 1.mxd (GS)
April 20, 2023



0 750 1,500
Feet





Pine Canyon Property

- | | | | |
|----------------------------|---------------------|---|---------------------------|
| ➔ Photo Point | Vegetation | Mixed Shrubland | Sandbar Willow |
| ▭ Project Area Boundary | Disturbed/Developed | Plains Cottonwood | Ponderosa Forest |
| 🌊 Ordinary High Water Mark | Native Grassland | Plains Cottonwood/Mixed Shrubland | Ponderosa Pine/Gambel Oak |
| 🌊 Open Water | Mixed Grassland | Plains Cottonwood/Peachleaf Willow/Sandbar Willow | Gambel Oak |
| 🟡 Potential Wetland | | | |

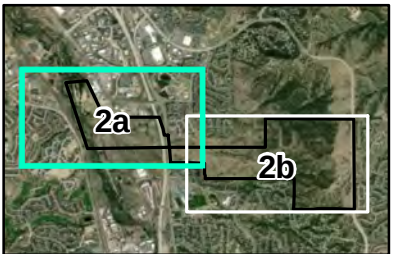


Image Source: Maxar Technologies©, June 17, 2021

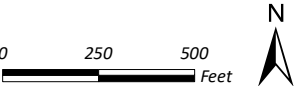
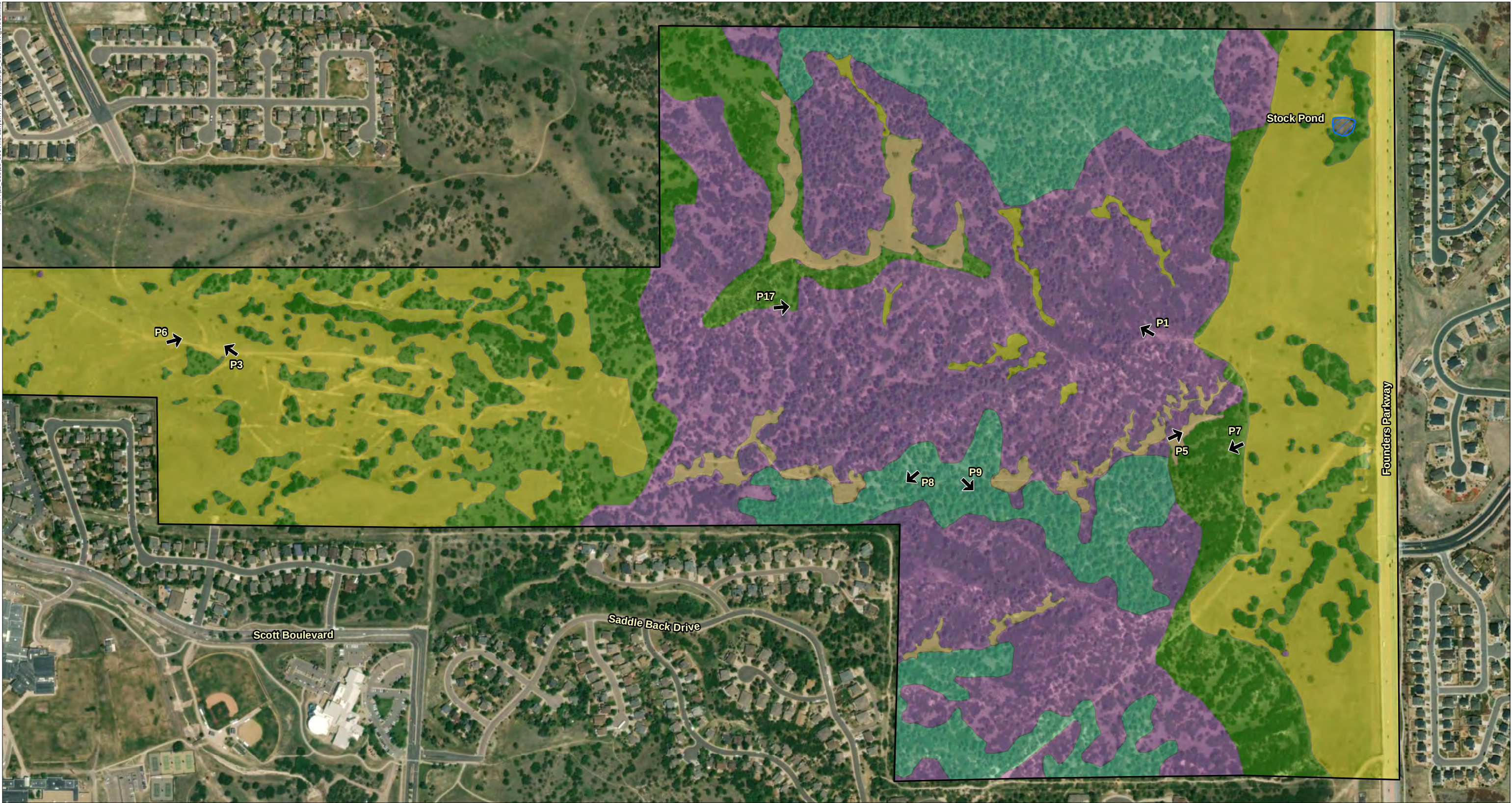


Figure 2a
Vegetation Communities
West of I-25

Prepared for: Pine Canyon
File: 23_051 NRA Figure 2s.mxd (GS)
May 2, 2023





Path: P:\23_000\23_051 Pine Canyon Property\Maps\23_051 NRA Figure 2s.mxd

Pine Canyon Property

- ➔ Photo Point

▭ Project Area Boundary

🌊 Ordinary High Water Mark

🌊 Open Water

🌊 Potential Wetland
- Vegetation

🌿 Disturbed/Developed

🌿 Native Grassland

🌿 Mixed Grassland
- 🌿 Mixed Shrubland

🌿 Plains Cottonwood

🌿 Plains Cottonwood/Mixed Shrubland

🌿 Plains Cottonwood/Peachleaf Willow/Sandbar Willow
- 🌿 Sandbar Willow

🌿 Ponderosa Forest

🌿 Ponderosa Pine/Gambel Oak

🌿 Gambel Oak

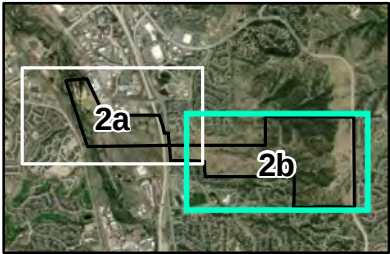


Image Source: Maxar Technologies©, June 17, 2021

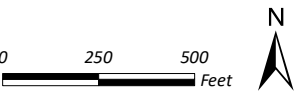


Figure 2b
Vegetation Communities
East of I-25

Prepared for: Pine Canyon
File: 23_051 NRA Figure 2s.mxd (GS)
May 2, 2023



Regulatory Framework

Development in the project area may be affected by several federal and state environmental regulations. One of the goals of this document is to provide information to assist JRW Family Limited Partnership LLLP in addressing regulatory compliance issues. The environmental regulations most pertinent to the proposed project are described below.

Federal, State, and Local Regulations

Clean Water Act

The Clean Water Act (CWA) protects the chemical, physical, and biological quality of waters of the U.S. (WOTUS). The U.S. Army Corps of Engineers' (Corps) Regulatory Program administers and enforces Section 404 of the CWA. Under Section 404, a Corps permit is required for the discharge of dredged or fill material into wetlands and other WOTUS (streams, ponds, and other waterbodies). Findings regarding WOTUS are addressed in the *Wetlands and Waters of the U.S.* section of this report.

Endangered Species Act

Federally listed T&E species are protected under the Endangered Species Act of 1973, as amended (ESA; 16 United States Code (U.S.C.) 1531 et seq.). Significant adverse effects on a federally listed species or its habitat require consultation with the U.S. Fish and Wildlife Service (Service) under Section 7 or 10 of the ESA. No regulations require consultations for effects on candidate species; however, if a species were to become listed during project planning or construction, consultation with the Service would be required. Findings regarding federal T&E species are addressed in the *Federally Threatened, Endangered, and Candidate Species* section of this report.

Migratory Bird Treaty Act

Migratory birds, including raptors, and any active nests are protected under the Migratory Bird Treaty Act (MBTA). Removal of active nests that results in the loss of eggs or young is prohibited under the MBTA. In Colorado, most birds (except grouse species and nonnative Eurasian collared dove, European starling, house sparrow, and rock pigeon) are protected under the MBTA (§§ 703-712). Even species that tend to be present throughout the year, such as magpie and great horned owl, are protected under the MBTA. All nests are protected, including cavity (e.g., flicker), ground (e.g., killdeer), and subterranean (e.g., burrowing owl) nests. The MBTA does not contain any prohibition that applies to the destruction of a bird nest alone (without birds or eggs), provided that no possession occurs during the destruction. Findings regarding migratory birds are addressed in the *Raptors and Migratory Birds* section of this report.

Colorado State Statute 33

As directed by Colorado State Statute 33 (State Statute 33; Colorado Revised Statutes Ann. §§33-2 to 102-106), the Colorado Wildlife Commission issues regulations and develops management programs implemented by Colorado Parks and Wildlife (CPW; formerly Colorado Division of Wildlife (CDOW)) for wildlife species not federally listed as threatened or endangered. This includes maintaining a list of state

T&E species. CPW also maintains a list of species of concern, but these species are not protected under State Statute 33. Although State Statute 33 prohibits the take, possession, and sale of state-listed species, it does not include protection of their habitat. Findings regarding state T&E species and other wildlife species are addressed in the *State Threatened and Endangered Species and Species of Special Concern* section of this report.

Douglas County Policies

As part of Douglas County's (County) 2040 Comprehensive Master Plan (CMP; Douglas County 2019), the County has established additional guidance, goals, and policies to protect and enhance wildlife, wildlife habitat, and movement corridors. Section 9 of the CMP specifies four objectives, with accompanying policies associated with wildlife habitat protection and enhancement. Recommendations on compliance with the County's policies are provided in the *Habitat Management Guidelines* and *Post-construction Habitat Recommendations* sections of this report.

Project Background and Environmental Baseline

ERO conducted a natural resources assessment for the Pine Canyon in 2011 (2011 site visit) and submitted the report to JRW Family Limited Partnership in 2012 (ERO 2012). The 2011 site visit included surveying the Pine Canyon (Walker Properties) and abutting Scott Properties. This report focuses on the Pine Canyon, Walker Properties (Figure 1) and provides an updated assessment of the project area to identify natural and wildlife resources that may be impacted by development of portions of the project area and to identify any significant changes in natural resources since the assessment conducted in 2011.

The project area has been continually influenced by human activities for more than 100 years. The entire project area has been impacted to varying degrees by agricultural activities, primarily grazing and hay cultivation. Two residences, a blacksmith shop, and equipment storage yard are located in the northwest portion of the project area. Several utility and road corridors, including pipeline and transmission line corridors, a railroad, local connector roads, and a major interstate, cross the project area. A pedestrian/bike trail was installed along East Plum Creek in 2010. The trail, roads, and utility corridors are periodically disturbed for construction and maintenance activities.

Methods

ERO conducted a natural resources assessment of the project area to identify natural and wildlife resources that may be impacted by development of the project area and to identify any significant changes since the 2011 site visit (ERO 2012).

This evaluation focuses on the key natural resource characteristics, and wildlife habitat functions, including:

- Native vegetation communities

- Water resources, especially wetlands and riparian areas
- Biodiversity, including plant and animal species of conservation concern
- Wildlife corridors
- Migratory and resident bird (including raptors) seasonal habitats and nests
- Big game seasonal habitat
- Habitat restoration and enhancement opportunities, based on existing vegetation characteristics and habitat quality

In addition to the information gathered during the 2023 site visit, wildlife and natural resource information was obtained from existing sources such as aerial photography, the Colorado Natural Diversity Information Source, Douglas County Riparian Conservation Zone (RCZ) mapping, Service National Wetlands Inventory database, Douglas County RCZ mapping, the Colorado Natural Heritage Program (CNHP), U.S. Geological Survey (USGS) National Hydrography Dataset (NHD), and other sources (Google, Inc 2023; Natural Diversity Information Source 2021; Douglas County, Town of Castle Rock, and Town of Parker 2006; Service, n.d.; Colorado Natural Heritage Program 2023; U.S. Geological Survey 2023).

Based on the information gathered from existing sources and the 2023 site visit, ERO verified existing vegetation communities and identified important wildlife attributes of the project area both within the project area boundaries and in a regional context (Figure 2a and Figure 2b). In addition, ERO used existing data from CPW map databases and the 2040 Douglas County CMP (Douglas County 2019) to compile this description of natural resources and wildlife habitat.

Project Area Description

The U.S. Department of Agriculture (USDA) has mapped the project area within the Southern Rocky Mountain Foothills Major Land Resource Area, which is mainly characterized by rugged mountains with some broad valleys and remnants of high plateaus (USDA, NRCS 2006). The climate of the area is typical of midcontinental semiarid temperate zones, but the strong rain shadow effect of the Southern Rocky Mountains makes the area somewhat drier. The average annual precipitation is between 9 inches in certain valleys and 63 inches on some mountain peaks (USDA, NRCS 2006).

The project area is located in the Middle South Platte-Cherry Creek and Upper South Platte watersheds and is part of the Platte River system, which is tributary to the Missouri River, the longest river in the United States (about 2,341 miles long). The geology of the area consists largely of exposed sedimentary rock and alluvial fill. The majority of the region historically consisted of shortgrass and midgrass prairie.

The project area is surrounded by a mixture of undeveloped and developed land, including residential communities east of I-25 to the north, east, and south of the project area, and commercial/industrial development along the railroad (Figure 2a and Figure 2b).

The National Land Cover Database maps 10 land cover types in the project area (U.S. Geological Survey 2016). The most dominant land cover types are Grassland/Herbaceous, which occurs at lower

elevations on both sides of I-25, and Scrub/Shrub and Evergreen Forest at higher elevations on the east side of I-25. The other land cover types in the project area include Developed (high, medium, and low intensity); Developed/Open Space; Woody Wetlands; Emergent Herbaceous Wetlands; and Deciduous Forest.

The topography of the project area generally slopes from plateaus and rolling ridges into tapered drainage basins (Photo 1; Appendix A). East Plum Creek runs through the west end of the project area, and two unnamed drainages (Tributary 1 and Tributary 2) flow into East Plum Creek (Figure 2a and Figure 2b). Much of the eastern edge of the East Plum Creek floodplain is sharply defined by large sheer dirt banks. East of I-25, the project area is being used for grazing cattle.

ERO identified four distinct land cover types in the project area: Upland Grasslands consisting of both native and mixed herbaceous vegetation at lower elevations and moderate slopes on both sides of I-25, Oak Shrublands and Ponderosa Pine Forest at higher elevations on the east side of I-25, and drainage corridors that support riparian and wetland vegetation. Each primary vegetation community is described in detail in the *Vegetation Communities* section below. Within these primary communities, ERO mapped 12 distinct vegetation community types: (1) Disturbed/Developed, (2) Native Grassland, (3) Mixed Grassland, (4) Mixed Shrubland, (5) Plains Cottonwood, (6) Plains Cottonwood/Mixed Shrubland, (7) Plains Cottonwood/Peachleaf Willow/Sandbar Willow, (8) Sandbar Willow, (9) Ponderosa Forest, (10) Ponderosa Pine/Gambel Oak, (11) Gambel Oak, and (12) Open Water (Figure 2a and Figure 2b).

Vegetation Communities

During the 2023 site visit, ERO documented primary vegetation communities that provide contiguous habitat, water resources, and core wildlife values such as cover and forage for various wildlife species. As discussed above, the primary vegetation communities found in the project area are Upland Grasslands, Oak Shrublands, Ponderosa Pine Forest, and drainage corridors (Figure 2a and Figure 2b). Wildlife habitat in the project area correlates to the existing vegetation communities and topographical features. Each primary vegetation community, and the distinct vegetation community types that are categorized as part of the primary vegetation communities, are described in more detail below.

Disturbed/Developed areas were also mapped in the project area, but do not fall under the primary vegetation communities discussed below. These areas were limited to the residences, blacksmith shop, and equipment storage yard and along the utility, trail, and road corridors (Photo 2).

Upland Grasslands

The Native Grassland and Mixed Grassland vegetation community types fall within the broader Upland Grasslands primary vegetation community. This vegetation community was observed in the lower elevation areas east and west of I-25, and in moderately flat upland areas interspersed in the Ponderosa Pine/Gambel Oak vegetation communities and at the tops of the plateaus in the eastern portion of the project area (Photos 3 through 5).

On the west side of I-25, the grasslands are characterized as shortgrass prairie consisting of mixed grasslands with native and introduced pasture grasses, which primarily occur in agricultural fields that have been recently planted with native herbaceous species. Grass species observed in these areas include sand dropseed (*Sporobolus cryptandrus*), blue grama (*Bouteloua gracilis*), little bluestem (*Schizachyrium scoparium*), needle-and-thread grass (*Hesperostipa comata*), purple threeawn (*Aristida purpurea*), smooth brome (*Bromus inermis*), crested wheatgrass (*Agropyron cristatum*), and cheatgrass (*Bromus tectorum*).

Native and Mixed Grasslands on the east side of I-25 are dominated by grasses including blue grama, purple threeawn, and smooth brome with scattered patches of yucca (*Yucca glauca*), aster (*Aster* sp.), pricklypear cactus (*Opuntia polyacantha*), and prairie sagewort (*Artemisia frigida*). Small patches and scattered noxious weeds were noted in the Upland Grasslands vegetation community including Scotch thistle (*Onopordum acanthium* - List B), diffuse knapweed (*Centaurea diffusa* - List B), common mullein (*Verbascum thapsus* - List C), and cheatgrass (List C). The noxious weed species were found in areas of higher disturbance in the project area but are not prevalent in the project area.

Typically, small predators, such as coyote (*Canis latrans*) and red fox (*Vulpes vulpes*), use this vegetation community to hunt small rodents, ground-nesting birds, and reptiles that inhabit these areas.

Oak Shrublands

Oak Shrublands, mapped primarily as Gambel Oak in the project area, are interspersed in the Native Grassland vegetation communities east of I-25 and occur in medium- to high-density patches on the moderately to relatively steep slopes further east in the project area (Photos 6 and 7). Oak Shrublands are generally dominated by Gambel oak (*Quercus gambelii*) with a variety of subshrub species and an understory of shortgrass prairie species. Additional native shrub species observed in this vegetation community include mountain mahogany (*Cercocarpus montanus*), chokecherry (*Prunus virginiana*), and Woods' rose (*Rosa woodsii*). This vegetation community intermixes with Ponderosa Pine Forest in the eastern portion of the project area (Figure 2a and Figure 2b). The Ponderosa Pine/Gambel Oak community is dominated by large mature ponderosa pines (*Pinus ponderosa*) with a shrub understory dominated by Gambel oak and other native shrubs scattered throughout the community and along drainages.

Fire mitigation has been conducted in the Oak Shrublands and Ponderosa Pine/Gambel Oak vegetation communities east of I-25, along the southern boundary of the project area, and adjacent to existing residential communities. The fire mitigation includes thinning and removing oak, particularly under pine trees, and clearing and disposing of limbs, branches, and other woody debris that has accumulated in the understory (Photos 8 and 9).

This vegetation community is important for its diversity. Wildlife species, such as elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), and avian species, typically use these areas for cover and foraging.

Ponderosa Pine Forest

The Ponderosa Pine Forest vegetation community in the project area is primarily low- to mid-density and consists of an understory of shrubby species and sparse coverings of mixed-grass prairie (Photos 8 and 9). This vegetation community occurs in large contiguous areas intermixed with the Ponderosa Pine/Gambel Oak vegetation community in the eastern portion of the project area (Figure 2b).

The Ponderosa Pine Forest vegetation community supports nesting and foraging areas for squirrels (*Sciuridae* sp.) and birds. This vegetation community can also provide cover for big game species.

Drainage Corridors and Wetland and Riparian Communities

East Plum Creek, a perennial stream, generally flows from southeast to northwest along the western boundary of the project area, and two tributaries flow into East Plum Creek in the project area (Tributary 1 and Tributary 2; Photos 10 through 14; Figure 2a and Figure 2b). East Plum Creek and the tributaries contribute to the varied topography of the project area. Potential wetlands occur along East Plum Creek on the western edge of the project area and in a few localized depressions in the project area. Potential wetland areas are described in detail under the *Wetlands and Waters of the U.S.* section below.

Riparian areas are integrated vegetation communities adjacent to and affected by surface water and groundwater associated with drainage corridors, including creeks, streams, lakes, and other water bodies. These communities usually support greater levels of plant diversity than the surrounding landscape and are important to the survival of many wildlife species. While they cover only a small fraction of the landscape, riparian habitats play an important role in the life cycles for most wildlife species in the region by providing a source for cover, water, prey, and reproduction areas.

Riparian vegetation community types occur along East Plum Creek and at the downstream end of the tributaries and include Mixed Shrubland, Plains Cottonwood/Mixed Shrubland, Plains Cottonwood/Peachleaf Willow/Sandbar Willow, and Sandbar Willow (Photos 10 through 12; Figure 2a). In the project area, most of the riparian communities are dominated by an understory of native and nonnative species including western wheatgrass (*Pascopyrum smithii*), reed canarygrass (*Phalaris arundinacea*), wild licorice (*Glycyrrhiza lepidota*), scouring horsetail (*Equisetum* sp.), sand dropseed, blue grama, Kentucky bluegrass (*Poa pratensis*), smooth brome, cheatgrass, common mullein, and diffuse knapweed. The riparian overstory along East Plum Creek is dominated by plains cottonwood (*Populus deltoides*), peachleaf willow (*Salix amygdaloides*), sandbar willow (*Salix exigua*), and western snowberry (*Symphoricarpos occidentalis*), with patches of Gambel oak and chokecherry.

Although not all the drainage corridors in the project area support a permanent water source, and some lack well-developed wetland and riparian communities, they provide protective cover, foraging, and nesting habitat for wildlife and birds. The drainages can support movement corridors and core habitat connections for wildlife, as well as add to the scenic quality of the project area. Several wildlife species dwell in these areas, while others use them as a passageway; therefore, there is typically high biodiversity in the project area. Maintaining drainage corridors and their associated vegetation

communities as habitat corridors contribute to the colonization, migration, and interbreeding of wildlife species.

Wetlands and Waters of the U.S.

Background

The CWA protects the chemical, physical, and biological quality of WOTUS. The Corps Regulatory Program administers and enforces Section 404 of the CWA. Under Section 404, a Corps permit is required for the discharge of dredged or fill material into wetlands and other WOTUS (streams, ponds, and other waterbodies). On June 22, 2020, the Environmental Protection Agency (EPA) and Corps' Navigable Waters Protection Rule (NWPR) (U.S. Environmental Protection Agency 2020) to define "waters of the United States" became effective in 49 states and in all U.S. territories. A preliminary injunction was granted for Colorado. On March 2, 2021, the United States Court of Appeals for the 10th Circuit vacated the stay on the NWPR in Colorado, thereby ruling the NWPR effective in Colorado. After April 23, 2021, jurisdiction of wetlands and other potential WOTUS in Colorado was to be determined using the NWPR. However, on August 30, 2021, the Arizona District Court remanded and vacated the NWPR. In response, the EPA and Corps have halted implementation of the NWPR and, until further notice, are interpreting WOTUS consistent with the pre-2015 regulatory regime (also referred to as the "Rapanos" guidelines). On January 18, 2023, the EPA and Corps published a final rule to define WOTUS (new rule). The new rule codified the pre-2015 approach to WOTUS, with some changes to the definition of "adjacency" and "significantly affect" that could expand jurisdiction of certain streams or wetlands. The new rule went into effect on March 20, 2023; however, there is a strong potential it will be challenged in court, affecting its implementation. As such, the identification of WOTUS in this report follows the Rapanos guidelines. Potential rulings and guidance in the future could change the results of this report regarding the jurisdictional status of waters and wetlands in the project area. While ERO may provide its opinion on the likely jurisdictional status of wetlands and waters, the Corps will make the final determination of jurisdiction based on the current rulings.

Under the Rapanos guidelines, the Corps considers traditionally navigable waters (TNWs), wetlands adjacent to a TNW, and tributaries to TNWs that are relatively permanent waters (RPWs) and their abutting wetlands jurisdictional waters. Other wetlands and waters that are not TNWs or RPWs will require a significant nexus evaluation to determine their jurisdiction. A significant nexus evaluation assesses the flow characteristics and functions of a tributary and its adjacent wetlands to determine if they significantly affect the chemical, physical, or biological integrity of downstream TNWs.

Methodology

During the 2023 site visit, ERO surveyed the project area for potential isolated wetlands, jurisdictional wetlands, and other WOTUS. A full jurisdictional wetland delineation following Corps guidelines was not conducted during the 2023 site visit; however, ERO followed the methods for routine on-site wetland determinations as described in the 1987 Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and methods in the Regional Supplement to the Corps of Engineers

Wetland Delineation Manual: Great Plains Region (Version 2.0) (Corps 2010) to map existing wetlands and refine changes in wetland boundaries between the 2011 and 2023 site visits. In the rest of the project area, ERO verified the 2011 delineation boundaries of wetlands, stream channels, and open water in the project area. Before the 2023 site visit, ERO reviewed USGS quadrangle topographic maps and aerial photography to identify mapped streams and areas of open water that could indicate wetlands or WOTUS. ERO also reviewed the proximity and potential surface water connection of wetlands to known jurisdictional WOTUS using aerial photo interpretation, landowner information, and information from the 2023 site visit.

The Corps defines wetlands as “areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (33 Code of Federal Regulations (CFR) 328.2(c)). Wetland boundaries were determined by a visible change in vegetation community, soils, topographic changes, and other visible distinctions between wetlands and uplands. The wetland indicator status of plant species was identified using the *National Wetland Plant List* (Corps 2020), taxonomy was determined using *Flora of Colorado* (Ackerfield 2015), and nomenclature was determined using the *PLANTS Database* (USDA, NRCS 2023).

