Geologic Hazards Study

Wilson Tank Replacement
Colorado Springs, Colorado
July 27, 2021 (Revised November 18, 2021)
Terracon Project No. 23215020

Prepared for:
Kimley-Horn & Associates, Inc.
Colorado Springs, Colorado

Prepared by:
Terracon Consultants, Inc.
Colorado Springs, Colorado

July 27, 2021 (Revised November 18, 2021)

Kimley-Horn & Associates, Inc.
4582 South Ulster Street, Suite 1500
Colorado Springs, Colorado 80237

Attn: Mr. Adam Monchak
P: (720) 943-9961
E: Adam.Monchak@kimley-horn.com

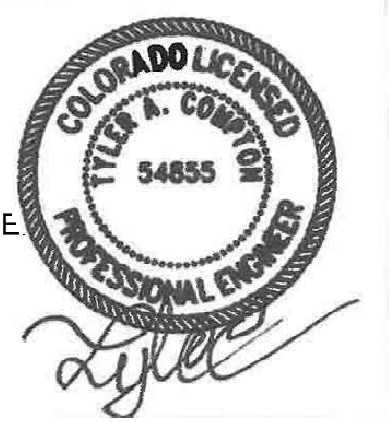
Re: Geologic Hazards Study
Wilson Tank Replacement
6570 Alabaster Way
Colorado Springs, Colorado
Terracon Project No. 23215020

Dear Mr. Monchak:

Terracon Consultants, Inc. (Terracon) has prepared a Geologic Hazard Study for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P23215020 dated June 15, 2020. This report presents the findings on geologic hazards for the proposed project.

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

Sincerely,
Terracon Consultants, Inc.



Tyler A. Compton, P.E.
Group Manager

Scott B. Myers, P.E.
Senior Regional Consultant

LAND USE REVIEW DIVISION
COMMUNITY DEVELOPMENT DEPARTMENT

CITY OF COLORADO SPRINGS

APPLICATION FORM FOR GEOLOGIC HAZARD REPORT

Applicant: Kimley-Horn & Associates, Inc. Telephone 719-453-0180 Fax _____

Address: 2 North Nevada Avenue, Suite 300, Colorado Springs, CO Zip Code 80903 e-mail Adam.Monchak@kimley-horn.com

Premises Involved: Development Plan/Subdivision Plat Name: Wilson Tank

Tax Schedule No(s). 7 3 1 5 2 - 0 0 - 0 0 3, _ _ _ _ _ - _ _ - _ _ _
(This can be obtained from the El Paso County Tax Assessor located at 27 E. Vermijo Avenue on the 2nd Floor; phone: 520-6600 or at their web site http://www.land.elpasoco.com)

GEOLOGIC HAZARD REPORT REQUIRED: (FIVE (5) PRELIMINARY COPIES)

An application review fee will be required to accompany these applications (make checks payable to City of Colorado Springs). The fee schedule is as follows:

Review of Geologic Hazard Reports	City Planning Fee: $300 plus any Colorado Geological Survey Review Cost Over $300
	City Engineering Fee: $284

The following documents have been included and considered as part of this report (checked off by individual(s) preparing the geologic report):

Development Plan: Wilson Tank Development Plan , Pre-App #10374781, DP #TBD (Not Reviewed)

Landscape Plan (if applicable): Not Reviewed

Grading Plan: Grading and Erosion Control Plan by Kimley-Horn, dated November 5, 2021 (Reviewed)

Drainage Report (necessary if debris and/or mud flow hazard is present): Not Reviewed

ENGINEERS STATEMENT

I hereby attest that I am qualified to prepare a Geolo[illegible] ordanc[illegible] with the provisions of Section 504 of the Geologic Hazards Ordinance of Colorado Springs.

_____ Professional Geologist as defin[illegible] by [illegible] 54-1-2[illegible],

X Professional Engineer as defin[illegible] by [illegible] S[illegible]me[illegible]:0.2 - "Engineering in Natural Hazard Areas" of the Colorado State Board of [illegible]tion for Profe[illegible]ngi[illegible]eers and Professional Land Surveyors. Board authority as defined by C[illegible].107(1).