Intermittent, ephemeral, and perennial drainages with characteristics of a defined streambed, streambank, ordinary high water mark (OHWM), and other erosional features also were identified. The OHWM identifies the lateral jurisdictional limits of nonwetland WOTUS. Federal jurisdiction over nonwetland WOTUS extends to the OHWM, defined in 33 CFR 328.3 as “the line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.” The Corps defines “stream bed” as “the substrate of the stream channel between the OHWMs. The substrate may be bedrock or inorganic particles that range in size from clay to boulders.”

Jurisdictional Assessment

ERO reviewed the proximity and potential surface water connection of wetlands to known jurisdictional WOTUS using aerial photo interpretation and information from the wetland assessment. In the project area, wetlands were distinguished as isolated, abutting, or adjacent to a TNW, or as abutting or adjacent to a tributary to a TNW. Abutting wetlands are not separated from a TNW or tributary by uplands, a berm, a dike, or similar feature. Adjacent wetlands are bordering, contiguous, or neighboring a TNW or tributary, and may be separated from a TNW or tributary by uplands, a berm, a dike, or similar feature. Wetlands or waters that have a surface water connection to the South Platte River may provide more than a speculative or insubstantial effect on the chemical, physical, and/or biological integrity of a TNW. While ERO may provide its opinion on the likely jurisdictional status of wetlands and waters, the Corps will make the final determination of jurisdiction based on the current rulings. The following sections

contain information on potential surface water connections of wetlands and other waters in the project area.

Description of Wetlands and Other Waters

Streams and Open Water Areas

East Plum Creek generally flows from south to north, just inside the western boundary of the project area (Figure 2a). During the 2023 site visit, water was flowing in the creek and potential wetlands were identified in fringes and on low terraces along the channel banks (Photos 10 through 12).

Two tributaries to East Plum Creek also occur in the project area (Tributary 1 and Tributary 2; Figure 2a). Both are ephemeral drainages shown on the USGS Castle Rock North topographic quadrangle. Tributary 1 occurs on the west side of East Plum Creek and flows into the creek in the southwest corner of the project area. Tributary 1 did not contain any water during the 2011 or 2023 site visit but did contain a defined channel bed and bank. The tributary is eroded with steep banks and is vegetated with Gambel oak with no wetland vegetation. Tributary 2 begins at a culvert at I-25 and heads west through the project area. The NHD shows Tributary 2 beginning east of I-25; however, in this area the tributary was identified as an upland vegetated swale that did not contain any characteristics of a WOTUS. Directly west of I-25, Tributary 2 contains a sandy wash. Surface runoff from I-25 likely contributes to flows in Tributary 2 during storm events. The banks of Tributary 2 are vegetated with smooth brome, western snowberry, Canada thistle (*Cirsium arvense*), switchgrass (*Panicum virgatum*), and kochia (*Bassia scoparia*). West of North Liggett Road, the majority of Tributary 2 contains a defined bed and bank; however, intermittent sections are vegetated with upland species. Tributary 2 connects to East Plum Creek in the southern portion of the project area (Photos 13 and 14; Figure 2a).

Wetlands

Wetlands occur along East Plum Creek on the western edge of the project area (Figure 2a). The dominant vegetation found in this wetland community are hydrophytic species dominated by sandbar willow, reed canarygrass, meadow fescue (*Schedonorus pratensis*), Baltic rush (*Juncus arcticus*), redtop (*Agrostis gigantea*), Emory's sedge (*Carex emoryi*), water speedwell (*Veronica aquatica-galli*), and watercress (*Nasturtium officinale*).

A small potential wetland (Wetland 1) is located in the northern portion of the project area directly west of I-25 (Figure 2a). The wetland appears to receive water from an outfall located along the I-25 berm. The area is dominated by sandbar willow, plains cottonwood, peachleaf willow, and narrowleaf cattail (*Typha angustifolia*), with some barnyard grass (*Echinochloa crus-galli*) and curly dock (*Rumex crispus*) observed (Photo 15). Open water was observed in the area during the 2011 and 2023 site visits. Wetland 1 does not appear to have a connection to any known WOTUS and is surrounded by upland vegetation.

Two potential wetlands are in the project area directly east of Front Street (Wetlands 2 and 3). Wetland 2 contained standing water at the time of the 2023 site visit and was only sparsely vegetated due to disturbance from cattle (Photo 16). This wetland extends to the culvert that runs under I-25 to Tributary

2. As such, it may have a downstream connection to East Plum Creek and may be considered jurisdictional. Wetland 3 is in a small pond containing narrowleaf cattail on the southern boundary behind an apartment complex. The pond may be a detention facility for the adjacent development. Wetland 3 is surrounded by uplands and does not appear to have a connection to a known WOTUS.

A stock pond is located along the eastern boundary of the project area just west of Founders Parkway (Figure 2b). The stock pond does not appear to have a connection to a known WOTUS. Stock ponds are not usually considered a jurisdictional WOTUS.

Recommendations

East Plum Creek is considered a WOTUS by the Corps. The ephemeral drainages (Tributary 1 and Tributary 2) and Wetland 2 would likely be considered jurisdictional WOTUS because of their connections and adjacency to East Plum Creek. Wetlands 1 and 3 and the stock pond may be considered isolated and nonjurisdictional because they lack surface connections to a known WOTUS. If any work is planned in any of these areas, a jurisdictional determination should be requested from the Corps. In the event any of these areas are considered jurisdictional, and work is planned in any of the wetlands, East Plum Creek, or open waters in the project area, a wetland delineation should be conducted and a report should be submitted to the Corps for review.

Any discharge of dredged or fill material into jurisdictional WOTUS, including adjacent wetlands, would require authorization under Section 404 of the CWA. If any of the wetlands are determined nonjurisdictional or if no work is planned in any of the wetlands or open water, no action would be necessary.

Federally Threatened, Endangered, and Candidate Species

ERO assessed the project area for habitat for T&E species under the ESA. Federally listed T&E species are protected under the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). Significant adverse effects on a federally listed species or its habitat require consultation with the Service under Section 7 or 10 of the ESA. The Service's Information for Planning and Consultation (IPaC) resource list for the project area identifies several T&E species that could be potentially affected by the project (Table 1) (Service 2023).

Table 1. Federally threatened, endangered, and candidate species potentially found in the project area or potentially affected by the project.

Common Name	Scientific Name	Status*	Habitat	Suitable Habitat Present
Mammals				
Gray wolf	<i>Canis lupus</i>	E	Wolves can thrive in a wide range of habitats; a highly adaptable species that occurs in temperate forests, mountains, and grasslands	No - this species does not currently occur in Douglas County and project activities would not result in appreciable take
Preble's meadow jumping mouse	<i>Zapus hudsonius preblei</i>	T	Shrub riparian/wet meadows	Yes
Birds				
Piping plover**	<i>Charadrius melodus</i>	T	Sandy lakeshore beaches and river sandbars	No habitat, no potential to affect

Common Name	Scientific Name	Status*	Habitat	Suitable Habitat Present
Whooping crane**	<i>Grus americana</i>	E	Mudflats around reservoirs and in agricultural areas	No habitat, no potential to affect
Fish				
Greenback cutthroat trout	<i>Oncorhynchus clarki stomias</i>	T	Cold, clear, gravel headwater streams and mountain lakes	No
Pallid sturgeon**	<i>Scaphirhynchus albus</i>	E	Large, turbid, free-flowing rivers with a strong current and gravel/sand substrate	No habitat, no potential to affect
Invertebrates				
Monarch butterfly	<i>Danaus plexippus</i>	C	Dependent on milkweeds (<i>Asclepiadoideae</i>) as host plants and forage on blooming flowers; a summer resident	No
Plants				
Ute ladies'-tresses orchid	<i>Spiranthes diluvialis</i>	T	Moist to wet alluvial meadows, floodplains of perennial streams, and around springs and lakes below 7,800 feet in elevation	No
Western prairie fringed orchid**	<i>Platanthera praeclara</i>	T	Moist to wet prairies and meadows	No habitat, no potential to affect

*T = Federally Threatened Species, E = Federally Endangered Species; C = Candidate for Federal Listing.

**Water depletions in the South Platte River may affect the species and/or critical habitat in downstream reaches in other counties or states.

Source: Service 2023.

Species Eliminated from Further Consideration

The proposed project would not affect the gray wolf, greenback cutthroat trout, or monarch butterfly because the project area is outside of the known range of these species or because of the lack of potentially suitable habitat in the project area.

The piping plover, whooping crane, pallid sturgeon, and western prairie fringed orchid are species that are affected by continued or ongoing water depletions to the Platte River system. If the project includes activities that deplete water in the South Platte River, such as diverting water from a stream or developing new water supplies, these species could be affected by the project, and consultation with the Service may be required.

Potential habitat for Preble's meadow jumping mouse (Preble's) and Ute ladies'-tresses orchid (ULTO) is generally more prevalent in areas across the Front Range. Because these species are more likely to be addressed by counties and regulatory agencies such as the Corps, a more detailed discussion is provided below.

Threatened and Endangered Species Habitat

Preble's Meadow Jumping Mouse

Species Background

Preble's was listed as a threatened species on May 13, 1998. Several petitions to delist Preble's have been filed with the Service since 2011. On March 30, 2017, a petition to delist Preble's was filed; the

Service found that the petition did not present substantial scientific or commercial information indicating that delisting Preble's may be warranted (Service 2018). The Service refers to this finding as a "not substantial" petition finding (2018). On August 10, 2018, the Service announced the initiation of a five-year status review for Preble's (Service 2018b). Until the completion of this five-year finding, Preble's remains protected under the ESA. Preble's is found along the foothills of southeastern Wyoming and southward along the eastern edge of the Colorado Front Range to Colorado Springs (Clark and Stromberg 1987; Fitzgerald, Meaney, and Armstrong 1994). The semiarid climate in southeastern Wyoming and eastern Colorado limits the extent of riparian corridors and, therefore, restricts Preble's range, which is associated with these corridors.

Along Colorado's Front Range, Preble's is found below 7,800 feet in elevation, generally in lowlands with medium to high moisture along permanent or intermittent streams. Preble's prefer riparian areas featuring well-developed, multistoried, and horizontal cover with an understory of grasses and forbs (Armstrong et al. 1997b; 1997a). Preble's typically inhabits areas characterized by plains riparian vegetation with relatively undisturbed grassland and a water source nearby (Armstrong, Fitzgerald, and Meaney 2011). High-use areas for Preble's tend to be close to creeks and are associated with a high percentage of shrubs, grasses, and woody debris (Trainor, Shenk, and Wilson 2007). Previous studies have suggested that Preble's may have a wider ecological tolerance than previously thought and that the requirement for diverse vegetation and well-developed cover can be met under a variety of circumstances (Meaney et al. 1997). Radio-tracking studies conducted by the CPW have documented Preble's using upland habitat adjacent to wetlands and riparian areas (Shenk and Sivert 1999). Additional research by CPW has suggested that habitat quality for Preble's can be predicted by the amount of shrub cover available at a site (White and Shenk 2000). Mountain riparian sites may be surrounded by dense forest vegetation (such as ponderosa pine in Colorado), and sites on the plains have less woody vegetation.

Potential Habitat and Possible Effects

Habitat for Preble's is present in the project area, and Preble's is assumed to be present along East Plum Creek. Because of the presence of Preble's in many riparian corridors in Douglas County, the County and the towns of Castle Rock and Parker (Towns) have developed the Douglas County Habitat Conservation Plan (DCHCP) in support of Incidental Take Permits (ITPs) from the Service for specified activities that would occur in Preble's habitat. The DCHCP provides programmatic incidental take coverage and ESA compliance regarding Preble's and its habitat for these activities, including impact mitigation. On May 11, 2006, the Service approved implementation of the DCHCP. As part of the DCHCP, riparian areas and adjacent upland habitats on nonfederal lands with a high likelihood of supporting Preble's were mapped and designated as potential habitat, which is referred to as the RCZ. The Service has approved the RCZ mapping as the geographic limits of Preble's habitat on nonfederal lands in Douglas County. East Plum Creek in the project area is within the RCZ (Figure 3a).

The DCHCP and associated ITPs expired on May 11, 2016. Douglas County and the Towns initiated the renewal process with the Service in June 2014 and formally submitted their renewal application to the Service on December 22, 2015. Although the DCHCP and associated ITPs expired, Douglas County and

the Towns received confirmation from the Service that the County and Towns can continue to rely on the DCHCP and associated ITPs for ESA compliance, including impact mitigation, for activities covered by the DCHCP regarding Preble's and its habitat potentially affected by these activities, and that the RCZ remains in effect during the renewal period.

Vegetation community types are the key elements in determining the outer extents of potential Preble's habitat in the project area. In general, Preble's habitat in the project area includes riparian shrub and tree vegetation and adjacent uplands. Roads, buildings, and other disturbed areas are not considered habitat. The residential and disturbed areas in the northwest corner of the project area were incorrectly mapped as habitat in the RCZ. ERO mapped a more accurate determination of suitable Preble's habitat based on site-specific vegetation characteristics and topography (Figure 3a). In November 2022, JRW Family Limited Partnership LLLP submitted a habitat assessment letter to revise existing habitat maps (RCZ and/or Federal Emergency Management Agency floodplain) to better reflect actual habitat conditions and provide a logical scientific basis for the revision. In December 2022, the Service concurred that 7.18 acres of the property, as designated in their letter, are unlikely to result in take of a listed species, with a vegetated buffer area of 0.22 acre to remain as recognized, suitable Preble's mouse habitat that would serve as a transitional zone between the degraded property and the riparian area. The Service's concurrence letter is included as Appendix B.

A trapping survey was conducted in and adjacent to the project area and no Preble's were found (Figure 3a and Figure 3b); however, the closest known Preble's population is approximately 0.5 river mile directly upstream (south) of the project area along East Plum Creek (Service 2014).

Recommendations

Under existing regulations, some level of consultation with the Service for Preble's is required for any habitat-disturbing activities in areas determined to be potential Preble's habitat. ERO determined that vegetation characteristic of suitable Preble's habitat is present in the project area in the RCZ along East Plum Creek; however, JRW Family Limited Partnership LLLP is planning to preserve the RCZ in the project area and placed under a conservation easement.

If any work activities are proposed in the RCZ, ERO recommends that a formal habitat assessment be completed and submitted to the Service. Where possible, project impacts on Preble's habitat should be avoided. If the proposed project were likely to affect Preble's habitat, consultation with the Service would be required. Enhancement of the East Plum Creek corridor would be of great benefit to Preble's and other riparian wildlife species. Although restoration would benefit Preble's, any activity in Preble's habitat would require consultation with the Service.



Pine Canyon Property

-  Inactive Raptor Nest

 Unknown Raptor Nest

Preble's Trapping Results

 Evaluated, not Trapped
-  ERO Preble's Habitat Boundary

 Aquatic Native Species Conservation Waters HPH

 Douglas County Riparian Conservation Zone Boundary

 Project Area Boundary

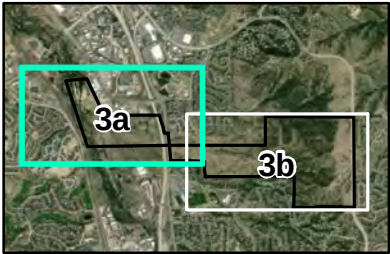


Image Source: Maxar Technologies©, June 17, 2021
* Data Source: Colorado Parks and Wildlife

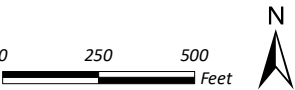
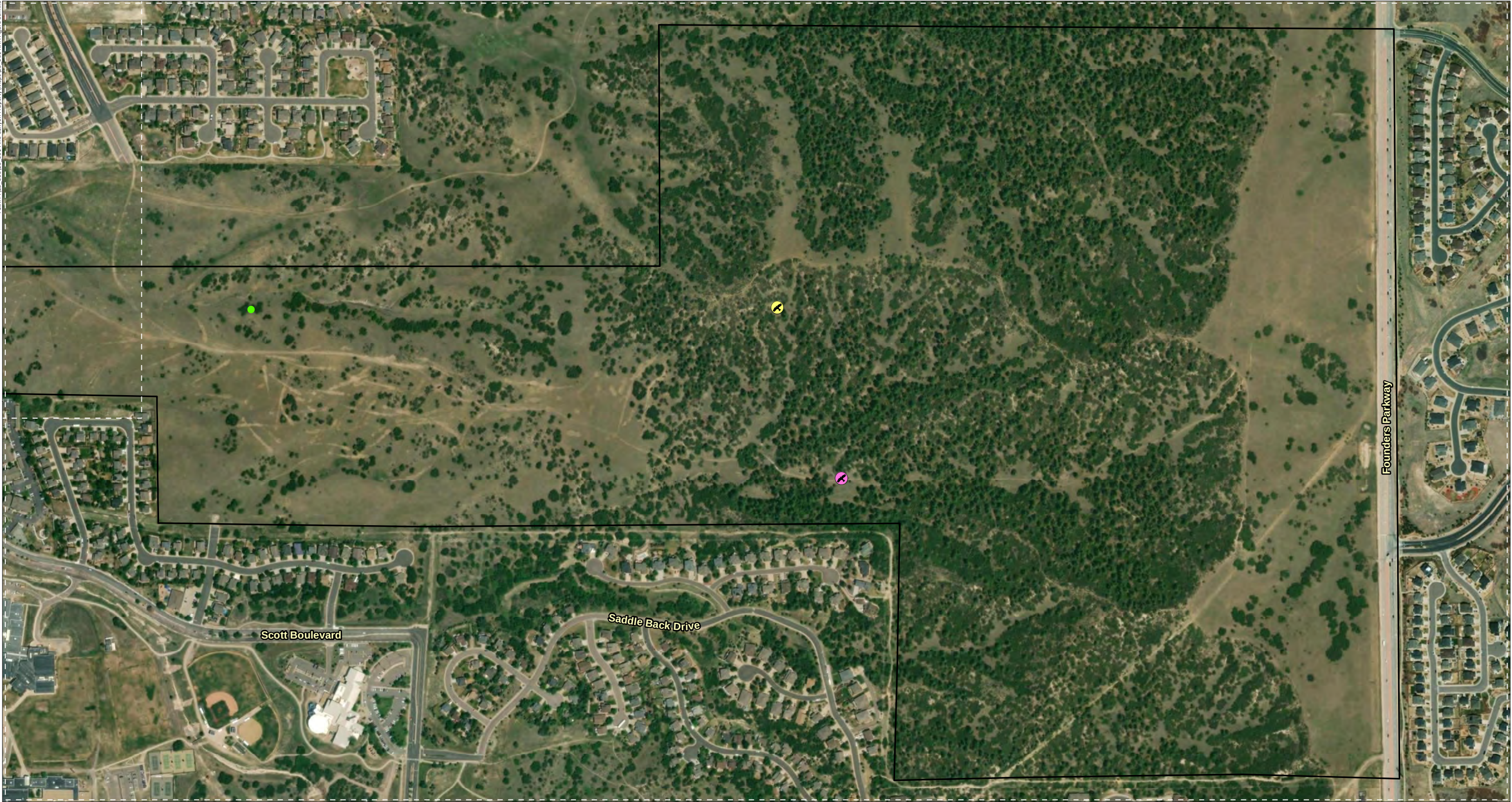


Figure 3a
Wildlife Resources
West of I-25

Prepared for: Pine Canyon
File: 23_051 NRA Figure 3s.mxd (GS)
May 2, 2023





Path: P:\23_000\23_051 Pine Canyon Property\Maps\23_051 NRA Figure 3s.mxd

Pine Canyon Property

-  Inactive Raptor Nest
-  Unknown Raptor Nest
- Preble's Trapping Results

 Evaluated, not Trapped
-  ERO Preble's Habitat Boundary
-  Aquatic Native Species Conservation Waters HPHC*
-  Douglas County Riparian Conservation Zone Boundary
-  Project Area Boundary

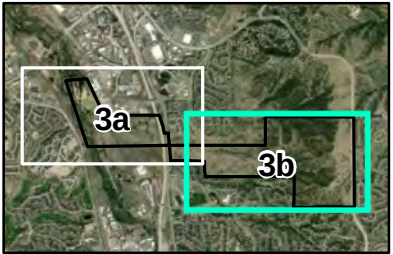


Image Source: Maxar Technologies©, June 17, 2021
* Data Source: Colorado Parks and Wildlife

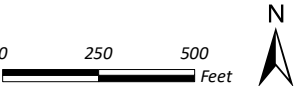


Figure 3b
Wildlife Resources
East of I-25

Prepared for: Pine Canyon
File: 23_051 NRA Figure 3s.mxd (GS)
May 2, 2023



Ute Ladies'-Tresses Orchid

Species Background

Ute ladies'-tresses orchid (ULTO) is federally listed as threatened. ULTO occurs at elevations below 7,800 feet in moist to wet alluvial meadows, floodplains of perennial streams, and around springs and lakes where the soil is seasonally saturated within 18 inches of the surface (CNHP 2014; Service 1992a). This species has also been found along irrigation canals, irrigated meadows, gravel pits, and other human-modified wetlands (NatureServe 2022). Once thought to be fairly common in low-elevation riparian areas in the interior western United States, ULTO is now rare (Service 1992a). The species' known range is from Nevada to British Columbia. The largest known populations occur in Utah, followed by Colorado (NatureServe 2022).

In Colorado, the Service requires surveys in suitable habitat within the 100-year floodplain segments of the South Platte River, Fountain Creek, and Yampa River and their perennial tributaries, or in any area with suitable habitat in Boulder and Jefferson Counties. Since the protocols were submitted in 1992, ULTO has been found along the Roaring Fork River. Therefore, surveys should be conducted in suitable habitat in the floodplain of the Roaring Fork River and its tributaries. ULTO does not bloom until late July to early September (depending on the year) and timing of surveys must be synchronized with blooming (Service 1992b).

Potential Habitat and Effects

There is no suitable habitat to support potential populations of ULTO in the project area because the project area lacks wet meadow habitat typically associated with this species. In addition, vegetation in the riparian areas is dominated by species not typically found with the ULTO and the stands of sandbar willows and other vegetation are most likely too dense to allow establishment of a new population of ULTO in the project area.

Recommendations

Because no suitable habitat occurs in the project area, no action is necessary regarding ULTO.

State Threatened and Endangered Species and Species of Special Concern

During the 2023 site visit, ERO also assessed the project area for potential habitat for T&E species and species of special concern protected under State Statute 33. Although State Statute 33 prohibits the take, possession, and sale of state-listed species, it does not include protection of their habitat. The state lists several T&E species and species of special concern that could occur in the project area (Table 2).

Table 2. State-listed species and state species of concern potentially occurring in the project area.

Common Name	Scientific Name	Habitat	State Status ¹
Mammals			
Black-tailed prairie dog	<i>Cynomys ludovicianus</i>	Rangeland; shortgrass prairie; dry, flat, sparsely vegetated grasslands; prefer fine or medium-textured soils	SC
Birds			
Western burrowing owl	<i>Athene cunicularia</i>	Rangeland and shortgrass prairie with prairie dogs	ST
Reptiles and Amphibians			
Common garter snake	<i>Thamnophis sirtalis</i>	Limited to the floodplain of the South Platte River and its tributaries in Colorado	SC
Northern leopard frog	<i>Rana pipiens</i>	Wet meadows and shallows of marshes, ponds, lakes, reservoirs, streams, and irrigation ditches up to 11,000 feet in elevation	SC
Fish			
Common shiner	<i>Luxilus cornutus</i>	Moderate-gradient streams with cool, clear, gravel-bottomed water with overhanging shade	ST
Iowa darter	<i>Etheostoma exile</i>	Clear sluggish vegetated headwaters, creeks, and small to medium rivers	SC

¹ ST = Threatened Species, SC = Species of Special Concern.

Source: CPW 2023.

Black-Tailed Prairie Dog

Species Background

The black-tailed prairie dog is a Colorado species of special concern (CPW 2016). Black-tailed prairie dogs are important components of the short and mesic grasslands systems. Threats to this species include habitat loss and degradation, habitat fragmentation, disease (sylvatic plague), and lethal control activities. Typically, areas occupied by prairie dogs have greater cover and abundance of perennial grasses and annual forbs compared with unoccupied sites (Whicker and Detling 1988); (Witmer et al. 2000).

Black-tailed prairie dogs are commonly considered a “keystone” species because their activities (burrowing and intense grazing) provide food and shelter for many other grassland species and have a large effect on community structure and ecosystem function (Power et al. 1996). Prairie dogs can contribute to overall landscape heterogeneity, affect nutrient cycling, and provide nest sites and shelter for wildlife (Whicker and Detling 1988). Species such as black-footed ferret, burrowing owl, prairie rattlesnake, and mountain plover are closely linked to prairie dog burrow systems for food and cover. Prairie dogs also provide an important prey resource for numerous predators including American badger, coyote, red fox, bald eagle, golden eagle, ferruginous hawk, and other raptors. Prairie dogs also can denude the surface by clipping aboveground vegetation and contributing to exposed bare ground by digging up roots (Kuford 1958); (Smith 1967).

Potential Habitat and Possible Effects

No black-tailed prairie dog burrows or colonies were observed in the project area during the 2023 site visit. Although viable prairie dog colonies can be considered areas of high resource value, the ecological value of a prairie dog colony in the project area would be reduced by its isolation from other more expansive prairie dog colonies in more contiguous grassland habitats, the overall degraded condition of the grasslands supporting the colony, and the proximity of residential development.

Prairie dog colonies can provide breeding areas for burrowing owls and some forage value to wintering bald eagles and other raptors. If prairie dogs move into the project area, CPW recommends conducting burrowing owl clearance surveys in prairie dog towns that are subject to poisoning or construction projects during the period from March 15 through October 31 (CPW 2020). Construction occurring from November 1 through March 14 would not require clearance surveys.

Recommendations

If removal of black-tailed prairie dog colonies becomes necessary, CPW recommends removing them in a humane manner before any earthwork or construction takes place. Currently, neither the Towns nor Douglas County has a prairie dog management plan or policy for private properties. Prior to any work between March 15 and October 31 that would disturb a colony, the colony should be surveyed for western burrowing owls.

Western Burrowing Owl

Species Background

The western burrowing owl (burrowing owl) is a small migrant owl listed by the state of Colorado as a threatened species and is federally protected under the MBTA. Primary threats to the burrowing owl include habitat loss and fragmentation, anthropogenic sources of mortality such as vehicular collisions, and loss of wintering grounds, largely in Mexico (McDonald, Korfanta, and Lantz 2004).

In general, burrowing owls are found in grasslands with vegetation less than 4 inches high and a relatively large proportion of bare ground (Gillihan and Hutchings 2000). In Colorado, burrowing owls are usually associated with black-tailed prairie dog colonies (Andrews and Righter 1992). More than 70 percent of sightings reported in Colorado Breeding Bird Atlases were in prairie dog colonies (Colorado Bird Atlas Partnership 2016).

Burrowing owls usually arrive on their breeding grounds around mid-March to early April and remain until September (Haug and Oliphant 1990). Burrowing owls are typically present in Colorado from March 15 through October 31, with breeding from mid-April through early/mid-August (Andrews and Righter 1992; Colorado Bird Atlas Partnership 2016). CPW suggests conducting burrowing owl clearance surveys in prairie dog towns that are subject to poisoning or construction projects during the period from March 15 through October 31 (CPW 2021).

Potential Habitat and Possible Effects

No black-tailed prairie dog burrows or colonies were observed in the project area during the 2023 site visit. If prairie dogs move into the project area, their burrows provide breeding areas for burrowing owls. Inadvertent killing of burrowing owls could occur during prairie dog poisoning, construction, or earthmoving projects during the breeding period. CPW has a recommended buffer of $\frac{1}{8}$ mile (660 feet) surrounding active burrowing owl nests (CPW 2021).

Recommendations

If any construction is planned within the recommended 660-foot buffer of a prairie dog burrow, CPW recommends conducting burrowing owl clearance surveys during the period from March 15 through October 31 (CPW 2021). Construction occurring from November 1 through March 14 would not require clearance surveys; however, if burrowing owls are known to be present in an area in the winter, CPW recommendations may apply. If burrowing owls are found within the construction footprint, individual nest burrows and a 660-foot buffer around the burrow should be left undisturbed until the owls have moved or migrated from the site, which can be determined through monitoring (CPW 2021).

Common Garter Snake

Species Background

The common garter snake is a Colorado species of special concern (CPW 2016). The subspecies of the common garter snake that occurs in Colorado has black and red sides with a pale yellow to white stripe down the center of the back. In Colorado, this species is found from northern Jefferson County and southern Boulder County northeast through Nebraska and Wyoming (Hammerson 1999). The common garter snake inhabits the margins of streams, irrigation ditches, natural and artificial ponds, as well as open areas that are surprisingly far from water.

Potential Habitat and Possible Effects

No common garter snakes were observed during the 2023 site visit; however, the entire project area occurs within the species' overall range (CPW 2021a). Streams and ponds in the project area provide potential habitat for this species, and this species would be expected to occur in suitable habitat.

Recommendations

JRW Family Limited Partnership LLLP is planning to preserve the wetland and riparian corridor along East Plum Creek in the project area. Activities in the project area could potentially affect common garter snakes if work is conducted in the wetland areas along East Plum Creek, primarily due to displacement from suitable habitat during construction. ERO recommends implementing Conservation Measures (CMs) and Best Management Practices (BMPs) to avoid habitat and incidental take. Recommended CMs and BMPs include: (1) constructing the project during the winter when common garter snakes are inactive, minimizing the risk of incidental take of any random occurrence or movement of common garter snakes in the area; (2) confining clearing to the minimal area necessary to facilitate construction activities, confining movement of heavy equipment in designated areas, and minimizing impacts on habitat disturbance along stream and drainage channels and wetlands; (3) planning staging areas to be

in nonnative upland areas; (4) prior to construction activities, surveying the project area for common garter snakes.

If a common garter snake is encountered during construction, ERO recommends that activities cease until appropriate corrective measures have been completed or it has been determined that the common garter snake will not be harmed. After completion of construction activities, any temporary fill and construction debris should be removed and, wherever feasible, disturbed areas should be restored to pre-project conditions. Restoration work may include replanting species removed from impacted channels, banks, or wetland areas; or planting native vegetation in undisturbed areas for habitat enhancement. The listed CMs and BMPs would prevent long-term impacts on the species and minimize potential short-term impacts. If no activities would occur in the wetland areas, the proposed project would not likely adversely affect the common garter snake because suitable habitat would not be impacted.

Northern Leopard Frog

Species Background

The northern leopard frog is listed as a Colorado species of special concern (CPW 2023). This species typically inhabits the banks and shallow portions of wetlands, ponds, lakes, streams, and other permanent water bodies. The northern leopard frog occurs at elevations from 3,500 to 11,000 feet in Colorado (Hammerson 1999).

Potential Habitat and Possible Effects

East Plum Creek and its wetlands may provide habitat for the northern leopard frog. No leopard frogs were observed during the 2023 site visit.

Recommendations

CPW does not currently enforce restrictive measures if a northern leopard frog is encountered during construction, and corrective measures are voluntary. JRW Family Limited Partnership LLLP is planning to preserve the wetland and riparian corridor along East Plum Creek in the project area. Similar to the recommendation for the common garter snake above, if work activities would occur along East Plum Creek, ERO recommends implementing CMs and BMPs to avoid habitat and incidental take.

If a northern leopard frog is found during construction, ERO recommends that activities cease within a 30-foot buffer of where the animal was seen and a qualified biologist be brought to the site to correctly identify the animal and, if possible, relocate the animal to suitable habitat outside the construction limits. If no activities would occur in East Plum Creek or the potential wetland areas, the proposed project would not likely adversely affect leopard frogs because suitable habitat would not be impacted.

Common Shiner

Species Background

The common shiner, a state threatened species, is a medium-sized minnow that inhabits moderate-gradient streams with cool, clear water and gravel bottoms that are shaded by vegetation (CDOW 2006; Woodling 1985). In Colorado, the distribution of the common shiner is localized in the South Platte River Basin; the species is found primarily in St. Vrain Creek and the Upper South Platte River tributary system (USGS 2007), including the Big Thompson and Poudre Rivers.

The common shiner feeds on aquatic insects in the summer and winter, small fish in the fall, and both plant material and small fish in the spring. This species spawns on gravel beds in flowing water, often at the head of a riffle area (CDOW 2006). The common shiner appears to be sensitive to habitat changes due to siltation events.

Potential Habitat and Possible Effects

The common shiner has historically been collected in cool transitional-zone streams of the South Platte River Basin, and in the Lower East Plum Creek watershed, which overlaps the project area. As such, the common shiner could be affected by actions in East Plum Creek.

Recommendations

Activities in and adjacent to East Plum Creek could result in temporary and permanent impacts on aquatic habitat; however, JRW Family Limited Partnership LLLP is planning to preserve the East Plum Creek channel in the project area, and therefore, avoid impacts to habitat for the common shiner. If work activities are planned in or along the creek, standard BMPs to minimize direct impacts, as well as sediment loading and turbidity in the creek during construction, should minimize impacts on the common shiner and its habitat.

Iowa Darter

Species Background

The Iowa darter is a state species of concern that prefers cool, clear water over a sand or organic matter substrate (CDOW 2006; Woodling 1985). Iowa darters are native to Colorado and are found throughout the Front Range in streams and ponds (U.S. Forest Service (USFS) n.d.). Specifically, populations are found in some plains streams in northeast Colorado, Plum Creek, and single locations on St. Vrain Creek and the Big Thompson River, as well as Eleven Mile Reservoir in South Park. Iowa darters have also been introduced to the upper Colorado River Basin (Woodling 1985).

The Iowa darter eats small aquatic invertebrates and spawns in the spring to early summer in shallow water over vegetation (CDOW 2006). In Colorado, this species' abundance is relatively low, and populations are likely on a downward trend. Reduction in habitat due to urban and industrial development along the Front Range continues to put Iowa darter habitat at risk. However, given the habitat requirements of the Iowa darter, this species is able to cope with environmental changes as long as development or natural disturbances do not preclude water availability (USFS n.d.).

Potential Habitat and Possible Effects

The Iowa darter has historically been collected in the Lower Plum Creek watershed and potentially occurs in East Plum Creek in the project area and, therefore, could be potentially affected by actions in this portion of the project area.

Recommendations

Activities in and adjacent to East Plum Creek could result in temporary and permanent impacts on aquatic habitat; however, JRW Family Limited Partnership LLLP is planning to preserve the East Plum Creek channel in the project area, and therefore, avoid impacts to habitat for the Iowa darter. If activities are proposed in and adjacent to East Plum Creek, they could result in temporary and permanent impacts on aquatic habitat. Standard BMPs to minimize direct impacts, as well as sediment loading and turbidity in the creek during construction should minimize impacts on the Iowa darter and its habitat.

Other Species of Concern

In 2021, CPW released a High Priority Habitat (HPH) table that identifies species and habitats, as well as recommendations to avoid and minimize impacts on wildlife from land use development (CPW 2021b). The Aquatic Native Species Conservation Waters HPH occurs in the project area along East Plum Creek and is discussed below (CPW 2021b). No other HPH occurs in the project area; however, ERO assessed the project area for potential habitat for species and habitats listed in the HPH table during the 2023 site visit. Because elk, mule deer, and white-tailed deer likely frequent the project area, these species are discussed in more detail below.

Aquatic Native Species Conservation Waters

Background

Aquatic native species are found throughout Colorado, wherever water resources are present. They are typically sensitive to changes in water quality factors such as temperature, dissolved oxygen, and turbidity. The health of a water resource can often be evaluated based on the presence or absence of certain aquatic species. A major threat to the aquatic native resources in Colorado is urban development, which leads to consumptive water use and dams, as well as aquatic nuisance species, which often outcompete native species for resources (CPW n.d.).

Potential Habitat and Effects

In the project area, East Plum Creek coincides with the Aquatic Native Species Conservation Waters HPH (CPW 2021b). East Plum Creek in the project area contained wetlands and open water during the 2023 site visit. The presence of water moving through East Plum Creek provides suitable habitat for aquatic native species.

Recommendations

For any work conducted in areas mapped within the Aquatic Native Species Conservation Waters area associated with East Plum Creek, ERO recommends contacting the local CPW district manager requesting concurrence that the proposed project would not likely affect native aquatic species. Any impacts on East Plum Creek or its associated wetlands would require a Section 404 permit, which typically requires a combination of restoration and mitigation of impacts. Restoration or mitigation could provide resiliency to the Aquatic Native Species Conservation Waters area.

Big Game

Elk

Species Background

Elk once occurred over much of central and western North America from Alaska south through Canadian Provinces and further south through much of the United States (Fitzgerald et al. 1998; Peek 1999). In Colorado, elk primarily occupy the western two-thirds of the state but can also be found on the eastern plains (Fitzgerald et al. 1998). The statewide estimate for elk in 2004 post-hunt was 274,570 (Watkins 2005) and CPW's long-term objective for the elk population in Colorado is about 228,000 (Kahn 2006).

Elk once occupied the eastern plains of Colorado, but today they are mostly associated with semi-open forests or forest edges adjacent to parks, meadows, and alpine areas (Fitzgerald et al. 1998). Elk are considered generalist feeders, grazers, and browsers, foraging on a variety of grasses, forbs, and shrubs throughout the year, with grasses, shrubs, and even conifers such as Douglas fir as winter forage (Fitzgerald et al. 1998; Peek 1999; Stewart et al. 2002). Most elk herds migrate between summer and winter ranges, with winter ranges typically occurring at lower elevations; however, some herds are relatively sedentary (Fitzgerald et al. 1998).

Potential Habitat and Possible Effects

The entire project area is located within the overall range for elk in Colorado, and elk may occasionally forage in the project area; however, no HPH for this species (including migration corridors, production areas, severe winter range, or winter concentration areas) occurs in the project area (CPW 2021). I-25 is generally considered a barrier to elk movement from elk concentration areas found west of the highway. Elk and deer highway crossings occur where traditional elk and deer movement corridors cross roads, presenting potential conflicts between elk and motorists (CPW 2021). No elk highway crossings have been identified by Douglas County (Douglas County 2019) or CPW (CPW 2021) in or near the project area. No elk were observed in the project area during the 2023 site visit.

Mule Deer

Species Background

Mule deer are found in all ecosystems in Colorado from grasslands to alpine tundra. Spring and summer ranges are typically mosaics of meadows, aspen woodlands, alpine tundra-subalpine forest edges, or montane forest edges (Fitzgerald 1994). Seasonally, mule deer are relatively sedentary, although most

will spend the summer at higher elevations and migrate to lower elevations in the winter. Mule deer diets vary seasonally but generally consist of browsing trees and shrubs, forbs, and grasses.

Potential Habitat and Possible Effects

The project area overlaps areas CPW identified as mule deer highway crossing, summer range, winter concentration area, concentration area, winter range, and overall range areas (CPW 2021). No mule deer HPH areas are located in the project area (CPW 2021). Although no mule deer were observed during the 2023 site visit, it is likely that mule deer forage and migrate through the project area.

White-Tailed Deer

Species Background

In Colorado, the white-tailed deer is less widespread and more secretive than the mule deer. Like mule deer, white-tailed deer occupy shrublands that provide plentiful forage and cover; however, white-tailed deer are most often seen in riparian areas bordering larger streams and rivers. Although this species does not migrate in large numbers like elk, white-tailed deer will move seasonally up and down river corridors in small numbers (Fitzgerald, Meaney, and Armstrong 1994).

Similar to mule deer, the white-tailed deer is common throughout northeastern Colorado, especially along riparian corridors (Fitzgerald, Meaney, and Armstrong 1994). White-tailed deer concentration areas are considered critical habitat for white-tailed deer and occur in corridors of riparian habitat that support higher populations of white-tailed deer or serve as travel corridors. CPW does not designate winter or summer concentration areas or severe winter range for white-tailed deer.

Potential Habitat and Possible Effects

The project area overlaps areas CPW identified as white-tailed concentration area, winter range, and overall range (CPW 2021). No mule deer HPH areas are in the project area (CPW 2021). Although no white-tailed deer were observed during the 2023 site visit, it is likely that this species forages and migrates through the project area.

Big Game Recommendations

Because no HPH for elk, mule deer, or white-tailed deer occurs in the project area, no action is necessary. Residents should be educated on wildlife interactions and provided with links to CPW's educational websites for "Living with Wildlife" and "Avoid Wildlife Conflicts." Additional recommendations are provided in the *Habitat Management Guidelines* section of this report.

Raptors and Migratory Birds

Species Background

Migratory birds, as well as their eggs and nests, are protected under the MBTA. The MBTA does not contain any prohibition that applies to the destruction of a bird nest alone (without birds or eggs), provided that no possession occurs during the destruction. While destruction of a nest by itself is not prohibited under the MBTA, nest destruction that results in the unpermitted take of migratory birds or their eggs is illegal and fully prosecutable under the MBTA (Service 2003). The regulatory definition of a

take is to pursue, hunt, shoot, wound, kill, trap, capture, or collect; or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect (50 CFR 10.12).

Under the MBTA, the Service may issue nest depredation permits, which allow a permittee to remove an active nest. The Service, however, issues few permits and only under specific circumstances, usually related to damage to agricultural crops/livestock and private property, and protection of human health and safety. Obtaining a nest depredation permit is unlikely and involves a process that takes, at a minimum, 8 to 12 weeks. The best way to avoid a violation of the MBTA is to remove vegetation outside of the active breeding season, which typically falls between March and August, depending on the species. MBTA enforcement actions are typically the result of a concerned member of the community reporting a violation.

CPW maintains a leadership role with respect to raptor management in Colorado; however, the primary authority for the regulation of take and the ultimate jurisdiction for most of these species rests with the Service under the MBTA and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c).

Potential Habitat and Possible Effects

ERO surveyed the project area for nests during the 2023 site visit. ERO observed one unoccupied raptor nest in a pine tree near the headwaters of Lemon Gulch in the southern portion of the project area (Photo 17; Figure 3b). The size and shape of the nest suggests it is a raptor nest. A forest raptor such as Cooper's hawk (*Accipiter Cooperii*) could potentially use the observed nest. Additionally, a raptor nest was identified during the 2011 site visit near the southern border of the project area; however, this nest was not found during the 2023 site visit (Figure 3b).

Depending on the species, CPW recommends a $\frac{1}{3}$ - or $\frac{1}{4}$ -mile buffer from active raptor nests from February through July for human encroachment activities or installation of a permanent or long-standing physical object or structure (CPW 2020). The breeding season for most birds in Colorado is March through mid-September, with the exception of a few species that begin breeding in February, such as great-horned owls. Because the 2023 site visit was conducted in March when many birds are just starting to nest, it is unknown if the observed nest is active during the breeding season or which species use the nest.

A wide variety of bird species may use different vegetation communities in the project area for shelter, breeding, wintering, and foraging at various times during the year. Several migratory birds were observed in the project area during the 2023 site visit including northern flicker (*Colaptes auratus*), rock pigeon (*Columba livia*), common raven (*Corvus corax*), black-billed magpie (*Pica hudsonia*), black-capped chickadee (*Poecile atricapillus*), woodhouse scrub jay (*Aphelocoma woodhouseii*), horned lark (*Eremophila alpestris*), and American tree sparrow (*Spizelloides arborea*). The breeding season for most birds in Colorado is March through August, with the exception of a few species that begin breeding in February, such as great-horned owls.

Recommendations

Although no active nests were observed during the 2023 site visit, ground and arboreal nests are difficult to detect and may be present in the grasslands, trees, and shrubs in the project area. To avoid destruction of potential migratory bird nests, vegetation removal should be conducted outside of the April 1 through September 15 breeding season. CPW has identified the primary nesting season for migratory birds in Colorado as occurring from April 1 through September 15 (Service 2022). However, a few species such as bald eagles, great horned owls, and red-tailed hawks can nest as early as January (eagles) or late February (owls and red-tailed hawks). Because of variability in the breeding seasons, ERO recommends that a nest survey be conducted within one week prior to construction to determine if the observed raptor nest or any other active nests are present in the project area so that they can be avoided. Additional nest surveys during the nesting season may also be warranted to identify active nesting species that may present additional project timing restrictions (e.g., eagles or red-tailed hawks).

If active nests are identified in or near the project area, activities that would directly affect the nests should be restricted. Habitat-disturbing activities (e.g., tree removal, grading, scraping, and grubbing) should be conducted during the nonbreeding season to avoid disturbing active nests, or to avoid a “take” of the migratory bird nests in the project area. Nests can be removed during the September 16 through March 31 nonbreeding season to preclude future nesting and avoid violations of the MBTA. There is no process for removing nests during the nonbreeding season; however, nests may not be collected under MBTA regulations. If the construction schedule does not allow vegetation removal outside of the breeding season, a nest survey should be conducted immediately prior to vegetation removal to determine if the nests are active and by which species. If active nests are found, any work that would destroy the nests or cause the birds to abandon young in the nest should not be conducted until the birds have vacated the nests.

Consultation with CPW or the Service may be required if construction is proposed within a buffer zone of an active raptor nest. Although no CPW buffer is designated for great horned owls, any active nest should be left undisturbed until the birds have left the nest. CPW recommends consultation with local CPW staff early in the planning phase of project proposals to assess and develop site-specific recommendations based on preexisting conditions (e.g., existing development, topography, vegetation, and line-of-sight to nest).

Other Wildlife

The project area provides habitat for a variety of small mammals such as cottontail rabbits (*Sylvilagus* sp.), deer mice (*Peromyscus maniculatus*), voles (*Microtus* sp.), and pocket gophers (*Geomyidae* sp.). Grassland habitat likely provides breeding habitat for numerous ground-nesting prairie bird species, and riparian ecosystems typically support many more species of native birds than surrounding grassland or shrubland communities (Knopf and Samson 1994).

Predators such as coyote, raccoon (*Procyon lotor*), red fox, striped skunk (*Mephitis mephitis*), and short-tailed weasels (*Mustela ermine*) are also likely to occur in the project area. The project area is mapped

as overall range for mountain lion (*Puma concolor*) and black bear (*Ursus americana*) (CPW 2021). In addition, the project area is included in a black bear summer concentration area (CPW 2021). Any residential or commercial development will need to implement programs using BMPs to avoid human/wildlife (predator) conflicts. As discussed in the elk and mule deer sections above, residents should be educated on wildlife interactions and provided with links to CPW's educational websites for "Living with Wildlife" and "Avoid Wildlife Conflicts." Additional recommendations are provided in the *Habitat Management Guidelines* section of this report.

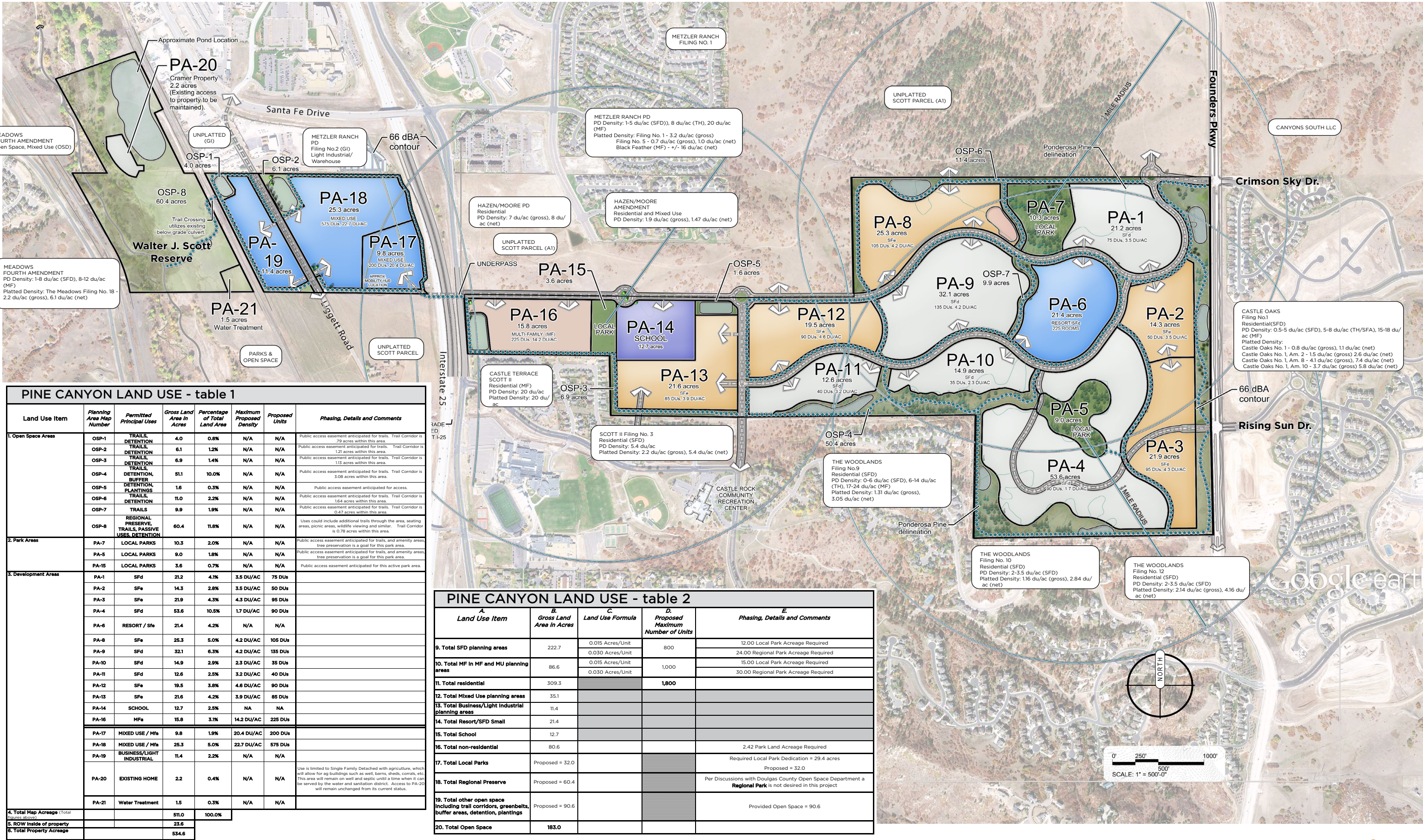
Habitat Management Guidelines

As described in the Douglas County 2040 CMP (Douglas County 2019), East Plum Creek is identified as a wildlife corridor and the remainder of the project area is identified as having low and moderate wildlife habitat value. The overall habitat value is degraded by the existing and ongoing residential and commercial development that isolates and fragments the habitat from other large blocks of habitat.

To maximize the continued use of the area by native wildlife, ERO recommends implementing the following strategic planning principles, several of which have already been incorporated into the planned development plan (Figure 4):

- Design and install well-designed trails to encourage human use in appropriate areas and discourage use in sensitive wildlife areas. Such trails should not be placed in the bottom of drainages, and buffers should be established to avoid impacts on wildlife movement areas.
- Locate trails planned for the project generally along the edge of residential development to the extent practicable to minimize fragmentation of wildlife habitat in open space areas. Keeping trails at this human-natural area interface will maximize the potential for wildlife such as mule deer to use the open space areas for movement corridors. Placing trails in these areas will also create a visual and physical contrast that may discourage unwanted wildlife from entering residential neighborhoods.
- Preserve, to the greatest extent feasible, the wetland and riparian, oak scrub, and ponderosa pine communities, which provide valuable forage and cover for many wildlife species, including elk and mule deer. Management of the proposed open space areas should focus on maintaining or enhancing these communities and providing movement corridors for elk and other big game species.
- Limit fencing to open rail fencing along driveways and public rights-of-way to minimize disruption of wildlife movement in the project area. JRW Family Limited Partnership LLLP should work with CPW to identify areas where conflicts may occur and fence those areas accordingly.
- Where feasible and applicable, implement wildlife-friendly road crossings.
- Conduct surveys prior to construction of the project to avoid the inadvertent take of raptor or migratory bird nests, which are protected under federal and state laws. No active nests were identified in the project area during the 2023 site visit. If an active nest is found, follow CPW recommendations and implement buffers restricting disturbance and construction activities around nests to the extent they remain active (CPW 2020). Conduct habitat-disturbing activities such as tree removal, grading, scraping, and grubbing during the nonbreeding season

(September through March for most songbirds) to avoid disturbance (or take) of an active migratory bird nest, including nests of ground-nesting species.



PINE CANYON
PLANNED DEVELOPMENT PLAN - 12-13-2022

1. TRANSITION TO ADJACENT DEVELOPMENT: Pine Canyon will match or exceed the lot size within 300' of any existing adjacent Single Family Dwelling Unit along the southern property boundary.
2. Streets and access points are conceptual in nature.



Figure 4. Zoning Exhibit

- Follow the CPW burrowing owl guidelines if any black-tailed prairie dog removal is necessary in the project area. If any construction is planned within the recommended 660-foot buffer of a prairie dog burrow, CPW recommends conducting burrowing owl clearance surveys during the period from March 15 through October 31 (CPW 2021). Construction occurring from November 1 through March 14 would not require clearance surveys; however, if burrowing owls are known to be present in an area in the winter, CPW recommendations may apply. If burrowing owls are found within the construction footprint, individual nest burrows and a 660-foot buffer around the burrow should be left undisturbed until the owls have moved or migrated from the site, which can be determined through monitoring (CPW 2021).
- Where feasible, leave large trees in place to provide continued nesting habitat for avian species.
- Retain sections of shortgrass prairie in and adjacent to the project area whenever feasible to maintain habitat for wildlife species associated with the shortgrass prairie community.
- Develop and implement a noxious weed plan and management recommendations to control weeds on-site and maintain foraging habitat for big game and other wildlife.
- Contain and control noxious weeds in areas not slated for development or that will not be developed until later phases as required by the Douglas County weed ordinance.
- Reclaim temporarily disturbed areas that will not be landscaped with a mix of native species that are found on-site or that are highly compatible with site conditions.
- Educate residents on wildlife interaction. All wildlife, particularly big game, predators, and human commensal species such as raccoons, can cause nuisance problems in residential developments. Contact information and resources from CPW, the Towns, and the County should be provided to residents that describe how to minimize conflicts and ways to enjoy the natural resources in the area. Residents should also be made aware that feeding wildlife, with the exception of birds, is against state law.
- To minimize impacts on soils, identify topsoil depth and salvage topsoil from the project area and then revegetate.
- Revegetate as soon as practicable after construction activities have been completed in accordance with the recommended seasons for revegetation and use practices conducive to success.
- Take care to minimize temporary disturbance to and permanent loss of woody vegetation in the construction area. Whenever possible, avoid blading and grubbing of woody vegetation in areas of temporary disturbance. Cut woody vegetation to ground level in areas of temporary disturbance without removing the root mass.
- Implement BMPs to minimize the risk of a spill of hazardous materials and waste in the construction area and in particular near the drainages.

In addition to those strategies above, the following CMs are suggested to further minimize impacts on area wildlife:

- Place signs along trails near open space areas to remind trail users to respect wildlife and their habitat.
- To help to minimize collision risk, place wildlife crossing signs throughout the project area reminding residents to be aware that big game and other wildlife may be present on the roads.
- Restrict domestic animals to building envelopes through covenants. Pets should be on leashes when in open space areas.

Post-Construction Habitat Recommendations

Drainage Corridors and Wetland and Riparian Communities

ERO recommends that revegetation and erosion control be conducted along the drainages to stabilize areas where erosion is occurring. To mitigate for impacted trees and shrubs and to enhance the restored areas, a native seed mix and native shrubs should be planted. Increasing the diversity and abundance of riparian species would create habitat for a number of species, including the western terrestrial garter snake (*Thamnophis elegans*), bull snake (*Pituophis catenifer*), western chorus frog (*Pseudacris triseriata*), red fox, coyote, raccoon, greentailed towhee (*Pipilo chlorurus*), lazuli bunting (*Passerina amoena*), yellow warbler (*Dendroica petechia*), and many other species. Enhancing riparian vegetation along the drainages would create habitat, improve wildlife movement corridors, and provide cover, foraging, and nesting habitat for a number of species. JRW Family Limited Partnership LLLP is proposing open space areas along the drainage corridors in the eastern and western portions of the project area, which would help protect and preserve higher wildlife habitat value areas .

Upland Grassland, Ponderosa Pine, and Gambel Oak Communities

To maintain shortgrass and midgrass prairie communities and associated wildlife, native seed should be planted in areas temporarily disturbed by construction and throughout open space areas as appropriate. Recommended species to be planted include blue grama, prairie junegrass (*Koeleria macrantha*), western wheatgrass, buffalo grass (*Bouteloua dactyloides*), prairie sagewort, and prairie coneflower (*Ratibida columnifera*), among others.

The proposed open space areas would help mitigate impacts on the species associated with the Upland Grasslands, Gambel Oak, and Ponderosa Pine Forest communities. ERO recommends preserving larger-diameter ponderosa pines, as well as contiguous patches of Gambel oak, to the greatest extent feasible to maintain habitat for the large number of species associated with these community types.

Conclusions

The existing vegetation communities and topographical features in the project area provide contiguous habitat, water resources, and core wildlife values such as cover and forage for various natural resources and wildlife species. In particular, the drainage corridors along East Plum Creek, its tributaries, and contiguous grasslands and shrublands along these drainages contribute to the overall diversity of the project area and provide wildlife movement passageways that help maintain connections between wildlife populations. Preservation of the drainages as open space would help maintain and conserve the wildlife values of the project area. Additionally, conservation of larger contiguous parcels, such as the proposed open space areas along the eastern and western portions of the project area, provides a greater value to wildlife than numerous smaller parcels.

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Appendix A Photo Log

PHOTO LOG
PINE CANYON RANCH
DOUGLAS COUNTY, COLORADO
MARCH 20, 2023



Photo 1 - Overview of the project area with topography generally sloping from plateaus and rolling ridges into tapered drainage basins. View is northwest.



Photo 2 - Residence, blacksmith shop, and equipment storage yard in the western portion of the project area. View is north.

PHOTO LOG
PINE CANYON RANCH
DOUGLAS COUNTY, COLORADO
MARCH 20, 2023



Photo 3 - Upland grasslands west of Interstate 25 in the project area. View is northwest.



Photo 4 - Upland grasslands east of Interstate 25 and North Liggett Road in the project area. View is northwest.

PHOTO LOG
PINE CANYON RANCH
DOUGLAS COUNTY, COLORADO
MARCH 20, 2023



Photo 5 - Upland grasslands in moderately flat areas interspersed in the Ponderosa Pine/Gambel Oak vegetation communities in the eastern portion of the project area. View is northeast.



Photo 6 - Oak shrublands intermixed with upland grasslands east of Front Street in the project area. View is northeast.

PHOTO LOG
PINE CANYON RANCH
DOUGLAS COUNTY, COLORADO
MARCH 20, 2023



Photo 7 - Oak shrublands intermixed with ponderosa pine forest in the western portion of the project area. View is southwest.



Photo 8 - Fire mitigation in the project area including thinning and removing oak and clearing and disposing of limbs, branches, and other woody debris. View is southwest.

PHOTO LOG
PINE CANYON RANCH
DOUGLAS COUNTY, COLORADO
MARCH 20, 2023



Photo 9 - Low- to mid-density ponderosa pine forest in the southeastern portion of the project area.
View is southeast.



Photo 10 - Overview of East Plum Creek in the project area and its abutting wetlands and riparian corridor.
View is northwest.

PHOTO LOG
PINE CANYON RANCH
DOUGLAS COUNTY, COLORADO
MARCH 20, 2023



Photo 11 - East Plum Creek in the project area and its abutting wetlands and riparian corridor in the southern portion of the project area. View is southwest.



Photo 12 - East Plum Creek in the project area and its abutting wetlands and riparian corridor with sandy terraces and eroded banks. View is southeast.

PHOTO LOG
PINE CANYON RANCH
DOUGLAS COUNTY, COLORADO
MARCH 20, 2023



Photo 13 - Tributary 2 east of North Liggett Road. View is east.



Photo 14 - Tributary 2 near the confluence with East Plum Creek. View is east.

PHOTO LOG
PINE CANYON RANCH
DOUGLAS COUNTY, COLORADO
MARCH 20, 2023



Photo 15 - Wetland 1 south of Interstate 25. View is northeast.



Photo 16 - Wetland 2 east of Interstate 25, inundated at the time of the 2023 site visit. View is north.

PHOTO LOG
PINE CANYON RANCH
DOUGLAS COUNTY, COLORADO
MARCH 20, 2023



Photo 17 - Potential raptor nest in the project area; inactive at the time of the 2023 site visit. View is east.

Appendix B U.S. Fish and Wildlife Concurrence Letter



United States Department of the Interior



FISH AND WILDLIFE SERVICE Mountain-Prairie Region

IN REPLY REFER TO:
FWS/R6/ES/COFO

134 Union Boulevard, Suite 670
Lakewood, Colorado 80228-1807

ECOSphere: 2023-0018583

December 15, 2022

Kurt Walker
Partner, JRW Family Limited Partnership, LLPW

Subject: JRW request to recognize Pine Canyon Ranch property as non-habitat

Dear Kurt Walker:

Thank you for your communication requesting consultation from the U.S. Fish and Wildlife Service (Service) regarding your property located in unincorporated Douglas County, Colorado (project). Discussions over this project started between the Service and you on November 14, 2022. Your initial communication requested that the Service agree with your determination that while your property falls within the Douglas County Habitat Conservation Plan (HCP) Riparian Conservation Zone (RCZ), 7.18 acres are currently not functioning as suitable habitat for the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) (Preble's mouse), listed as threatened under the Endangered Species Act (ESA), as amended (16 U.S.C. 1531 *et seq.*). Our comments are provided in accordance with section 7 of the ESA. There is no federal nexus to this project.

According to your photos, the 7.18-acre section proposed as non-habitat is currently dominated by weedy species and bare ground. You also shared that the property has historically hosted a working horse and cattle corral, and was used for continual storage of dumpsters, shipping containers, heavy equipment, and farm equipment. Many of these activities occurred before the Preble's mouse was federally listed as threatened and before the RCZ was developed. The area was also heavily traversed by large trucks and trailers via a dirt/gravel "turn around" road. Based on your photos and history, you believe that any alterations to the 7.18-acre section of your property currently residing within the RCZ would not disturb any suitable habitat for use by the Preble's mouse due to its deteriorated status. Thus, you concluded that any alterations to this property are not likely to result in "take" of a listed species (take is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct of a listed species).

Given the extent of historic human alteration of the property, the Service concurs that any alterations to the designated 7.18 acres of property are unlikely to result in take of a listed species. A vegetated buffer area of 0.22 acre shall remain as recognized, suitable Preble's mouse habitat and will serve as a transitional zone between the degraded property and the riparian area.

2023-0018583: Pine Canyon Ranch

If we can be of any additional assistance, please contact Kate Lunz of the Colorado Field Office by email at kathleen_lunz@fws.gov.

Sincerely,

Liisa Niva
Eastern Colorado Supervisor
Colorado Ecological Services Field Office

Attachment: Pine Canyon Ranch map designating suitable (green polygon) and unsuitable (blue) polygon Preble's mouse habitat





Consultants in Natural Resources and the Environment

Cultural Resource Survey Pine Canyon Development Project Douglas County, Colorado

Prepared for:

JRW Family Limited Partnership, LLLP
5975 East Jamison Place
Centennial, Colorado 80112

Prepared by:

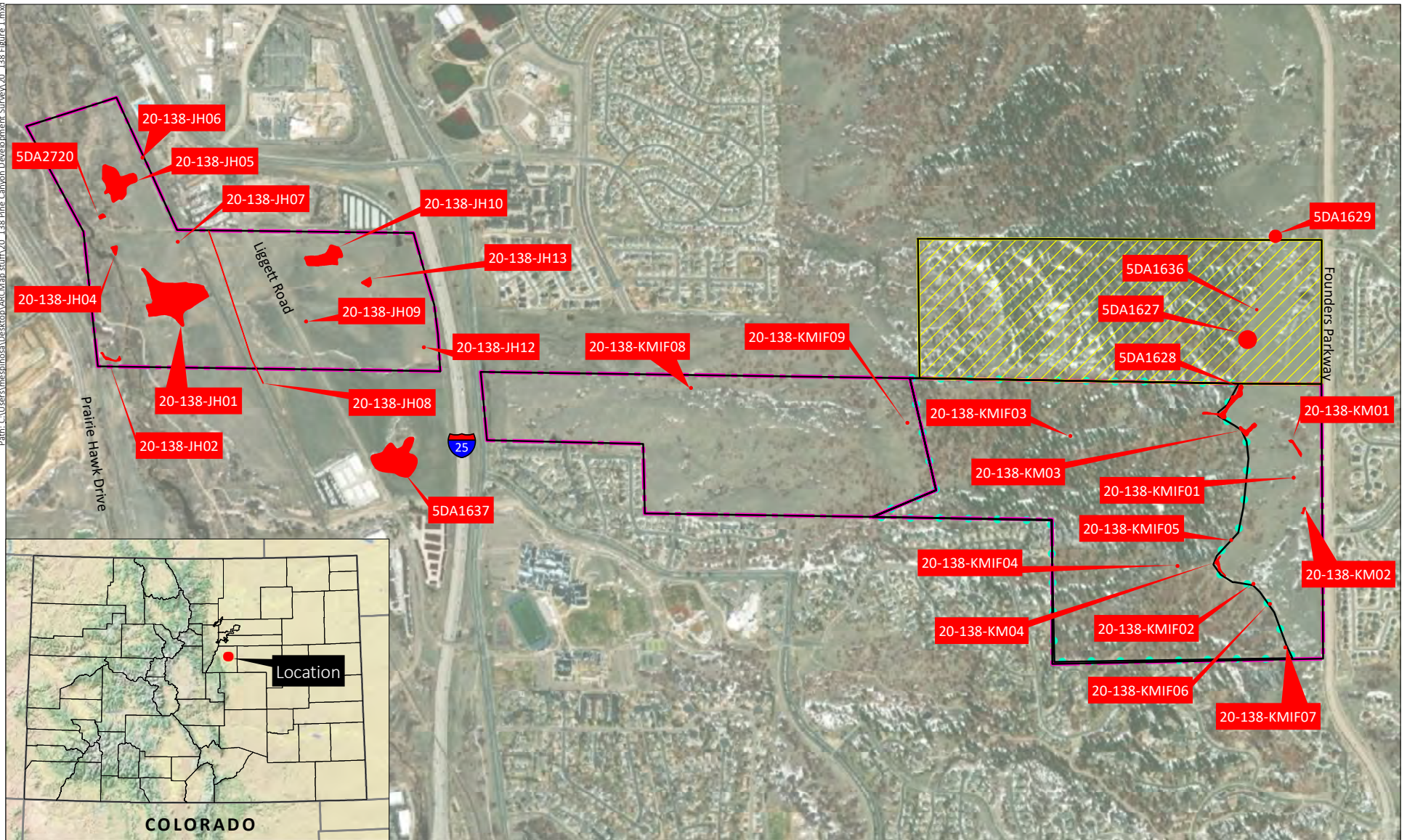
ERO Resources Corporation
Justin Batista
Jonathan Hedlund, Principal Investigator

July 14, 2020

Introduction

JRW Family Limited Partnership, LLLP (Client) contracted ERO Resources Corporation (ERO) to perform a Class II and III cultural resource survey of the Pine Canyon Development in Douglas County, Colorado (project). The project includes the development of two areas west and east of Interstate 25 (I-25). A cultural resource assessment for the project is required by Douglas County Subdivision Resolution Stipulation 408.08; which includes a “report which discusses existing or potential cultural, archaeological and historical resources of significance on site and plans for the protection of such resources.” ERO conducted pedestrian survey of the entire project area (about 540 acres) from June 29, 2020 to July 1, 2020 and identified 27 cultural resources (Figure 1). About 270 acres of the project area were surveyed at a Class III level (20-meter (m)-spaced transects) and about 150 acres of rugged terrain were surveyed at a Class II level using irregularly spaced transects in open valleys and narrow ridges. About 120 acres were previously surveyed by SWCA in 2000. ERO did not resurvey the previously surveyed areas. This technical memorandum, provided to the Douglas County Preservation Board, serves as cultural resources documentation in lieu of a standard federal compliance report and Colorado Office of Archaeology and Historic Preservation (OAHP) site forms.

Areas designated for residential and commercial development may be impacted by construction. The goal of the survey is to identify potential cultural resources in the development parcels and to consider potential impacts on cultural resources.



Class II and III Cultural Resource Survey Pine Canyon Development Project Douglas County, Colorado

Sections 34, 35, and 36, T7S, R67W; 6th PM
Section 1, T8S, R67W; 6th PM
USGS Castle Rock North, CO Quadrangle (1:24,000; 1980)
Douglas County, Colorado

- Resource Boundary
- Project Area
- Class II Survey
- Class III Survey
- Previous Survey

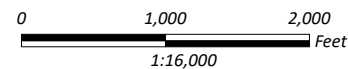


Figure 1
Project Location

Prepared for:
JRW Family Limited Partnership, LLLP
File: 20_138 Figure 1.mxd (ME)
July 14, 2020



ERO is unaware of any federal or state nexus that would require the Client to comply with regulations such as Section 106 (54 United States Code [USC] § 306108) of the National Historic Preservation Act (54 USC § 300101) or the Colorado State Register Act (Colorado Revised Statute [CRS] 24-80.1). This report does not meet OAHP standards and cannot be used to complete consultation between federal agencies and the Colorado State Historic Preservation Officer. ERO evaluated the documented resources against the criteria stipulated by the State Register Act (CRS 24-80.1).

Project Area

The project area consists of two areas west and east of Interstate 25 (I-25) that cover approximately 420 acres near Castle Rock, Colorado in Sections 34, 35, and 36, Township 7 South, Range 67 West; and Section 1, Township 8 South, Range 67 West of the 6th Principal Meridian (Figure 1). Landforms within the west survey area are primarily rolling hills and low ridges (Figure 2) incised occasionally by small ephemeral drainages. Drainages in the west project area feed East Plum Creek as it runs along the western border. The easternmost portion of the project area is characterized by a mesa at the top of a Gambel oak-covered west-facing slope (Figure 3). Vegetation is disturbed shortgrass prairie consisting of grasses, forbs, yucca, and barrel cacti. Gambel oak and ponderosa pine line the hills and ridges within the Class II survey area (Figure 4Figure 3), and low mountain mahogany lines the drainages. No water was present in any of the drainages at the time of survey, and the drainages likely only carry water during flash floods. The elevation ranges from 6,060 to 6,590 feet (ft) above sea level (asl).



Figure 2. Class III survey area west of I-25.



Figure 3. Class III survey area east of I-25.



Figure 4. Class II survey area east of I-25.

Methodology

Before the survey, ERO conducted a file review of the project area using the OAHP online Compass database to identify previously conducted surveys and previously documented sites. ERO also reviewed publicly available historical maps and aerial imagery to identify potential historical resources such as buildings and roads.

The OAHP records indicate that SWCA surveyed the northern edge of the survey area east of I-25 in association with the proposed Scott Ranch Development in 2000 (DA.LG.R10) (Martin and Reynolds 2000). SWCA's survey identified four precontact resources within the survey area. ERO redocumented 5DA1628 because a portion of the site was outside of SWCA's survey area. The resource was recommended not eligible for listing in the National Register of Historic Places (NRHP) in 2000. Three additional precontact resources (5DA1627, 5DA1629, and 5DA1636) were present within the current survey area but were not resurveyed because they did not extend beyond SWCA's survey area.

One previously documented resource is present in the survey area west of I-25. The Peter Smidt Ranch/Gotlob Bader Ranch/Cramer Ranch (5DA2720) was documented by Scheuber Darden Architects in 2005 and recommended eligible for listing in the NRHP.

ERO archaeologists Jonathan Hedlund, Katherine Mayo, Shayleen Ottman, Justin Batista, Alexandra Friedl, and Mason Seymore conducted a Class II and III survey of the project area from June 29, 2020 to July 1, 2020. The results of the file review were used to guide the survey, and ERO relocated and reviewed one precontact Native American archaeological site (5DA1628) and one historical site (5DA2720).

ERO used systematic pedestrian survey with 20-m transect spacing across the Class III survey area. The Class II survey focused on unsystematic survey of drainages, ridges, and other areas with site potential. ERO followed historic property and cultural resource documentation standards for all cultural resources encountered during survey.

Historic Property Identification

Historic properties may consist of buildings, structures, objects, or sites and can include districts, landscapes, and traditional cultural properties. The National Park Service has established an age criterion of 50 years for historic property evaluation and to be listed in the NRHP; in some instances, a federal agency will establish the age criterion at 45 years to account for the duration of the undertaking. Because of the county-level survey requirements, ERO made recommendations based on eligibility to the Colorado State Register of Historic Places (SRHP), which follows similar guidelines.

Cultural Resource Documentation

ERO documents cultural resources according to a standardized approach to ensure consistency and accuracy. Sites are digitally documented from multiple perspectives, and all significant tools, diagnostic

artifacts, and features are photographed to scale. Individual site maps are produced using a mapping grade (submeter- and subcentimeter-capable) Trimble GeoXH Explorer global positioning system (GPS) unit. Elements of the site map include all cultural features, diagnostic and point provenience artifacts (designated as field specimens [FS] or catalog numbers [CN] if collected), artifact concentrations (AC), major vegetation breaks and contour topography, modern features, and disturbances. Site locations are mapped in Appendix A. Photos of the sites and artifacts are included in Appendix B and debitage and tool analysis results are included in Appendix C.

The NRHP defines an archaeological site as “the place or places where the remnants of a past culture survive in a physical context that allows for the interpretation of these remains” (Little et al. 2000). Archaeological sites must retain sufficient context to convey purposeful and patterned human activity. Isolated finds (IFs) represent evidence of past human activity that is either not patterned (as in the inadvertent loss or discard of one or more artifacts), too limited to qualify as a site, or indicative of conscious discard of material culture manufactured and/or used for its primary purpose elsewhere. Professional judgment is generally used to distinguish between purposeful activity and isolated occurrences of artifacts often attributable to “background noise”; however, in those instances where a land management agency has defined the difference between a site and an IF, ERO follows the agency’s definition.

For the purposes of this project, resources are documented as resources and not separated into categories (e.g., site or IFs) but are discussed as resources or sites.

Precontact Archaeological Sites

Larger precontact resources are defined by the classes of artifacts found. Lithic scatters are defined by the presence of flaked lithic tools and debitage and are generally interpreted as representing short-term occupation and limited activities related to the production or rejuvenation of stone tools; open camps are defined by the presence of diverse artifact classes, including ground stone and often thermal features, which indicate longer occupations, possibly by a greater number of people. Open and sheltered architectural sites are defined by the presence of the remains of habitation structures (such as stacked masonry walls) or by rubble mounds and pit structure depressions representing the presence of larger or more elaborate architecture. Sheltered camps, in contrast, are found under natural rock overhangs or in other protected places but without associated architecture. Finally, lithic procurement areas must exhibit primary or secondary lithic raw material available on-site, such as nodules eroding from bedrock, lamellar bedrock, or as clasts found in a secondary context (such as alluvial cobbles) at a distance from the primary source. A quarry must exhibit evidence for prehistoric excavation, evidenced by holes dug to access geologic outcrops or gravel sources.

Prehistoric artifact terminology follows Adams (2014) for ground stone; Callahan (1979) for biface stage, which is determined by establishing a width-to-thickness ratio; and Andrefsky (1998) for general approaches for flake analysis.

Historic Period Sites

Historic period sites include such purposeful activities as homestead, ranching, or agricultural complexes; mining complexes; federal work programs; timber harvesting; and industry, among other site types. Age criteria is established for potential historic sites by referencing general land office patents, county assessor records, state water division records, historical maps, and 15' U.S. Geological Survey maps. Historical dumps and artifact scatters without features are evaluated on a case-by-case basis. A single artifact class within a dump, such as sanitary cans, is recorded as an isolated occurrence; conversely, dumps that exhibit diverse artifact classes and date prior to the early part of the twentieth century may be documented as archaeological sites, given their information potential.

Linear structures such as water conveyance systems, transmission lines, trails, and roads are documented as sites. An isolated fence line is generally not recorded as a resource unless it demarcates a boundary significant to the history of the area and can be physically linked with a purposeful activity; an isolated fence line may also be documented as a feature of a larger resource. Depending on their cultural context, single or small clusters of mining prospect pits with no associated artifacts are documented as IFs due to general ubiquity and limited information potential.

Survey Results

ERO identified 29 cultural resources (Table 1), including 4 previously recorded precontact sites, 21 newly recorded precontact resources, 1 previously recorded historical ranch, and 3 newly recorded historical resources. The precontact resources represent activities related to precontact Native American camping, plant and animal processing, and food preparation; and lithic material testing, procurement, core reduction, and tool manufacture. The artifacts are primarily manufactured from local chert, orthoquartzite, and Dawson Petrified Wood (DPW), which are common to the area. A few artifacts were manufactured from materials that would have been quarried in North Park and South Park. Historical sites are related to historical settlement and ranching, Civilian Conservation Corps (CCC) activity, and communication.

Table 1 lists documented resources, resource type, SRHP eligibility recommendation, and recommendations. Sites that benefit from additional description are discussed after the table. Twenty-one resources located during survey contain limited or no potential for significant cultural deposits and, therefore, ERO recommends them as not eligible for listing in the SRHP. Four resources (JH01, JH02, JH10, and KM03) contain moderate potential for significant cultural deposits, but this potential can only be confirmed through testing. One site (5DA1628) may continue outside of the project area; until the full extent of the site can be examined, ERO recommends the site needs data (Table 1).

Table 1. Resource summary.

Site Number	Site Type	SRHP Eligibility Recommendation	Recommendation
5DA1627	Open lithic scatter	Field not eligible (2000)	No further work
5DA1628	Open lithic scatter	Not eligible	No further work
5DA1629	Open lithic scatter	Field needs data (2000)	No further work
5DA1636	One core and two flakes	Field not eligible (2000)	No further work
5DA2720	Peter Smidt Ranch/Gotlob Bader Ranch	Field eligible (2005)	No further work
JH01	Open camp	Needs data	Limited testing
JH02	Open lithic scatter (cutbank)	Needs data	Limited testing
JH04	Open lithic scatter	Not eligible	No further work
JH05	Open lithic scatter	Not eligible	No further work
JH06	Biface fragment and flake	Not eligible	No further work
JH07	One flake	Not eligible	No further work
JH08	Telegraph line	Not eligible	No further work
JH09	Tested nodule	Not eligible	No further work
JH10	Open lithic scatter	Needs data	Limited testing
JH12	One flake	Not eligible	No further work
JH13	Open lithic scatter	Not eligible	No further work
KM01	CCC water control features	Not eligible	No further work
KM02	CCC water control features	Not eligible	No further work
KM03	Open lithic scatter	Needs data	Limited testing
KM04	Open lithic scatter	Not eligible	No further work
KMIF01	One flake	Not eligible	No further work
KMIF02	One flake and two fire-cracked rock (FCR)	Not eligible	No further work
KMIF03	One flake	Not eligible	No further work
KMIF04	Five flakes and one mano	Not eligible	No further work
KMIF05	Core	Not eligible	No further work
KMIF06	Three flakes	Not eligible	No further work
KMIF07	Two flakes	Not eligible	No further work
KMIF08	One flake	Not eligible	No further work
KMIF09	Three flakes	Not eligible	No further work

Sites

5DA1628 – Open lithic scatter

Description: The site is situated on top of a mesa above Plum Creek and McMurdo Gulch. A steep Gambel oak-covered slope is present to the west, and a gradual grass-covered slope is present to the east. Artifacts and feature are situated mainly on the level edge and west along a finger ridge. Sediments are tan brown eolian silty loam. Vegetation consists of smooth brome, grasses, yucca, Gambel oak, and ponderosa pine. The ground visibility is 50 percent. The elevation is 6,565 ft asl.

SWCA originally documented 5DA1628 in 2000 as an open artifact scatter and recommended it not eligible for listing in the NRHP due to a lack of sediment accumulation (i.e., lack of subsurface potential, as well as a lack of diversity in the assemblage). ERO relocated the site and expanded its boundaries to the north and south. The site continues north into previously surveyed areas.

The site consists of an open lithic scatter with two artifact concentrations (AC1 and AC2) that contain a broad scatter of other lithic of multiple material types. AC1 is likely the same as the AC recorded by SWCA as it has similar location and dimensions, although no ground stone was present. Nondiagnostic artifacts include 2 modified flakes and 58 debitage. The artifacts are indicative of stone tool

manufacturing. The shallow sediments and surface assemblage indicate the site contains no possibility for significant buried cultural components.

Debitage indicates the occupants were familiar with local tool stone, and the material types are generally reflective of locally available materials and are consistent with assemblages upstream (Hedlund and Mayo 2019). Material types include DPW (n=27), local chert (n=15), local orthoquartzite (n=11), Wall Mountain Tuff (WMT; n=3), quartz crystal (n=1), and rhyolite (n=1).

SRHP Eligibility: ERO recommends the site needs data. The site likely continues to the north outside of the project area. The area requires further investigation before an eligibility recommendation can be made. The portion of the site in the project area is not eligible based on a lack of sediment accumulation. Additional investigation is unlikely to yield additional important information regarding prehistoric occupation (Criterion E). The site is not associated with any known event or person important to history (Criteria A and B); the site does not embody any distinctive characteristics of a type, period, or method of construction (Criterion C); and the site is not important geographically (Criterion D).

Management Recommendations: No further work.

JH01 – Open camp

Description: The extensive open camp covers the north and south sides of an ephemeral drainage that flows irregularly into East Plum Creek to the west (Figure 5). The eastern half of the site is located on a broad fan deposited by the ephemeral drainage while the western portion of the site is located on the surface of the third terrace deposited by East Plum Creek. Impacts on the site include extensive plowing to the north and south of the ephemeral drainage, leaving only narrow intact portions of the site where it flanks the drainage. A sanitary sewer line and access road crosses north to south through the west portion of the site. Vegetation includes short prairie grasses. The ground visibility is about 60 percent. The elevation is 6,104 ft asl.

ERO identified numerous nondiagnostic artifacts at the site including a drill fragment, a mano, modified flakes, and a biface fragment, with more than half of the assemblage consisting of scrapers (Table 2). ERO also recorded 62debitage. Diagnostic artifacts include two unnotched triangular projectile points and one tri-notched projectile point (FS7, FS10, and FS15; Figure 6) that date to the Middle Ceramic Period (AD 1150 to 1540) (Gilmore 1999:262). Open sites dating to this period are rare in Douglas County as most sites are known in rockshelter or cave contexts in the hogbacks.



Figure 5. Site overview looking toward East Plum Creek, view to the southwest.

Table 2. JH01 artifacts.

FS No.	Type	Description	Material	Measurements (cm) Length x Width x Thickness
1	Disto-lateral scraper	Dorsal keel exhibits polish (hafting)	DPW	4.3 x 2.5 x 0.8
2	Drill fragment	Missing bit but retains hafting element	Chert	2.3 x 2.4 x 0.6
3	Side scraper	Unilateral, unifacial	Chert	4.0 x 3.5 x 0.9
4	End scraper fragment	Modified water-rounded crystal	Quartz crystal	1.0 x 1.8 x 1.0
5	Mano	River cobble with one lightly ground facet	Sandstone	5.5 x 4.1 x 2.6
6	Modified flake	Bilateral, unifacial	DPW	1.0 x 1.3 x 2.0
7	Projectile point	Triangular, missing tip	Chert	1.7 x 1.3 x 0.2
8	Scraper	Unifacially modified on distal margin	Chert	4.9 x 3.1 x 1.4
9	Modified flake	Bilateral, bifacial	WMT	9.9 x 4.9 x 2.0
10	Projectile point	Missing tip, tangs, and parts of margins	DPW	0.9 x 1.0 x 0.2 x 0.71 neck
11	End scraper fragment	Step fracture on distal end, dorsal cortex	DPW	3.2 x 2.4 x 1.5
12	Biface fragment	Mid-section, Kremmling chert	Chert	2.3 x 2.3 x 0.4
13	Side scraper	Polished along one modified margin	DPW	6.0 x 5.0 x 2.0
14	Modified flake	Unilateral, unifacial	Chert	1.6 x 1.8 x 0.3
15	Projectile point	Impact fracture, Trout Creek chert	Chert	1.4 x 1.2 x 0.3
16	End scraper	Spurred sides suggest rework in haft	Chert	1.4 x 2.3 x 0.6
17	End scraper	Disto-lateral, polish along modified margins	WMT	7.3 x 3.5 x 1.6
18	End scraper	Disto-lateral heavy polish	DPW	3.3 x 2.4 x 0.7
19	End scraper	Unifacial modification on distal margin	DPW	3.7 x 2.9 x 1.1



Figure 6. Projectile points at JH01.

The assemblage indicates heavy animal processing due to the presence of multiple projectile points and hide-working tools such as scrapers polished by repetitive use against soft materials. Plant processing likely undoubtedly occurred, but the small amount of ground stone and lack of FCR suggests plant processing may have been limited. Debitage indicates the occupants were familiar with local tool stone and the material types are generally reflective of locally available materials and are consistent with assemblages upstream (Hedlund and Mayo 2019). Material types include DPW (n=28), local chert (n=19), local orthoquartzite (n=7), WMT (n=4), chalcedony (n=3), and Kremmling chert (n=1). The debitage material frequencies do not mirror the materials in the tool assemblage where there is more chert (n=8) than DPW (n=7). This suggests one of two activities may have taken place. The first is that chert was preferred as a tool stone over DPW. The second and more likely alternative is that tools were being discarded and replenished with readily available DPW.

The small amount of ground stone and tool discard and replenishment indicate the occupants were mobile and unlikely to have used the location for extended camping. This is further supported by the presence of Trout Creek and Kremmling chert, which would have been conveyed from South Park or North Park. Both materials are present but are uncommon in assemblages from neighboring sites in the Newlin, Happy Canyon, and Oak Gulch drainage systems to the north (Gantt 2007; Hedlund et al. 2019, 2020)

Although ERO has not conducted any testing at this site, it is likely that the assemblage associated with the Middle Ceramic component is contained in the upper sediments of the landforms or on the surface. The terrace is mapped as late-Pleistocene alluvium (Broadway) (Thorson 2005) and the fan deposits stand about 2.5 m above the ephemeral drainage. The terrace therefore significantly predates the Middle Ceramic component and although the fan probably dates to the Holocene, it is unlikely to post-date the Middle Ceramic component based on its height above the drainage.

SRHP Eligibility: ERO recommends the site needs data. Surface sediments across the site contain the potential for buried cultural deposits. ERO recommends shovel testing to determine the nature, extent, and significance of the potential deposits.

Management Recommendations: Limited testing.

JH02 – Open lithic scatter (cutbank)

Description: The site is eroding from cutbanks cut into a fan exposed at the confluence of an unnamed ephemeral tributary of East Plum Creek and East Plum Creek. Sediments consist of more than 2 m of grey brown sandy loam over interbedded sands and gravel. Coal and cinders from the railroad are present in the top layers of sediment. Vegetation includes various grasses and forbs, barrel cactus, yucca, and mountain mahogany. The ground visibility is 10 percent. The elevation is 6,105 ft asl.

Artifacts are distributed in a cutbank on the west side of East Plum Creek and into the gully west of the cutbank. Flakes are mostly coming out of the upper 30 to 40 centimeters (cm) below ground surface, but one flake was identified in high-energy alluvium about 2.7 m below ground surface. No flakes were identified on the top of the terrace due to low ground visibility. Artifacts include 2 cores, 1 disto-lateral end scraper, and 9 debitage. Debitage material types include DPW (n=4), orthoquartzite (n=4), and local chert (n=1). The small size of the assemblage precludes meaningful interpretation.

SRHP Eligibility: ERO recommends the site needs data. The depositional nature of the terrace and the eroding artifacts indicate the potential for additional cultural material subsurface. ERO recommends shovel testing to determine the nature, extent, and significance of the potential deposits.

Management Recommendations: Limited testing.

JH05 – Open lithic scatter

Description: The site is situated on a gradual west- and south-facing slope on a Pleistocene-age terrace (Thorson 2005). East Plum Creek is 100 m to the west. The site intersects the boundary of the Peter Smidt Ranch/Gotlob Bader Ranch (5DA2720). The landform has been stripped of vegetation and is heavily disturbed. Sediment consists of tan loamy sand. The ground visibility is 100 percent. The elevation is 6,103 ft asl.

The assemblage has been scattered across the landform by tilling, and plow scars are present on all the large artifacts. Tilling has also likely redistributed the widely dispersed artifacts across the surface of the landform. More recently, the landform was stripped of vegetation and impacted by construction. The lack of vegetation is causing erosion of surface sediments and artifacts downslope to the west. Artifacts include 43 debitage and 10 tools (described in Table 3). Several fragments of deer bone across the site are weathered sufficiently to be associated with the precontact assemblage.

Debitage indicates the occupants were familiar with local tool stone, and the material types are generally reflective of locally available materials and are consistent with assemblages upstream (Hedlund and Mayo 2019). Material types include DPW (n=25), local chert (n=9), local orthoquartzite (n=7), WMT (n=1), and quartz crystal (n=1).

Table 3. JH05 artifacts.

FS No.	Type	Description	Material	Measurements (cm) Length x Width x Thickness
1	Mano	Bifacially ground, heavily pecked margins	Sandstone	14.0 x 10.0 x 2.7
2	Hammerstone	River cobble, battering on two margins	Chert	5.5 x 5.8 x 5.0
3	Core	Bifacial	Chert	5.1 x 4.0 x 2.2
4	Biface mid-section	Step fracture/grinding along one margin	DPW	4.4 x 3.3 x 0.6
5	End scraper	Disto-lateral, distal step fracture, and polish	Chert	3.7 x 3.0 x 0.8
6	Metate	Fragment	Sandstone	5.3 x 3.3 x 1.7
7	Metate	Fragment remaining of ground basin	Sandstone	9.5 x 7.4 x 4.5
8	Mano	Bifacially ground, lateral pecking	Orthoquartzite	7.5 x 8.7 x 4.7
9	Chopper	Unifacial retouch on lateral margins	WMT	15.0 x 10.0 x 9.0
10	Modified bone	Deer femur with possible cut marks	Bone	NA

Although the ground stone assemblage contrasts sharply with the tool assemblage at JH01, comparison between the two sites is not feasible. JH05 is located on a Pleistocene-age landform, precluding the potential for buried cultural deposits and, therefore, the assemblage may represent a palimpsest of human activity spanning thousands of years. Furthermore, the severe disturbance of the site prevents identification of any spatial patterns in the surface assemblage. These two factors prevent the site from yielding any meaningful information about Colorado prehistory.

SRHP Eligibility: ERO recommends the site not eligible for listing in the SRHP under any criteria because the site is not associated with any known event or person important to history (Criteria A and B); the site does not embody any distinctive characteristics of a type, period, or method of construction (Criterion C); and the site is not important geographically (Criterion D). Sedimentation indicates further investigation is unlikely to yield information important to the history of the area (Criterion E).

Management Recommendations: No further work.

JH08 – Telegraph line

Description: The historical telegraph line generally follows the footprint of the Denver and Rio Grande Railroad (5DA921.1). A portion of a modern utility line within the west project area generally overlaps the footprint of the historical telegraph line as it follows the railroad.

The telegraph line has been cut down (Figure 7). Cut utility poles, stumps, and beams with wood insulator pins remain in the project area. The line was likely associated with the railroad and presumably follows the railroad further to the south.

SRHP Eligibility: ERO recommends the site not eligible for listing in the SRHP under any criteria because the site is not associated with any known event or person important to history (Criteria A and B); the site does not embody any distinctive characteristics of a type, period, or method of construction (Criterion C); and the site is not important geographically (Criterion D). Further investigation is unlikely to yield information important to the history of the area (Criterion E).

Management Recommendations: No further work.



Figure 7. Cut telegraph line, view to the southwest.

JH10 – Open lithic scatter

Description: The site is situated on the top of a small east-west trending ridge. The site is surrounded by ephemeral drainages. East Plum Creek is 550 m to the west. Sediments are brown sandy loam. The landform and surrounding area have been plowed. Vegetation consists of short prairie grasses and forbs. The ground visibility is 70 percent. The elevation is 6,148 ft asl.

The site consists of 110 debitage and 6 tools (described in Table 4). A projectile point (FS2; Figure 8) is similar morphologically to Early Archaic projectile points associated with the Mount Albion Complex (Benedict and Olson 1978). The Early Archaic period lasted from 7500 to 5000 years BP (Tate 1999). Most artifacts are present on the northeast-facing slope of the landform (AC1).

Artifacts below the ridge are sparse, potentially because they are buried by windblown sediments. It is unclear if buried intact deposits are present, however. The site was plowed historically and, therefore, all subsurface artifacts may have been rearranged, and their lack of context would prohibit their ability to yield important information. The portions of the site with the best potential for deposition are the toe slopes north of AC1 and the southwest face of the ridge.

Table 4. JH10 artifacts.

FS No.	Type	Description	Material	Measurements (cm) Length x Width x Thickness
1	Biface	Laterally broken, ground margins	DPW	3.9 x 2.9 x 0.9
2	Projectile point	Lateral break across blade, impact fracture, expanding neck, convex base	Chert	2.3 x 2.0 x 0.6 x 1.4 neck x 1.6 base
3	Scraper	Modified split river cobble	Chert	4.0 x 4.2 x 1.5
4	Biface	Biface/bifacial core, broken laterally	DPW	3.4 x 2.8 x 0.9
5	Scraper	Minor retouch on distal margin	Chert	5.0 x 4.2 x 1.5
6	Modified flake	Unilateral, unifacial	Chert	2.2 x 1.8 x 0.4



Figure 8. FS2 - Archaic period projectile point.

Debitage indicates the occupants were familiar with local tool stone, and the material types are generally reflective of locally available materials and are consistent with assemblages upstream (Hedlund and Mayo 2019). Material types include DPW (n=72), local chert (n=19), local orthoquartzite (n=17), WMT (n=1), and quartz crystal (n=1). If the assemblage represents a single component, it indicates the occupants were drawing primarily from DPW tool stone sources and the material frequencies are more similar to sites on Cherry Creek than East Plum Creek (Hedlund and Mayo 2019). This may indicate a preference for DPW or that the Early Archaic group was travelling from drainages to the east. Single facet (n=17), dihedral (n=8), and multifacet (n=7) platforms on broken or complete flakes indicate mid to late stages of reduction happened and that unifacial and bifacial tools were manufactured or retouched.

SRHP Eligibility: ERO recommends the site as needs data. The toe slopes north of AC1 and the southwest face of the ridge contain the potential for buried cultural deposits. ERO recommends shovel testing to determine the nature, extent, and significance of the potential deposits.

Management Recommendations: Limited testing.

KM01 – CCC water control feature

Description: The site is situated on top of a mesa between East Plum Creek and McMurdo Gulch on a slope with a southeastern aspect. The sediments are brown aeolian loam. Vegetation consists of smooth brome, grasses, yucca, and Gambel oak. The ground visibility is 20 percent. The elevation is 6,510 ft asl.

The site consists of two stacked rock walls (F1 and F2) constructed by the CCC that serve as water control features. F1 is a rock wall water control feature measuring 6 ft by 12 ft. F2 is a rock stack approximately 8 ft long by 4 ft that has been cut by the drainage

SRHP Eligibility: ERO recommends the site not eligible for listing in the SRHP under any criteria.

Although the site is associated with the CCC, the simple feature is not significant to that association (Criterion A). The site is not associated with a person important to history (Criteria A and B); the site does not embody any distinctive characteristics of a type, period, or method of construction (Criterion C); and the site is not important geographically (Criterion D). Furthermore, the site represents common features of the CCC; therefore, further investigation is unlikely to yield information important to the history of the area (Criterion E).

Management Recommendations: No further work.

KM02 – CCC water control feature

Description: The site is situated on top of a mesa between East Plum Creek and McMurdo Gulch on a slope with a northeastern aspect and within an ephemeral drainage. The drainage trends toward modern water control features and culverts under Founder's Parkway. Vegetation consists of smooth brome, grasses, yucca, and Gambel oak. The sediments are brown aeolian loam. The ground visibility is 20 percent. The elevation is 6,500 ft asl.

The site consists of three stacked rock walls (F1 through F3) constructed by the CCC that serve as water control features. F1 is a rock wall water control feature measuring 3 ft by 13 ft. F2 is a rock wall measuring 12 ft long that has eroded due to the head cutting of the drainage. F3 is a rock wall stacked higher than the others and measures 15 ft long by 4 ft wide. All rocks that make up the walls appear to be made of a local sand, cobble, and concrete mix.

ERO recommends the site not eligible for listing in the SRHP under any criteria. Although the site is associated with the CCC, the simple feature is not significant to that association (Criterion A). The site is not associated with a person important to history (Criteria A and B); the site does not embody any distinctive characteristics of a type, period, or method of construction (Criterion C); and the site is not important geographically (Criterion D). Furthermore, the site represents common features of the CCC; therefore, further investigation is unlikely to yield information important to the history of the area (Criterion E).

Management Recommendations: No further work.

KM03 – Open lithic scatter

Description: The site is situated on top of a mesa between East Plum Creek and McMurdo Gulch. The site is situated on a gradual grass-covered slope with a northeastern aspect. A steep Gambel oak-covered slope is present to the west. Artifacts and features are situated mainly on the ridge top. The sediments are tan brown eolian silty loam. Vegetation consists of smooth brome, grasses, yucca, and Gambel oak. The ground visibility is 40 percent. The elevation is 6,559 ft asl.

The site consists of an open lithic scatter with material types including DPW and various cherts. Nondiagnostic artifacts include one WMT modified flake (FS1) and 21 debitage. F1 is a pile of 8 sandstone cobbles and 1 quartzite cobble that measures 60 cm by 39 cm. The feature is more likely to be a cairn than a hearth due to the lack of fire alteration, charcoal, or staining. Several potential FCR cobbles are present at the site. .

Debitage indicates the occupants were familiar with local tool stone, and the material types are generally reflective of locally available materials and are consistent with assemblages upstream (Hedlund and Mayo 2019). Material types include DPW (n=15) and local chert (n=6). The modified flake (FS1) is the only example of WMT at the site.

SRHP Eligibility: ERO recommends the site needs data. The northeastern portion of the site is located on a portion of the slope where gray brown silty loam sediments have accumulated up to about 15 cm. Additionally, artifacts were found eroding from a two-track along this portion of the site. ERO recommends shovel testing to determine the nature, extent, and significance of subsurface archaeological deposits.

Management Recommendations: Limited testing.

KM04 – Open lithic scatter

Description: The site is situated on top of a mesa above Plum Creek and McMurdo Gulch. The site is situated on a gradual grass-covered slope with a northeastern aspect. A steep Gambel oak-covered slope is present to the west. Artifacts and features are situated mainly on the ridge top. The sediments are tan brown eolian silty loam. Vegetation consists of smooth brome, grasses, yucca, and Gambel oak. The ground visibility is 40 percent. The elevation is 6,580 ft asl.

The site consists of an open lithic scatter with multiple material types. Tools include 1 chert modified flake (FS1), 1 WMT modified flake (FS2), 1 WMT biface fragment (FS3), 1 amazonite pebble, 1 possible quartz FCR, and 38 debitage.

Debitage indicates the occupants were familiar with local tool stone, and the material types are generally reflective of locally available materials and are consistent with assemblages upstream (Hedlund and Mayo 2019). Material types include WMT (n=20), DPW (n=9), local chert (n=6), and orthoquartzite (n=3). The site contains more WMT flakes than any other site recorded in the project area, which can be partially explained by the two WMT tools identified at the site (FS2 and FS3).

SRHP Eligibility: ERO recommends the site not eligible for listing in the SRHP under any criteria because the site is not associated with any known event or person important to history (Criteria A and B); the site does not embody any distinctive characteristics of a type, period, or method of construction (Criterion C); and the site is not important geographically (Criterion D). Due to the lack of deposition, further investigation is unlikely to yield information important to the prehistory of the area (Criterion E).

Management Recommendations: No further work.

Summary and Recommendations

ERO's Class II and III survey indicates that the Pine Canyon Development property was inhabited by Native Americans during the Early Archaic and Middle Ceramic periods. Sites are most common along East Plum Creek, which would have provided access to water and increased biodiversity along the riparian corridor. ERO recommends most of the sites do not require any additional work because they are either completely disturbed or have no potential to provide additional significant information regarding history or prehistory. Four sites (JH01, JH02, JH10, and KM03) may have potential for buried cultural deposits, and ERO recommends shovel testing to assess their subsurface potential if the sites will be impacted by construction.

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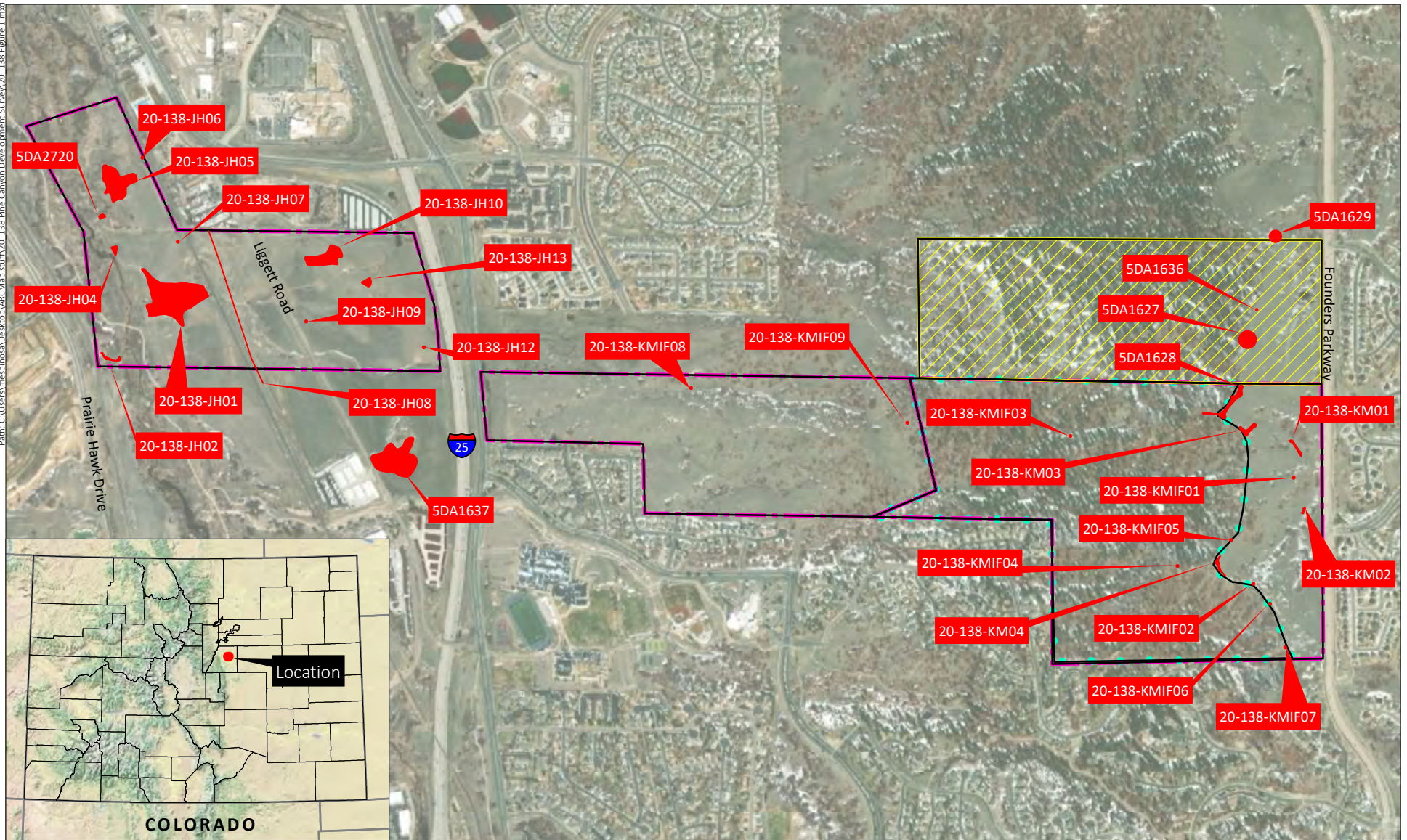
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Appendix A Cultural Resource Location Map and Site Maps (Figure 1)
For Official Use Only: Disclosure of Site Locations Prohibited (43 CFR 7.18)



Class II and III Cultural Resource Survey Pine Canyon Development Project Douglas County, Colorado

Sections 34, 35, and 36, T7S, R67W; 6th PM
Section 1, T8S, R67W; 6th PM
USGS Castle Rock North, CO Quadrangle (1:24,000; 1980)
Douglas County, Colorado

- Resource Boundary
- Project Area
- Class II Survey
- Class III Survey
- Previous Survey

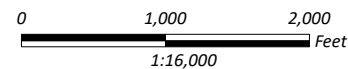


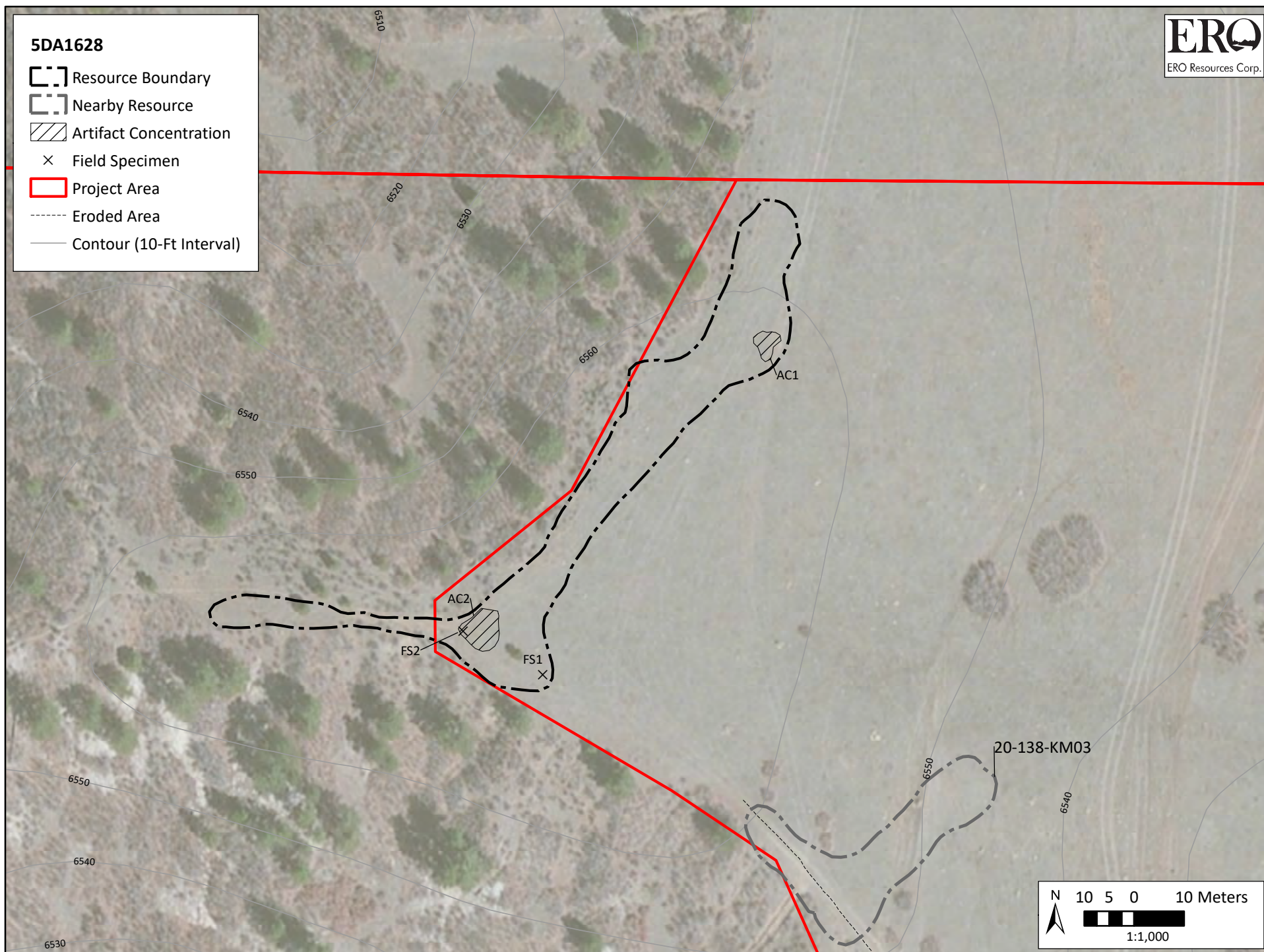
Figure 1
Project Location

Prepared for:
JRW Family Limited Partnership, LLLP
File: 20_138 Figure 1.mxd (ME)
July 14, 2020



5DA1628

-  Resource Boundary
-  Nearby Resource
-  Artifact Concentration
-  Field Specimen
-  Project Area
-  Eroded Area
-  Contour (10-Ft Interval)



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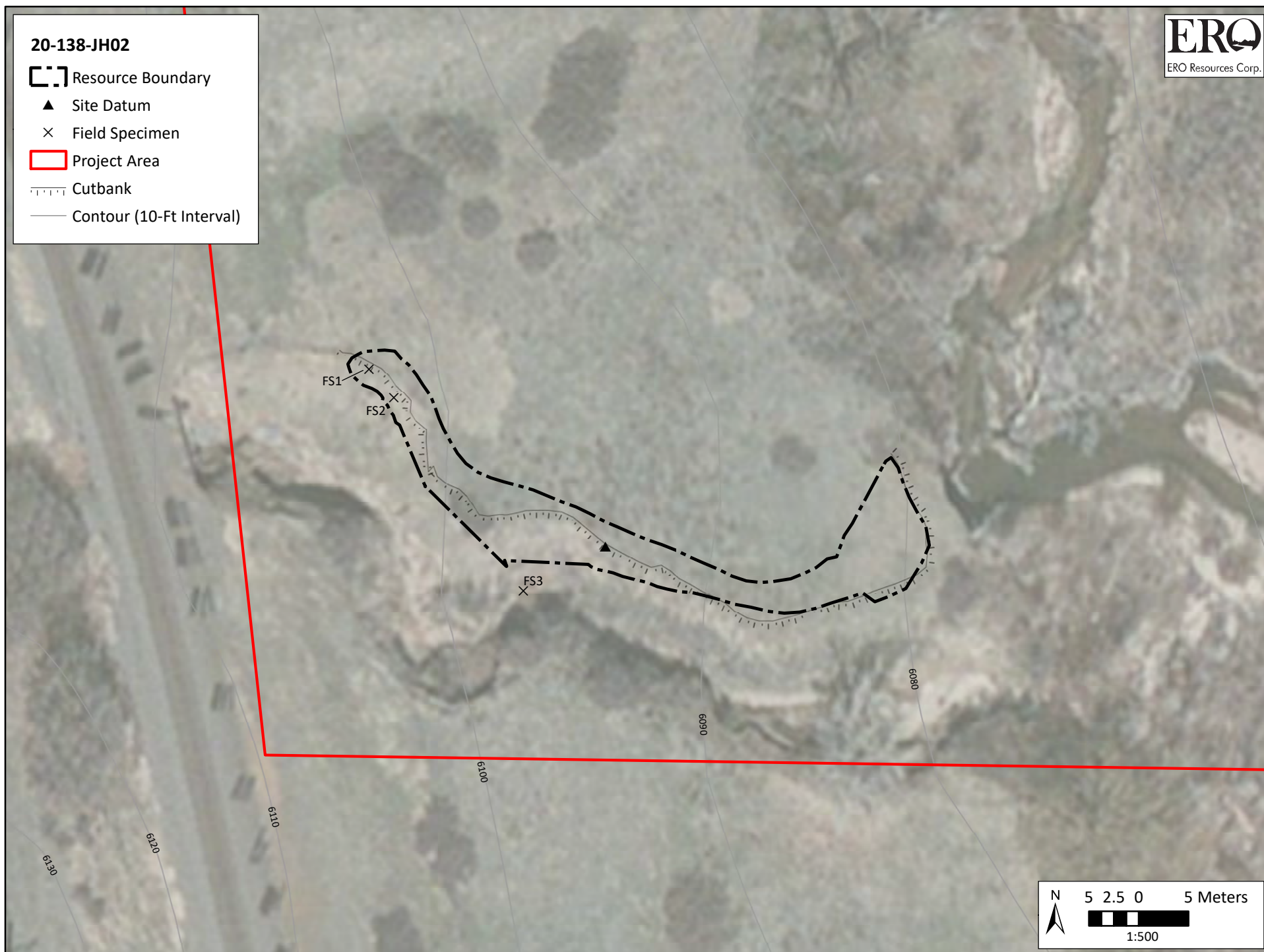
20-138-JH01

- Resource Boundary
- Site Datum
- Field Specimen
- Project Area
- Disturbance
- Cutbank
- Contour (10-Ft Interval)

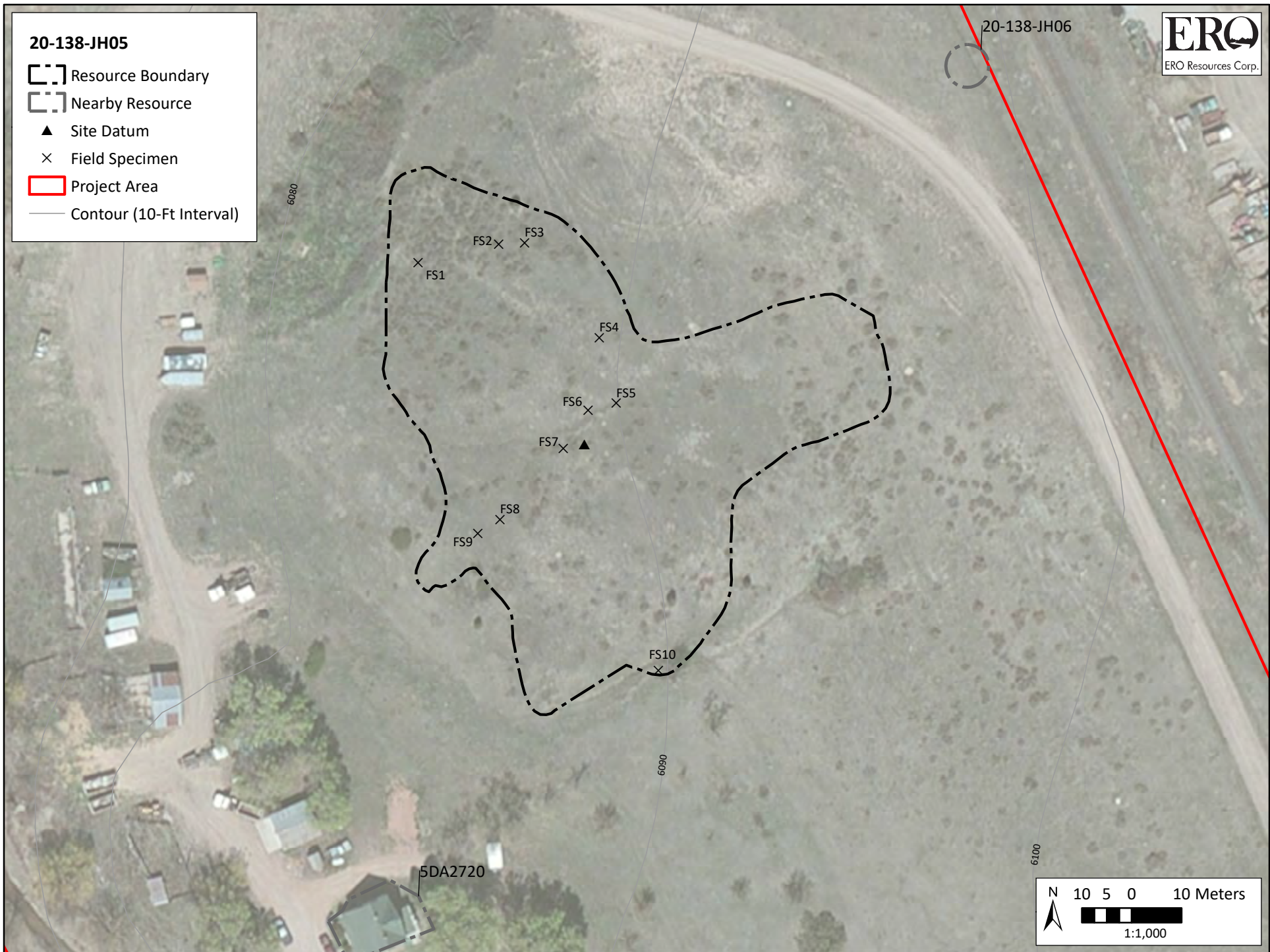


20-138-JH02

-  Resource Boundary
-  Site Datum
-  Field Specimen
-  Project Area
-  Cutbank
-  Contour (10-Ft Interval)



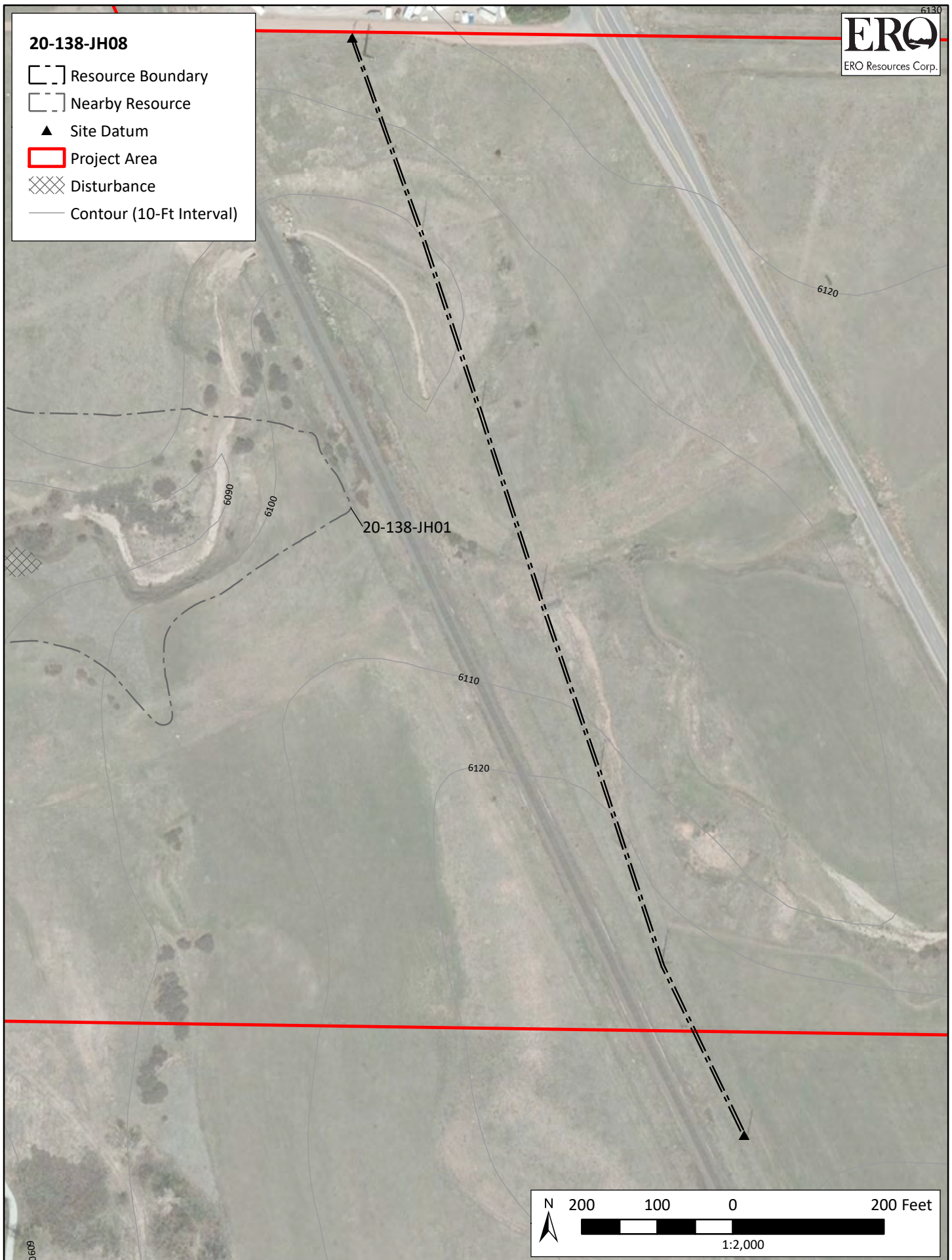
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20-138-JH08

-  Resource Boundary
-  Nearby Resource
-  Site Datum
-  Project Area
-  Disturbance
-  Contour (10-Ft Interval)



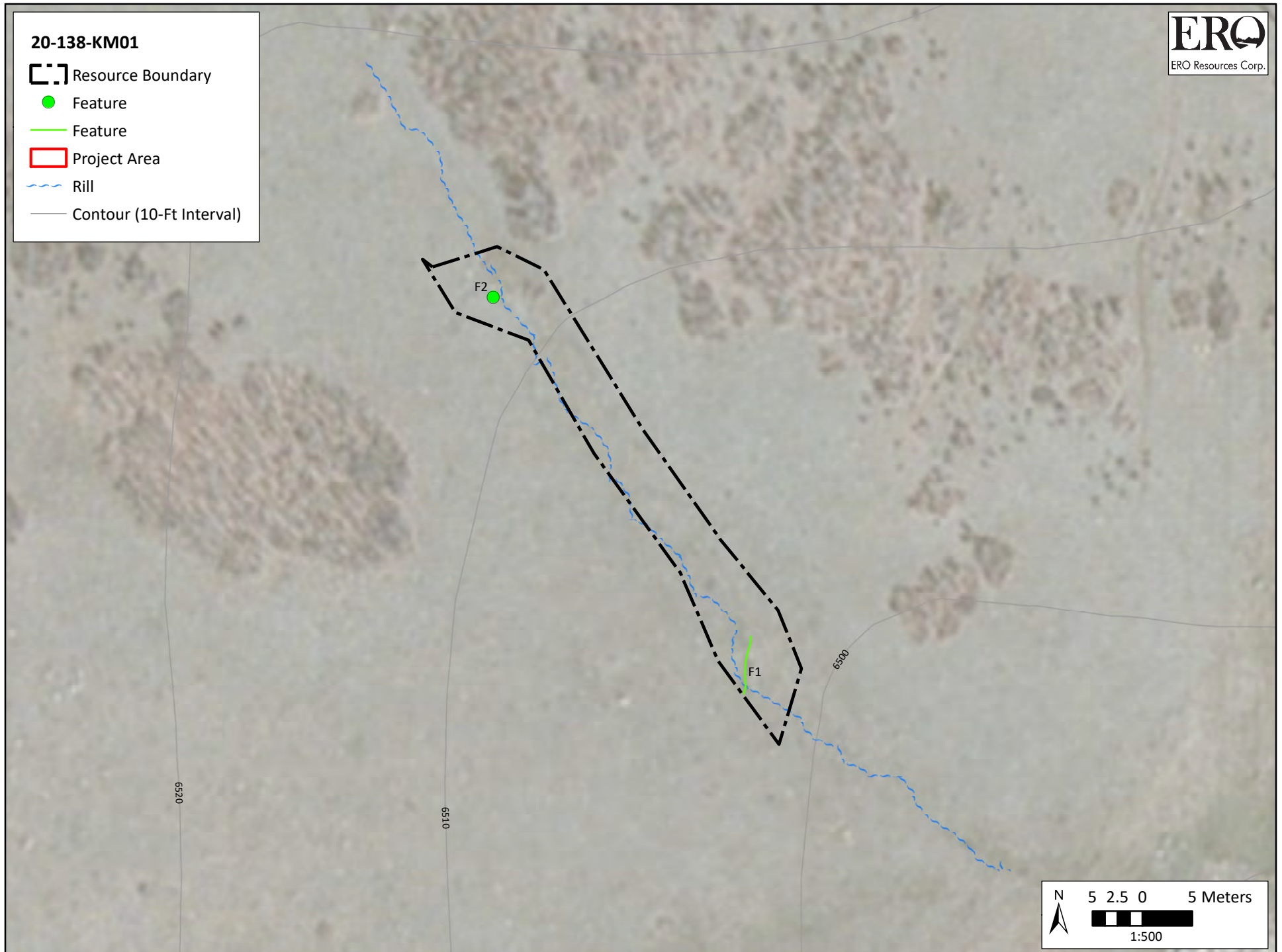
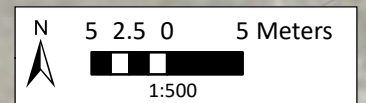
20-138-JH10

-  Resource Boundary
-  Site Datum
-  Artifact Concentration
-  Field Specimen
-  Project Area
-  Contour (10-Ft Interval)



20-138-KM01

-  Resource Boundary
-  Feature
-  Feature
-  Project Area
-  Rill
-  Contour (10-Ft Interval)

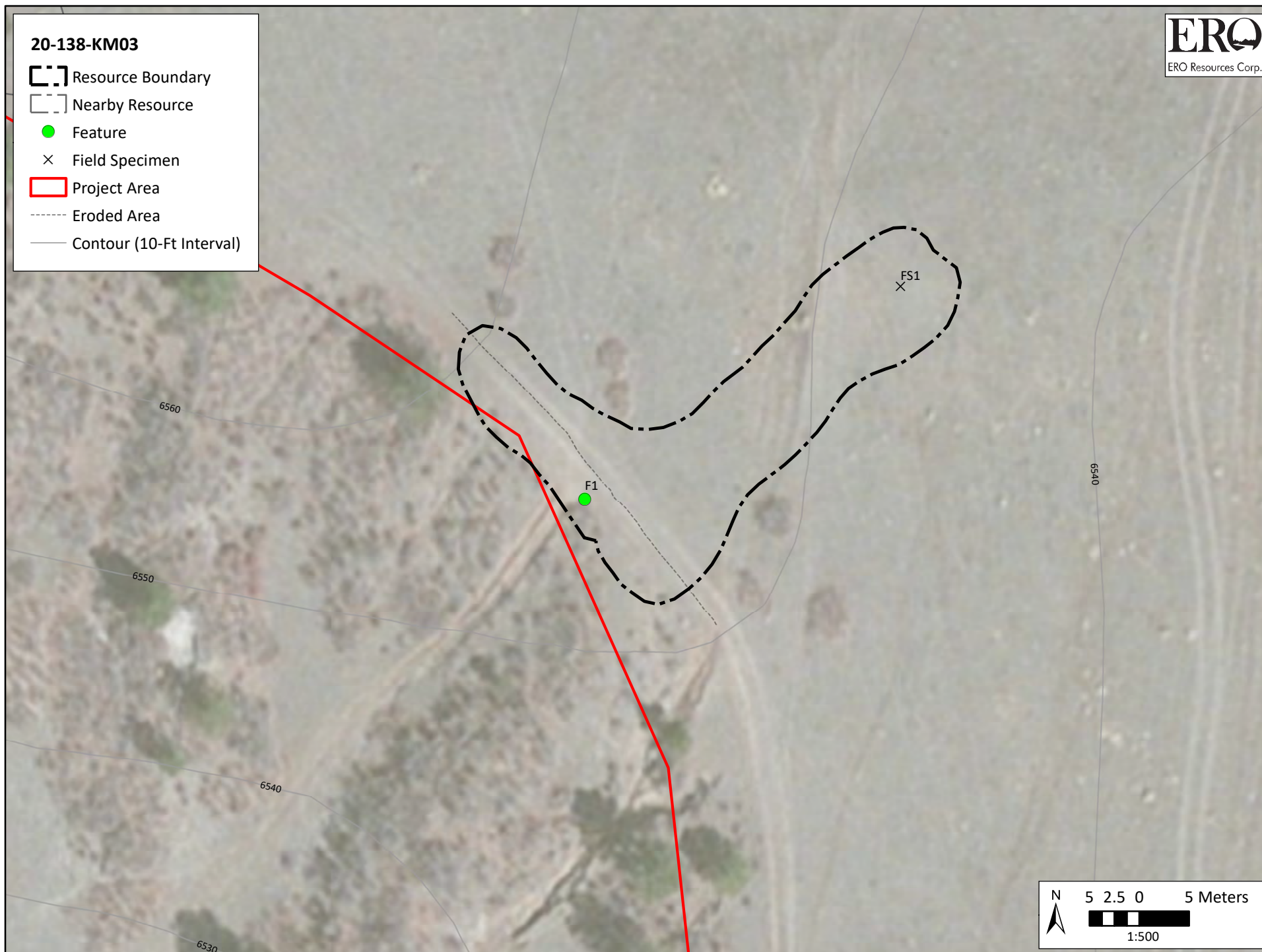




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20-138-KM03

-  Resource Boundary
-  Nearby Resource
-  Feature
-  Field Specimen
-  Project Area
-  Eroded Area
-  Contour (10-Ft Interval)





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Appendix B Additional Photos



JH01 - Site overview facing East Plum Creek, view to the southwest.
Photo Number: D3.107-0086 Date: 6.29.20



JH01 - Site overview facing I-25, view to the northeast.
Photo Number: D3.107-0088 Date: 6.29.20



JH01 - Overview of ephemeral channel and modern bridge disturbance, view to the southwest.
Photo Number: D3.107-0095 Date: 6.29.20



JH01 - Overview of cut bank profile, tape set to 1 meter, view to the south.
Photo Number: JH.60 Date: 6.29.20



JH01 – FS1, DPW disto-lateral scraper.
Photo Number: D3.107-0089 Date: 6.29.20



JH01 – FS2, chert drill fragment.
Photo Number: D3.107-0091 Date: 6.29.20



JH 01 – FS3, chert unilateral and unifacial side scraper.
Photo Number: D3.107-0093 Date: 6.29.20



JH 01 – FS4, modified quartz crystal end scraper fragment.
Photo Number: D3.107-0099 Date: 6.29.20



JH01 – FS5, sandstone mano.
Photo Number: D3.107-0101 Date: 6.29.20



JH01 – FS6, DPW bilateral and unifacial modified flake.
Photo Number: D3.107-0104 Date: 6.29.20



JH01 – FS7, DPW triangular projectile point.
Photo Number: D3.107-0106 Date: 6.29.20



JH01 – FS7, DPW triangular projectile point.
Photo Number: D3.107-0107 Date: 6.29.20



JH01 – FS8, chert unifacial scraper.
Photo Number: D3.107-0108 Date: 6.29.20.



JH01 – FS9, WMT bifacial and bilateral modified flake.
Photo Number: D3.107-0111 Date: 6.29.20



JH01 – FS10, DPW projectile point.
Photo Number: D3.107-0112 Date: 6.29.20



JH01 – FS10, DPW projectile point.
Photo Number: D3.107-0113 Date: 6.29.20



JH01 – FS11, DPW end scraper fragment.
Photo Number: D3.107-0115 Date: 6.29.20



JH01 – FS12, Kremmling chert mid-section biface fragment.
Photo Number: D3.107-0117 Date: 6.29.20



JH01 – FS13, DPW side scraper.
Photo Number: D3.107-0118 Date: 6.29.20



JH01 – FS14, chert modified flake.
Photo Number: D3.107-0121 Date: 6.29.20



JH01 – FS15, Trout Creek chert projectile point.
Photo Number: D3.107-0124 Date: 6.29.20



JH01 – FS15, Trout Creek chert projectile point.
Photo Number: D3.107-0125 Date: 6.29.20



JH01 – FS16, chert end scraper.
Photo Number: D3.107-0126 Date: 6.29.20



JH01 – FS17, WMT disto-lateral end scraper.
Photo Number: D3.107-0128 Date: 6.29.20



JH01 – FS18, DPW end scraper.
Photo Number: D3.107-0132 Date: 6.29.20



JH01 – FS19, DPW unifacial end scraper.
Photo Number: D3.107-0130 Date: 6.29.20



**JH02 – Site overview facing Denver and Rio Grande railroad, view to the northwest.
Photo Number: JB1.2397 Date: 6.29.20**



**JH02 – Site overview facing I-25, view to the northeast.
Photo Number: JH1.31 Date: 6.29.20**



**JH02 - Cut bank profile 1 (ca. 20 x 20 m), view to the east.
Photo Number: D3.107-0097 Date: 6.29.20**



**JH02 - Cut bank profile 2, tape extended to 1 m, view to the East.
Photo Number: JH1.36 Date: 6.29.20**



JH02 – FS1, DPW disto-lateral end scraper.
Photo Number: JH1.33 Date: 6.29.20



JH02 – FS2, Quartzite bifacial core.
Photo Number: JH1.34 Date: 6.29.20



JH04 – Site overview facing Plum Creek and SDA2720, view to the northwest.
Photo Number: JH1.28 Date: 6.30.20



JH05 – Site overview facing I-25, view to the northeast.
Photo Number: LT1.00002 Date: 6.30.20



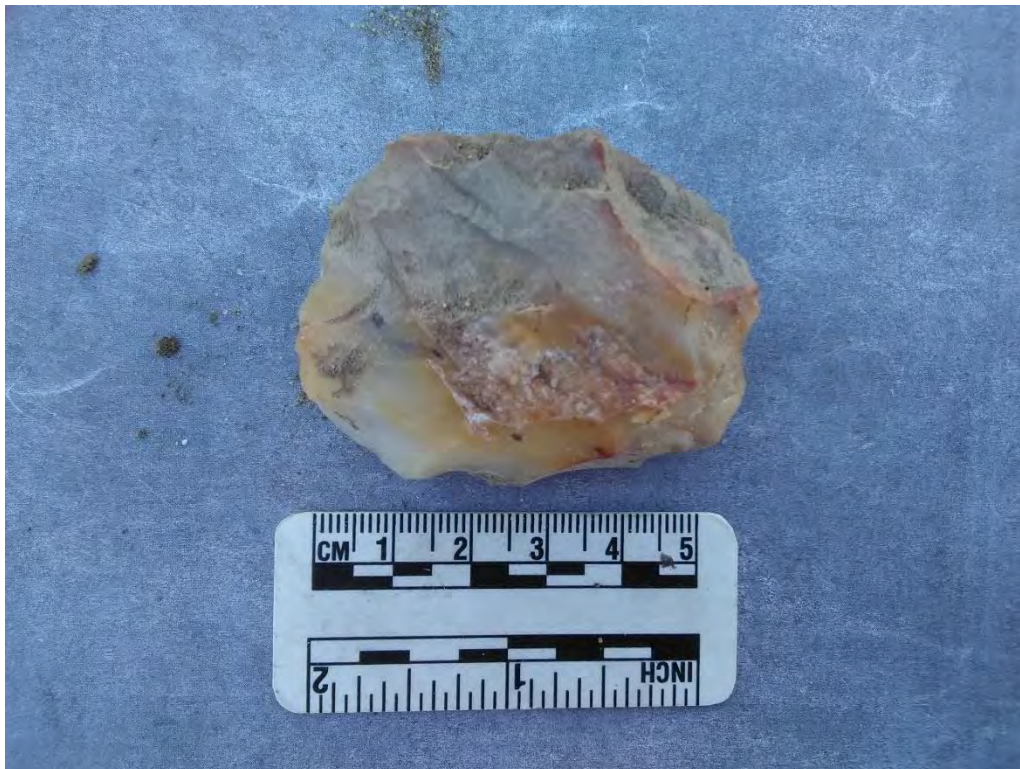
**JH05 – Site overview facing site 5DA2720. View to the southeast.
Photo Number: LT1.00004 Date: 6.30.20**



**JH05 – FS1, bifacially ground sandstone mano. Note plow scars.
Photo Number: LT1.00005 Date: 6.30.20**



JH05 – FS2, chert river cobble hammerstone. Note battered margins.
Photo Number: LT1.00010 Date: 6.30.20



JH05 – FS3, chert bifacial core.
Photo Number: LT1.00012 Date: 6.30.20



JH05 – FS4, DPW mid-section bifacial fragment.
Photo Number: LT1.00015 Date: 6.30.20



JH05 – FS7, sandstone metate grinding basin fragment.
Photo Number: LT1.00017 Date: 6.30.20



JH05 – FS8, bifacially ground orthoquartzite mano. Note plow marks.
Photo Number: LT1.00018 Date: 6.30.20



JH05 – FS9, WMT chopper.
Photo Number: LT1.00021 Date: 6.30.20



JH05 – FS10, medium ungulate radius. Note possible cut marks on the disto-caudal aspect of diaphysis.
Photo Number: LT1.00022 Date: 6.30.20



JH06 – Site overview facing East Plum Creek, view to the southwest.
Photo Number: JB1.2425 Date: 6.29.20



**JH06 – Site overview facing the Denver and Rio Grande Railroad, view to the northeast.
Photo Number: JB1.2424 Date: 6.29.20**



**JH06 – FS1, chert biface fragment.
Photo Number: JB1.2418 Date: 6.29.20**



JH08 – Site overview facing the Denver and Rio Grande railroad, view to the northwest.
Photo Number: JH1.08 Date: 6.29.20



JH08 – Site overview facing Castle Rock, view to the southeast.
Photo Number: JH1.09 Date: 6.29.20



JH08 – Telegraph pole detail.
Photo Number: JH1.07 Date: 6.29.20



JH10 – Site overview facing Castle Rock, view to the southeast.
Photo Number: LT1.00023 Date: 6.30.20



JH10 – Site overview facing East Plume Creek, view to the west.
Photo Number: LT1.00025 Date: 6.30.20



JH10 – FS1, DPW laterally broken biface.
Photo Number: LT1.00026 Date: 6.30.20



JH10 – FS2, chert projectile point.
Photo Number: LT1.00028 Date: 6.30.20



JH10 – FS2, chert projectile point.
Photo Number: LT1.00029 Date: 6.30.20



JH10 – FS3, split chert river cobble scraper.
Photo Number: LT1.000030 Date: 6.30.20



JH10 – FS4, DPW bifacial core.
Photo Number: LT1.000031 Date: 6.30.20



JH10 – FS5, chert scraper.
Photo Number: LT1.00033 Date: 6.30.20



JH13 – Site overview facing East Plum Creek, view to the southwest.
Photo Number: LT1.00035 Date: 6.30.20



JH13 – Site overview facing I-25, view to the north.
Photo Number: LT1.00036 Date: 6.30.20



5DA2720 – Site overview facing Castle Rock, view to the southeast.
Photo Number: JH1.26 Date: 6.29.20



**5DA2720 – Site overview, view to the southwest.
Photo Number: JH1.14 Date: 6.29.20**



**5DA2720 – Exposed foundation.
Photo Number: JH1.16 Date: 6.29.20**



5DA2720 – Standing structure.
Photo Number: JH1.017 Date: 6.29.20



5DA2720 – Standing structure, view to the west.
Photo Number: JH1.18 Date: 6.29.20



**5DA2720 – Standing structure.
Photo Number: JH1.019 Date: 6.29.20**



**5DA2720 – Structure foundation facing I-25, view to the northeast.
Photo Number: JH1.20 Date: 6.29.20**



5DA2720 – Fenced enclosure facing East Plum Creek, view to the northwest.
Photo Number: JH1.21 Date: 6.29.20



5DA2720 – Standing structures.
Photo Number: JH1.22 Date: 6.29.20



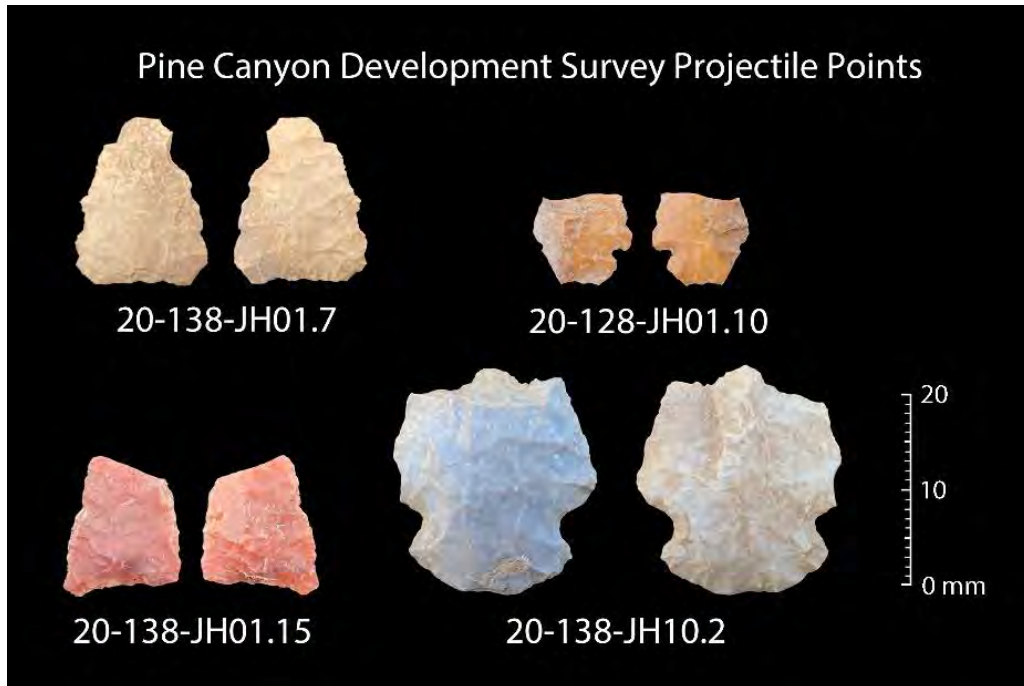
5DA2720 – Standing structure.
Photo Number: JH1.23 Date: 6.29.20



5DA2720 – Machinery and other historical objects, view to the southwest.
Photo Number: JH1.27 Date: 6.29.20



5DA2720 – Vehicle detail.
Photo Number: JH1.25 Date: 6.29.20



20-128 – Combined projectile points.



**20-138 – Project overview (Class III), view to the northwest.
Photo Number: D2.856 Date: 06.30.2020**



**20-138 – Project area overview (Class III), view to the northwest.
Photo Number: D2.899 Date: 7.01.2020**



**20-138 – Disturbance overview in east project area (Class III), view to the northwest.
Photo Number: D2.857 Date: 06.30.2020**



**20-138 – Project overview (Class II), view to the northwest.
Photo Number: D2.889 Date: 06.30.2020**



**20-138 – Project area overview (Class II), view to the southwest.
Photo Number: D2.884 Date: 06.30.2020**



**5DA1628 – Site overview, view to the southwest.
Photo Number: D2.876 Date: 06.30.2020**



5DA1628 – Site overview, view to the north.
Photo Number: D2.878 Date: 06.30.2020



5DA1628 – Site overview, view to the east.
Photo Number: D2.879 Date: 06.30.2020



5DA1628 – AC2 overview, view to the north.
Photo Number: D2.880 Date: 06.30.2020



5DA1628 – AC1 overview, view to the west.
Photo Number: D2.881 Date: 06.30.2020



5DA1628 – FS1, chert modified flake.
Photo Number: D2.882 Date: 06.30.2020



5DA1628 – FS2, quartzite modified flake.
Photo Number: D2.883 Date: 06.30.2020



KM01 – Site overview down drainage, view to the southeast.
Photo Number: D2.860 Date: 06.30.2020



KM01 – Site overview up drainage, view to the northwest.
Photo Number: D2.861 Date: 06.30.2020



KM01 – Feature 1, drainage feature, view to the northwest.
Photo Number: D2.858 Date: 06.30.2020



KM01 – Feature 2, drainage feature, view to the northeast.
Photo Number: D2.859 Date: 06.30.2020



**KM02 – Site overview looking up drainage, view to the south.
Photo Number: D2.865 Date: 06.30.2020**



**KM02 – Site overview looking down at drainage, view to the northwest.
Photo Number: D2.866 Date: 06.30.2020**



**KM02 – Feature 1, drainage feature, view to the east.
Photo Number: D2.862 Date: 06.30.2020**



**KM02 – Feature 2, drainage feature, view to the southeast.
Photo Number: D2.863 Date: 06.30.2020**



KM02 – Feature 3, drainage feature, view to the southeast.
Photo Number: D2.864 Date: 06.30.2020



KM03 – Site overview, view to the north.
Photo Number: D2.870 Date: 06.30.2020



KM03 – Site overview, view to the southwest.
Photo Number: D2.871 Date: 06.30.2020



KM03 – Feature 1 plan view.
Photo Number: D2.873 Date: 06.30.2020



KM03 – Feature 1 overview, view to the west.
Photo Number: D2.874 Date: 06.30.2020



KM03 – FS1, rhyolite modified flake.
Photo Number: D2.872 Date: 06.30.2020



**KM03 – Two-track road cut, view ot the southwest.
Photo Number: D2.875 Date: 06.30.2020**



**KM04 – Site overview, view to the south.
Photo Number: D2.890 Date: 7.01.2020**



KM04 – Site overview, view to the northwest.
Photo Number: D2.891 Date: 7.01.2020



KM04 – Site overview showing pipeline scar, view to the southwest.
Photo Number: D2.892 Date: 7.01.2020



KM04 – FS1, chert modified flake.
Photo Number: D2.893 Date: 7.01.2020



KM04 – FS2, WMT modified flake.
Photo Number: D2.895 Date: 7.01.2020



KM04 – FS3, WMT biface fragment.
Photo Number: D2.897 Date: 7.01.2020



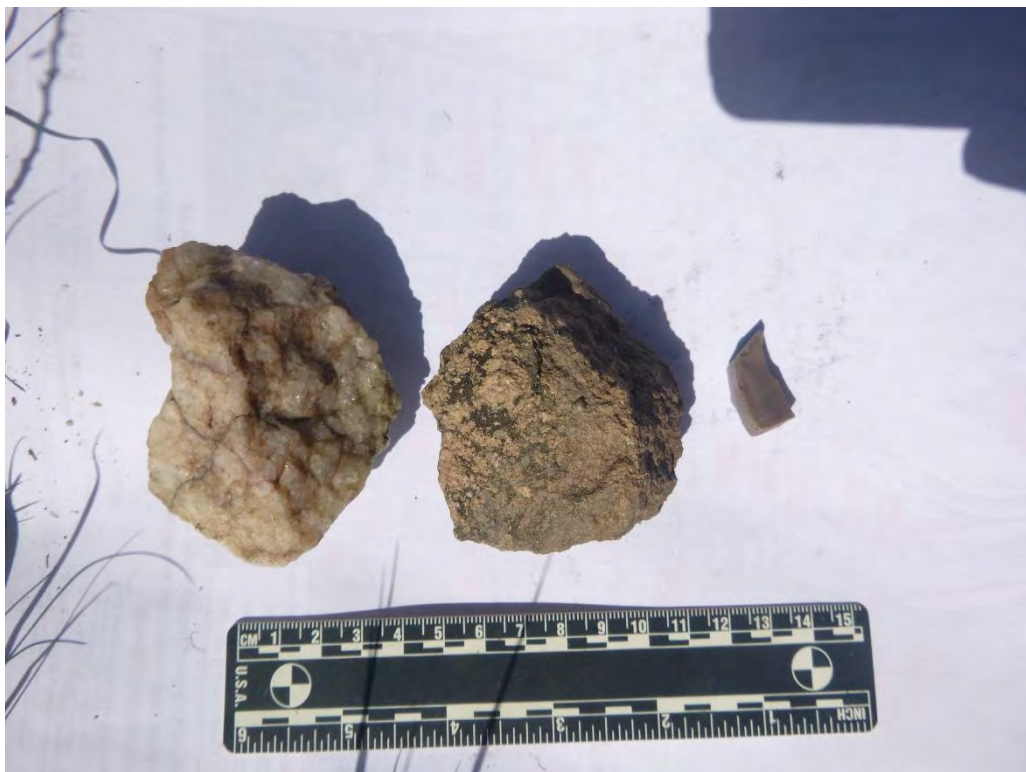
KM04 – Cut below site, view to the northwest.
Photo Number: D2.898 Date: 7.01.2020



**KMIF02 – Site overview, view to the southeast.
Photo Number: D2.687 Date: 06.30.2020**



**KMIF02 – Site overview, view to the west.
Photo Number: D2.868 Date: 06.30.2020**



**KMIF02 – Artifacts detail, 2 pieces of FCR and 1 chert shatter.
Photo Number: D2.869 Date: 06.30.2020**



**KMIF04 – Site overview, view to the southeast.
Photo Number: D2.887 Date: 06.30.2020**



KMIF04 – Site overview, view to the south.
Photo Number: D2.888 Date: 06.30.2020



KMIF04 – FS1, mano fragment.
Photo Number: D2.885 Date: 06.30.2020

Appendix C Debitage and Tool Analysis Results

Extended FS Descriptions

Table 1. JH01 - Open camp

FS No.	Type	Description	Material	Measurements (cm) Length x Width x Thickness
1	Disto-lateral scraper	Central dorsal keel exhibits polish likely due to hafting. Distal bit is mostly step-fractured with light polish.	DPW	4.3 x 2.5 x 0.8
2	Drill fragment	Red and brown chert drill fragment. Missing the bit but retains the hafting element. Bifacially reduced to the base of the drill bit.	Chert	2.3 x 2.4 x 0.6
3	Side scraper	Brown chert with black mottles. Unilateral, unifacial. Broken.	Chert	4.0 x 3.5 x 0.9
4	End scraper fragment	Only a portion of the bit remains. Manufactured from a water-rounded crystal.	Quartz crystal	1.0 x 1.8 x 1.0
5	Mano	Possible mano fragment. Sandstone river cobble with one lightly ground or polished facet.	Sandstone	5.5 x 4.1 x 2.6
6	Modified flake	Bilateral, unifacial	DPW	1.0 x 1.3 x 2.0
7	Projectile point	Light tan silicified sediment or fine textured chert projectile point. The tip is missing, blade margins are slightly excurvate and lead to a triangular base. The base is slightly convex. Flaking pattern is irregular. Triangular arrow point.	Chert	1.7 x 1.3 x 0.2
8	Scraper	Red and black complete scraper. Unifacially modified on distal margin.	Chert	4.9 x 3.1 x 1.4
9	Modified flake	Complete WMT modified flake. Bilateral, bifacial. Some step fracturing along both modified margins.	WMT	9.9 x 4.9 x 2.0
10	Projectile point	Projectile point fragment. Missing tip, parts of both blade margins and both tangs. Tip is broken due to impact fracture along with portions of both blade margins. One intact shoulder indicates the point is corner notched and the stem expands to two tangs which have broken off. The base is concave and possible notched. Flaking pattern is irregular and lateral cross section is biconvex.	DPW	0.9 x 1.0 x 0.2 x 0.71 neck
11	End scraper fragment	DPW end scraper fragment. Distal end is heavily step fractured. Dorsal surface retains cortex.	DPW	3.2 x 2.4 x 1.5
12	Biface fragment	Mid-section, Kremmling chert	Chert	2.3 x 2.3 x 0.4
13	Side scraper	Large DPW side scraper tool. One margin unifacially modified with slight polish along the modified margin.	DPW	6.0 x 5.0 x 2.0
14	Modified flake	White chert. Unilateral, unifacial	Chert	1.6 x 1.8 x 0.3
15	Projectile point	Trout Creek chert (red with small black speckles) projectile point. Missing tip due to impact fracture. Straight-to-excurvate blade margins that lead to an expanding base with one intact tang. Base is convex.	Chert	1.4 x 1.2 x 0.3

FS No.	Type	Description	Material	Measurements (cm) Length x Width x Thickness
16	End scraper	Black chert end scraper. Bit is heavily step fractured. One side margin exhibits a spoke shave and both sides are spurred suggesting reworking in the haft.	Chert	1.4 x 2.3 x 0.6
17	End scraper	Disto-lateral end scraper with retouch along both lateral margins. Step fracturing and polish along all modified margins.	WMT	7.3 x 3.5 x 1.6
18	End scraper	Black and brown complete DPW end scraper. Distolateral heavy polish across most of the tool.	DPW	3.3 x 2.4 x 0.7
19	End scraper	Complete DPW end scraper. Unifacial modification and heavy step fracturing on the distal margin.	DPW	3.7 x 2.9 x 1.1

Table 2. JH05 - Open lithic scatter

FS No.	Type	Description	Material	Measurements (cm) Length x Width x Thickness
1	Mano	Lyons sandstone river cobble mano. Tool is heavily bifacially ground and the margins of both ground facets and the lateral margins have been heavily pecked. Plow scars are present across both faces. Cross section is asymmetrical convex-concave.	Sandstone	14.0 x 10.0 x 2.7
2	Hammerstone	Chert river cobble hammerstone. Battering on two pronounced margins.	Chert	5.5 x 5.8 x 5.0
3	Core	Bifacial	Chert	5.1 x 4.0 x 2.2
4	Biface mid-section	Step fracture/grinding along one margin	DPW	4.4 x 3.3 x 0.6
5	End scraper	Chert disto-lateral end scraper. Both lateral margins unifacially flaked. Distal bit exhibits heavy step fracturing and polish. Material type unclear but unusual for the area. Some polish on dorsal flake ridges.	Chert	3.7 x 3.0 x 0.8
6	Metate	Fragment	Sandstone	5.3 x 3.3 x 1.7
7	Metate	White sandstone metate fragment. Fragment remaining of heavily ground basin.	Sandstone	9.5 x 7.4 x 4.5
8	Mano	Grey orthoquartzite bifacial mano. Both facets heavily ground and heavy battering and pecking across lateral margin. Plow scars present.	Orthoquartzite	7.5 x 8.7 x 4.7
9	Chopper	WMT chopper. Large flake with unifacial retouch on opposing lateral margins.	WMT	15.0 x 10.0 x 9.0
10	Modified bone	Deer femur with possible cut marks.	Bone	NA

Table 3. JH10 - Open lithic scatter

FS No.	Type	Description	Material	Measurements (cm) Length x Width x Thickness
1	Biface	DPW biface broken laterally. No flaking pattern and the margins feel ground.	DPW	3.9 x 2.9 x 0.9
2	Projectile point	Gray chert projectile point. The point is broken laterally across the blade and exhibits an impact fracture. The blade margins are straight and lead to rounded shoulders. The neck expands to a broad stem and a convex base. The base is ground, and the flaking pattern is irregular. Both cross sections are biconvex.	Chert	2.3 x 2.0 x 0.6 x 1.4 neck x 1.6 base
3	Scraper	Mottled brown and tan scraper. The tool was manufactured from a split cobble and most of the dorsal surface is water-rounded cortex	Chert	4.0 x 4.2 x 1.5
4	Biface	Biface/bifacial core, broken laterally	DPW	3.4 x 2.8 x 0.9
5	Scraper	Orange and red chert scraper. Minor retouch on the distal margin.	Chert	5.0 x 4.2 x 1.5
6	Modified flake	Complete chert retouched flake. Unilateral, unifacial.	Chert	2.2 x 1.8 x 0.4

ERO Resources Corp.
Debitage Analysis Coding Form (Rev. 07.11.18)

Material Types:

1. Sedimentary
 - 1.01 Quartzite
 - 1.02 Orthoquartzite
 - 1.03 Metaquartzite
 - 1.04 Siltstone
 - 1.05 Claystone
 - 1.06 Mudstone
2. Chert
 - 2.01 Solid
 - 2.02 Variegated
 - 2.03 Oolitic
 - 2.04 Chalcedony
 - 2.05 Trout Creek (Colorado)
 - 2.06 Kremmling (Colorado)
 - 2.07 Table Mountain (Colorado)
 - 2.08 Morrison/Burro Canyon (SW Colorado)
 - 2.09 Red/Gold (SW Colorado)
 - 2.10 Brushy Basin (SW Colorado)
 - 2.11 Cedar Mesa (Utah)
 - 2.12 Knife River Flint (Dakotas)
 - 2.13 Hartville Uplift (SW Nebraska)
 - 2.14 Tiger Chert (SW Wyoming)
3. Obsidian
4. Igneous
 - 4.01 Basalt
 - 4.02 Rhyolite
 - 4.03 Wall Mountain Tuff
 - 4.04 Unknown Igneous
5. Petrified Wood
 - 5.01 Dawson Formation (Colorado)
 - 5.02 Denver Formation Palmwood (Colorado)
6. Quartz
 - 6.01 Quartz Crystal
 - 6.02 Smoky Quartz

Flake Type:

1. Complete Flake
2. Broken Flake
3. Flake Fragment
4. Shatter

Platform Type:

0. Not applicable
1. Cortical
2. Single facet
3. Dihedral
4. Multiple facet

Dorsal Cortex Surface:

- 0 = No Cortex
1 = <50%
2 = >50%
3 = 100%
4 = Platform Only

Thermal Alteration:

0. Absent
1. Crazeing
2. Spall/Fracturing
3. Luster
4. Oxidation

Color codes (optional)

Bl - black
Br - brown
Gr - gray
G - green
O - orange
P - pink
Pr - purple
R - red
T - tan
Y - yellow
W - white

TR - translucent
ST - semi-translucent

Pine Canyon Debitage Analysis

Site Number	Material Type	Size Grade	Flake Type	Platform	Lipped	Ground	Dorsal Cortex	Thermal Alt.	Comments	AC
JH-01	2.04	4	2	2	0	0	1	0	tan	
JH-01	1.02	7	3	0	0	0	0	0	pink	
JH-01	1.02	5	3	0	0	0	0	0	tan-white	
JH-01	2.01	4	1	2	0	0	3	0	brown	
JH-01	2.01	5	1	2	0	0	0	0	brown	
JH-01	2.01	7	4	0	0	0	0	0	brown	
JH-01	2.02	4	3	0	0	0	0	0		
JH-01	5.01	4	4	0	0	0	0	0		
JH-01	5.01	3	3	0	0	0	0	0	P + T	
JH-01	5.01	4	3	0	0	0	0	0		
JH-01	2.02	7	2	2	0	0	0	0	tan-	
JH-01	5.01	6	3	0	0	0	0	0		
JH-01	2.04	6	3	0	0	0	0	0		
JH-01	4.03	3	3	0	0	0	0	0		
JH-01	4.03	6	2	1	0	0	3	0	purple	
JH-01	2.02	4	2	2	0	0	0	0	pink	
JH-01	2.04	7	4	0	0	0	2	0	yellow tan with white CRT	
JH-01	5.01	4	3	0	0	0	0	4		
JH-01	5.01	7	3	0	0	0	1	0		
JH-01	5.01	4	3	0	0	0	1	0		
JH-01	2.01	3	3	0	0	0	1	0		
JH-01	5.01	7	3	0	0	0	0	0		
JH-01	5.01	5	1	2	0	0	1	0		
JH-01	5.01	7	2	2	0	0	0	0	HT	
JH-01	5.01	7	3	0	0	0	1	4		
JH-01	2.01	5	3	0	0	0	0	0		

JH-01	2.01	4	1	3	1	0	0	0	brown	
JH-01	2.01	3	1	0	0	0	0	0	brown	
JH-01	5.01	4	6	0	0	0	0	0		
JH-01	5.01	5	1	2	0	0	0	0		
JH-01	2.01	4	3	0	0	0	0	0	red	
JH-01	4.03	3	3	0	0	0	0	0	pink	
JH-01	5.01	6	3	0	0	0	1	0		
JH-01	5.01	7	2	2	0	0	0	0		
JH-01	4.03	4	3	0	0	0	2	0	purple	
JH-01	2.06	6	3	0	0	0	0	0		
JH-01	5.01	3	2	2	1	0	0	0		
JH-01	2.02	4	3	0	0	0	0	0	black with brown spots	
JH-01	2.01	5	2	4	1	0	0	0	white pink ST	
JH-01	5.01	7	4	0	0	0	0	0		
JH-01	5.01	4	3	0	0	0	0	0		
JH-01	1.02	7	3	0	0	0	0	0	white-yellow	
JH-01	5.01	3	3	0	0	0	0	0		
JH-01	5.01	7	3	0	0	0	0	0	solid yellow tr	
JH-01	5.01	4	4	0	0	0	0	0		
JH-01	5.01	4	2	2	0	0	0	0		
JH-01	5.01	6	4	0	0	0	0	4		
JH-01	2.02	4	3	0	0	0	0	4	red with black spots, possibly TCC	
JH-01	1.02	4	3	0	0	0	0	0	yellow	
JH-01	5.01	7	3	0	0	0	0	4		
JH-01	1.02	7	3	0	0	0	2	0	yellow and tan	
JH-01	2.02	5	1	2	0	0	0	0	white and grey, 3 mbs in cutbank	
JH-01	5.01	7	4	0	0	0	0	0		
JH-01	5.01	3	3	0	0	0	0	4		

JH-01	2.01	5	2	4	0	0	0	0	brown	
JH-01	2.02	6	4	0	0	0	0	0	brown-black	
JH-01	1.02	6	1	4	0	0	0	0	pink-tan	
JH-01	1.02	5	3	0	0	0	0	0	white	
JH-01	2.02	6	3	0	0	0	0	1,2,4	red-white	
JH-01	2.02	6	1	3	0	0	0	0	tr brown with black dendrites	
JH-01	5.01	6	4	0	0	0	0	0		
JH-01	5.01	7	1	2	0	0	0	4		
JH-02	5.01	4	1	2	0	0	1	4		
JH-02	1.02	4	3	0	0	0	1	0	tan	
JH-02	5.01	3	3	0	0	0	0	0		
JH-02	5.01	3	4	0	0	0	2	0		
JH-02	2.02	7	1	2	0	0	0	0	red white	
JH-02	1.02	6	1	4	1	1	0	0	tan	
JH-02	1.02	7	1	1	0	0	4	0	pink	
JH-02	1.02	7	1	2	0	0	2	0	pink H2O	
JH-02	5.01	6	3	0	0	0	1	0		
JH-03	1.02	7	2	4	1	0	0	0	tan-black	
JH-03	5.01	6	3	0	0	0	0	0		
JH-03	1.02	7	1	1	0	0	0	0	tan with pink mottle	
JH-03	1.02	7	3	0	0	0	0	0	grey-yellow	
JH-03	1.02	7	2	2	0	0	0	0	grey-yellow	
JH-03	5.01	7	4	0	0	0	0	0		
JH-04	1.02	7	3	0	0	0	0	0	pink	
JH-04	2.06	5	3	0	0	0	0	0		
JH-04	2.01	5	3	0	0	0	0	0	orange	
JH-04	1.02	6	1	1	0	0	4	0	pink	
JH-05	5.01	6	4	0	0	0	0	0		
JH-05	5.01	5	3	0	0	0	0	0	tr orange	
JH-05	1.02	5	3	0	0	0	0	0	tan	

JH-05	5.01	7	3	0	0	0	0	0		
JH-05	5.01	6	2	3	1	0	0	0		
JH-05	5.01	4	4	0	0	0	0	0		
JH-05	5.01	7	3	0	0	0	0	4		
JH-05	5.01	6	1	2	0	0	0	0		
JH-05	2.02	6	3	0	0	0	0	1	white-red	
JH-05	5.01	7	3	0	0	0	1	0	tr yellow	
JH-05	2.01	7	4	0	0	0	0	0		
JH-05	2.02	7	1	1	0	0	1	0	tan grey	
JH-05	5.01	5	1	2	0	0	0	0		
JH-05	2.01	6	1	3	1	0	0	0	brown	
JH-05	5.01	5	3	0	0	0	0	0	BFT	
JH-05	5.01	7	3	0	0	0	0	0		
JH-05	2.01	6	1	2	0	0	0	0	oolites	
JH-05	1.02	7	1	3	1	0	0	0	grey	
JH-05	2.02	6	1	2	0	0	0	0	grey-colorless, wear scar	
JH-05	5.01	5	2	2	1	0	0	0		
JH-05	1.02	7	1	4	0	0	0	0	yellow-grey	
JH-05	6.01	7	TC	0	0	0	0	0	water-rounded cortex	
JH-05	2.02	6	3	0	0	0	0	0	white, brown, colorless	
JH-05	5.01	7	3	0	0	0	0	0		
JH-05	5.01	7	4	0	0	0	0	0		
JH-05	4.03	7	1	3	0	0	0	0	pink	
JH-05	5.01	5	4	0	0	0	0	3		
JH-05	2.01	5	2	2	0	0	0	0	yellow/oragne	
JH-05	5.01	5	3	0	0	0	0	0		
JH-05	2.01	5	3	0	0	0	0	0	white	
JH-05	5.01	7	1	2	0	0	0	0		
JH-05	5.01	5	1	3	0	0	0	0		
JH-05	1.02	7	1	2	0	0	1	0	yellow-grey	

JH-05	5.01	6	3	0	0	0	0	4		
JH-05	5.01	7	1	2	0	0	0	0		
JH-05	5.01	7	3	0	0	0	3	0		
JH-05	5.01	5	3	0	0	0	0	0		
JH-05	1.02	5	3	0	0	0	2	4	red-yellow	
JH-05	5.01	7	4	0	0	0	0	1,2,4		
JH-05	1.01	7	2	2	0	0	0	0	grey-yellow	
JH-05	5.01	7	1	1	0	0	3	0		
JH-05	5.01	4	3	0	0	0	0	0		
JH-05	1.02	5	2	4	1	0	0	0	brownish yellow	
JH-10	2.01	4	1	4	1	0	0	0	orange	
JH-10	5.01	4	3	0	0	0	0	0		
JH-10	1.02	5	3	0	0	0	0	0	red	
JH-10	5.01	3	3	0	0	0	0	0		
JH-10	2.01	3	3	0	0	0	0	0	orange	
JH-10	2.02	7	1	1	0	0	4	0	red-black	
JH-10	5.01	6	1	4	1	0	0	0	white	AC1
JH-10	1.02	5	1	1	1	0	1.4	0	red	AC1
JH-10	2.01	4	3	0	0	0	0	1	white	AC1
JH-10	5.01	3	3	0	0	0	0	4		AC1
JH-10	1.02	3	1	2	1	0	0	0	tan	AC1
JH-10	5.01	3	2	4	1	0	0	0		AC1
JH-10	5.01	7	1	1	0	0	1.4	0		AC1
JH-10	5.01	7	3	0	0	0	0	0	orange tr	AC1
JH-10	6.01	4	3	0	0	0	0	0		AC1
JH-10	5.01	4	4	0	0	0	0	0		AC1
JH-10	5.01	4	3	0	0	0	0	0		AC1
JH-10	5.01	7	3	0	0	0	0	0		AC1
JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	5.01	4	2	3	1	0	0	0		AC1

JH-10	1.02	5	3	0	0	0	0	0	brown	AC1
JH-10	2.02	5	3	0	0	0	0	0	brown black	AC1
JH-10	2.02	4	3	3	0	0	0	0	orange tr	AC1
JH-10	1.02	3	1	2	0	0	0	0	brown	AC1
JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	1.02	7	1	2	0	0	0	0	red	AC1
JH-10	5.01	5	3	0	0	0	1	0		AC1
JH-10	5.01	3	2			0	0	0		AC1
JH-10	2.02	7	1	3	1	0	0	0	red black	AC1
JH-10	5.01	3	2	3	1	0	0	0		AC1
JH-10	5.01	4	3	0	0	0	0	0		AC1
JH-10	5.01	6	3	0	0	0	0	0		AC1
JH-10	5.01	3	3	0	0	0	0	0		AC1
JH-10	5.01	6	2	4	1	0	0	0		AC1
JH-10	5.01	4	2	2	0	0	0	0		AC1
JH-10	5.01	4	3	0	0	0	0	0		AC1
JH-10	5.01	3	2	2	1	0	0	0		AC1
JH-10	5.01	7	2	2	0	0	0	0		AC1
JH-10	5.01	7	2	2	0	0	0	2,4		AC1
JH-10	5.01	4	3	0	0	0	0	0		AC1
JH-10	2.01	3	2	2	1	0	0	0	white	AC1
JH-10	5.01	3	3	0	0	0	0	0		AC1
JH-10	5.01	5	1	2	1	1	0	0		AC1
JH-10	2.02	7	1	2	0	0	1	0	black brown	AC1
JH-10	1.02	3	3	0	0	0	0	0	brown	AC1
JH-10	5.01	5	2	2	0	0	0	2,4		AC1
JH-10	5.01	6	3	0	0	0	0	0		AC1
JH-10	5.01	7	1	2	0	0	0	0		AC1
JH-10	5.01	7	3	0	0	0	0	0		AC1
JH-10	5.01	6	3	0	0	0	0	0		AC1

JH-10	2.02	5	4	0	0	0	0	1,2,4	red-orange	AC1
JH-10	5.01	4	1	3	0	0	0	0		AC1
JH-10	5.01	4	3	0	0	0	0	0		AC1
JH-10	5.01	5	3	0	0	0	0	4		AC1
JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	2.01	5	3	0	0	0	0	0	grey	AC1
JH-10	5.01	6	3	0	0	0	0	0		AC1
JH-10	5.01	4	1	2	0	0	0	0		AC1
JH-10	5.01	6	3	0	0	0	0	0		AC1
JH-10	1.01	7	1	3	0	0	0	0	tan	AC1
JH-10	5.01	6	4	0	0	0	0	0		AC1
JH-10	5.01	4	3	0	0	0	0	0		AC1
JH-10	5.01	6	1	4	1	0	0	0		AC1
JH-10	5.01	4	4	0	0	0	0	4		AC1
JH-10	1.02	7	1	3	0	0	0	0	yellow, tan, brown, red	AC1
JH-10	2.02	4	3	0	0	0	0	1,2,4	red, yellow, orange	AC1
JH-10	5.01	3	3	0	0	0	0	0		AC1
JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	5.01	5	3	0	0	0	0	4		AC1
JH-10	5.01	4	3	0	0	0	0	0		AC1
JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	2.01	4	3	0	0	0	0	0	brown	AC1
JH-10	5.01	3	3	0	0	0	0	4		AC1
JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	1.02	5	1	4	1	0	0	0	red	AC1
JH-10	5.01	7	3	0	0	0	0	4		AC1
JH-10	5.01	6	3	0	0	0	0	0		AC1
JH-10	5.01	7	4	0	0	0	0	1,2,4		AC1
JH-10	2.02	4	3	0	0	0	0	1,2,4	red, orange	AC1
JH-10	1.02	4	3	0	0	0	0	0	red	AC1

JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	5.02	7	3	0	0	0	1	1,2,4	white, colorless, red	AC1
JH-10	1.02	4	3	0	0	0	0	4	tan, red	AC1
JH-10	1.02	5	3	0	0	0	0	0	red	AC1
JH-10	2.02	4	4	0	0	0	0	1,2,4	red, orange	AC1
JH-10	1.02	4	2	2	0	0	0	4	tan, red	AC1
JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	5.01	6	4	0	0	0	0	0		AC1
JH-10	5.01	4	3	0	0	0	0	0		AC1
JH-10	5.01	4	3	0	0	0	0	0		AC1
JH-10	2.02	5	1	1	1	0	1,4	0		AC1
JH-10	2.02	4	3	0	0	0	0	0	white ST	AC1
JH-10	5.01	4	1	2	0	0	0	0		AC1
JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	5.01	5	2	2	0	0	0	0		AC1
JH-10	1.02	4	2	3	0	0	0	0	red	AC1
JH-10	1.02	5	3	0	0	0	0	0	red	AC1
JH-10	5.01	6	4	0	0	0	0	0		AC1
JH-10	5.01	4	3	0	0	0	0	0		AC1
JH-10	5.01	6	3	0	0	0	0	1,2,4		AC1
JH-10	2.02	6	2	4	0	0	0	4	orange, red, brown	AC1
JH-10	4.03	7	3	0	0	0	0	0	purple	AC1
JH-10	5.01	5	3	0	0	0	0	0		AC1
JH-10	5.01	6	3	0	0	0	0	0		AC1
JH-10	5.01	7	4	0	0	0	0	1,2,4		AC1
JH-10	5.01	5	3	0	0	0	0	2,4		AC1
JH-10	2.02	4	3	0	0	0	0	1,2,4	red, black	AC1
JH-10	1.02	6	3	0	0	0	0	0	tan, pink, red, white	
JH-10	5.01	6	1	2	0	0	0	0		AC1

JH-13	2.02	7	5	0	0	0	1	0	white black	
JH-13	2.04	3	2	2	1	0	0	0	orange	
JH-13	2.06	7	3	0	0	0	0	0		
JH-13	5.01	6	3	0	0	0	0	0		
JH-13	5.02	7	1	2	0	0	1	0	tan and black	
JH-13	5.01	3	1	2	1	0	0	0		
JH-13	5.01	6	4	0	0	0	0	0		
JH-13	4.03	5	4	0	0	0	0	0	tan-grey	
JH-13	2.02	5	3	0	0	0	0	1,2,4	red, orange, black	
JH-13	2.02	4	3	0	0	0	0	0	black, brown	
JH-13	5.01	6	4	0	0	0	0	0		
JH-13	2.02	6	3	0	0	0	0	0	tan, brown, ST	
JH-13	2.02	7	3	0	0	0	0	0	tan, brown	
5DA1628	2.02	4	3	0	0	0	0	0	cream, black	
5DA1628	5.01	4	3	0	0	0	0	1, 2, 4		
5DA1628	4.03	6	3	0	0	0	0	0		
5DA1628	2.02	5	2	4	1	1	0	0	prep	
5DA1628	5.01	4	1	1	0	1	4	4		
5DA1628	5.02	3	3	0	0	0	0	0		
5DA1628	5.01	4	3	0	0	0	0	3, 4		
5DA1628	4.03	6	3	0	0	0	1	0		
5DA1628	2.01	4	2	4	1	1	0	0	BIF	
5DA1628	2.02	3	3	0	0	0	0	0		
5DA1628	4.02	5	2	4	0	0	0	0		
5DA1628	2.01	3	2	4	1	1	0	0		
5DA1628	1.02	4	3	0	0	0	0	0		AC1
5DA1628	1.02	3	3	0	0	0	0	0		AC1
5DA1628	1.02	3	2	4	1	0	0	3, 4	BIF	AC1
5DA1628	1.02	2	2	4	0	0	0	0		AC1
5DA1628	1.02	2	3	0	0	0	0	0		AC1

5DA1628	5.01	4	3	0	0	0	0	0		AC1
5DA1628	1.02	2	3	0	0	0	0	0		AC1
5DA1628	1.02	3	3	0	0	0	0	3, 4		AC1
5DA1628	1.02	2	2	4	1	0	0	1, 2, 4		AC1
5DA1628	2.01	3	3	0	0	0	0	0		AC1
5DA1628	5.01	5	2	1	0	0	3	3	BIF	AC1
5DA1628	5.01	5	2	1	0	0	4	0		AC1
5DA1628	5.01	5	2	1	0	0	3	4		AC1
5DA1628	5.01	6	3	0	0	0	1	0		AC1
5DA1628	1.02	4	2	3	0	0	1	4		
5DA1628	5.01	6	4	0	0	0	0	0		
5DA1628	2.01	4	2	4	1	0	0	0		
5DA1628	5.01	4	4	0	0	0	0	0		
5DA1628	5.01	4	3	0	0	0	0	0	BIF	
5DA1628	2.01	4	3	0	0	0	1	0		
5DA1628	5.01	3	4	0	0	0	0	0		
5DA1628	4.03	7	1	3	0	0	0	0		
5DA1628	5.01	4	1	3	0	0	0	0		
5DA1628	5.01	5	3	0	0	0	1	0		
5DA1628	5.01	6	4	0	0	0	2	0	green, white, yellow, luster	
5DA1628	5.01	5	4	0	0	0	1	0		
5DA1628	2.01	3	3	0	0	0	0	3		
5DA1628	5.01	5	1	1	0	0	4	0	Poss. luster	
5DA1628	5.01	6	2	2	1	0	3	0		
5DA1628	2.01	4	3	0	0	0	0	0		AC2
5DA1628	5.01	3	1	4	1	0	0	0		AC2
5DA1628	5.01	7	1	4	0	0	0	0		AC2
5DA1628	5.01	4	3	0	0	0	0	1, 2, 3, 4		AC2
5DA1628	2.01	3	2	4	1	0	0	3	black, luster	AC2
5DA1628	5.01	3	4	0	0	0	0	1, 2, 3, 4		AC2

5DA1628	1.03	4	2	3	0	0	0	0	Coal Creek	AC2
5DA1628	5.01	3	3	0	0	0	0	0	translucent	AC2
5DA1628	2.01	4	2	4	0	1	0	0		AC2
5DA1628	5.01	4	3	0	0	0	0	0		AC2
5DA1628	2.02	7	4	0	0	0	1	0	red	
5DA1628	5.01	4	3	0	0	0	0	0		
5DA1628	2.02	4	3	0	0	0	0	0	orange	
5DA1628	1.02	4	3	0	0	0	0	0	grey	
5DA1628	6.01	4	3	0	0	0	2	0		
5DA1628	2.01	3	4	0	0	0	0	0		
5DA1628	5.01	5	1	2	0	0	1	0		
KM-03	5.01	4	4	0	0	0	0	0		
KM-03	5.01	4	3	0	0	0	2	0		
KM-03	5.01	4	3	0	0	0	0	1, 2, 3, 4		
KM-03	5.01	7	3	0	0	0	1	0		
KM-03	5.01	3	3	0	0	0	1	1, 2, 3, 4		
KM-03	2.01	3	3	0	0	0	0	0		
KM-03	5.01	4	1	1	0	0	1	0		
KM-03	2.01	4	4	0	0	0	1	3		
KM-03	5.01	6	2	3	0	0	4	0		
KM-03	5.01	3	3	0	0	0	0	1, 3, 4		
KM-03	2.01	4	3	0	0	0	0	0		
KM-03	2.01	3	3	0	0	0	0	0		
KM-03	5.01	5	4	0	0	0	0	1, 3, 4		
KM-03	5.01	3	4	0	0	0	0	1, 3, 4		
KM-03	2.01	5	3	0	0	0	0	4		
KM-03	5.01	6	4	0	0	0	1	1, 2, 3, 4		
KM-03	5.01	3	4	0	0	0	0	1, 3, 4		
KM-03	5.01	6	1	4	1	0	2	0		
KM-03	2.01	7	4	0	0	0	1	1, 3, 4		

KM-03	5.01	4	1	4	0	0	0	0		
KM-03	5.01	5	3	0	0	0	1	3, 4		
KM-04	4.03	7	2	1	0	0	4	0	red	
KM-04	5.01	4	1	2	0	0	0	0		
KM-04	5.01	6	3	0	0	0	0	3		
KM-04	5.01	5	3	0	0	0	0	0		
KM-04	2.01	3	3	0	0	0	0	0	orange	
KM-04	5.01	5	2	1	0	0	0	0		
KM-04	4.03	4	1	2	0	0	0	0	purple	
KM-04	4.03	6	1	2	1	0	0	0	purple	
KM-04	2.01	5	4	0	0	0	3	0	orange semi-translucent	
KM-04	5.01	4	4	0	0	0	2	0		
KM-04	4.03	5	3	0	0	0	0	0	purple	
KM-04	4.03	7	2	4	0	0	0	0	purple	
KM-04	5.01	5	3	0	0	0	0	0		
KM-04	1.02	4	1	2	1	0	0	0	brown	
KM-04	2.01	3	3	0	0	0	0	0	white	
KM-04	2.01	4	3	0	0	0	0	0	orange	
KM-04	4.03	5	3	0	0	0	0	0	purple	
KM-04	5.01	6	4	0	0	0	1	0		
KM-04	4.03	6	1	3	0	0	3	0		
KM-04	4.03	3	3	0	0	0	0	0	purple	
KM-04	4.03	6	1	2	0	0	0	0	purple	
KM-04	5.01	4	1	2	0	0	0	0		
KM-04	1.02	6	2	4	0	1	0	0	brown	
KM-04	4.03	3	3	0	0	0	0	0	purple	
KM-04	4.03	4	3	0	0	0	0	0	purple	
KM-04	4.03	5	3	0	0	0	0	0	purple	
KM-04	4.03	6	2	4	0	0	0	0	purple	
KM-04	4.03	7	3	0	0	0	3	0	purple	

KM-04	4.03	4	3	0	0	0	0	0	purple	
KM-04	4.03	4	3	0	0	0	0	0	purple	
KM-04	4.03	4	3	0	0	0	0	0	grey	
KM-04	1.02	6	3	0	0	0	2	0		
KM-04	4.03	6	1	2	1	0	0	0	purple	
KM-04	2.01	5	4	0	0	0	1	3	orange	
KM-04	4.03	5	2	4	0	0	0	0	purple	
KM-04	5.01	5	1	4	0	0	0	0		
KM-04	4.03	6	4	0	0	0	0	0	purple	
KM-04	2.01	4	3	0	0	0	0	0	orange	