COLORADO LICENSED TYLER A. COMPTON 54855 PROFESSIONAL ENGINEER

Submitted by: Tyler A. Compton, P.E. Date: November 18, 2021

This Geologic Hazard Study is filed in accord with [illegible] of the Code of the City of Colorado Springs, 2001, as amended.

Patrick V. Mannix 4/1/22
For the City Engineer Date

K.K.E. 04/01/2022
City Planning Director Date

REPORT TOPICS

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Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

SITE LOCATION
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Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

A Geologic Hazards Study has been performed for the proposed Wilson Tank Replacement project to be located at 6570 Alabaster Way in Colorado Springs, Colorado. We offer the following comments regarding geologic hazards:

- Based on our review of the available geologic literature and experience in the project vicinity, potential geologic hazards have been identified at the site that may impact the proposed development. These include the potential to encounter localized man-made slope instability and steeply dipping bedrock within foundation bearing elevations.

- The site is considered suitable for the proposed development provided that the geologic hazards discussed herein are appropriately mitigated during the design and construction phases of the project.

- This report should be used in conjunction with the Geotechnical Engineering Report by Terracon issued under Project Number 23205020 revised October 29, 2021.

This summary should be used in conjunction with the entire report. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

Geologic Hazards Study
Wilson Tank Replacement
6570 Alabaster Way
Colorado Springs, Colorado
Terracon Project No. 23215020
July 27, 2021 (Revised November 18, 2021)

INTRODUCTION

This report presents the results of our Geologic Hazards Study performed for the proposed Wilson Tank Replacement project to be located at 6570 Alabaster Way in Colorado Springs, Colorado. The purpose of these services is to provide Geologic Hazards information in accordance with the City of Colorado Springs City Code relative to, but not limited to:

- Unstable or potentially unstable slopes
- Landslide or potential landslide areas
- Undocumented fill soils and landfills
- Ground subsidence and mining activity
- Debris flow and debris fans
- Rockfall
- Groundwater springs
- Expansive soils and expansive rock
- Shallow water tables
- Flood prone areas
- Collapsible soils
- Steeply dipping bedrock
- Faults
- Radon

SITE CONDITIONS

The following description of surficial site conditions is derived from our review of publicly available aerial and topographic maps.

Item	Description
Parcel Information	The project is located at 6570 Alabaster Way in Colorado Springs, Colorado. Approximate Latitude/Longitude: 38.9215° N, 104.8850° W See **Site Location**
Existing Improvements	The site is developed with a 164.5-foot diameter by 32.5-foot tall above ground, welded steel potable water storage tank. The total capacity of the tank is reported to be 5 million gallons.
Current Ground Cover	Native grasses and weeds within the interior fenced area. An existing gravel-surfaced access road is also present at the site.

Item	Description
Existing Topography	Topography at the proposed tank location is relatively flat based on a provided site layout. Existing slopes of approximately 2H:1V (Horizontal:Vertical) are located to the west and south of the proposed tank location. Slopes to the west of the proposed tank are up to approximately 14-feet in height and tapper to surrounding grades south of the proposed tank location.

PROJECT DESCRIPTION

Our final understanding of the project conditions is as follows:

Item	Description
Information Provided	■ Request for Proposal RFP-LV-159074 ■ RFP-LV-159074 Addendum 1, dated March 17, 2021 ■ Geotechnical Checklist and Criteria, prepared by DN Tanks, dated April 18, 2014. ■ 90% Submittal Grading and Erosion Control Plan, dated November 5, 2021. ■ Meeting with our client on August 24, 2021 and November 11, 2021 ■ Initial Review Letter – Development Plan and Final Subdivision Plat for CSU Wilson Tank Site dated September 8, 2021
Project Description	We understand the existing tank was constructed in 1966 with an associated pump station. The tank was inspected in 2018 and it was determined that due to extensive corrosion, the existing tank will be replaced with a new concrete tank. The new tank will be constructed adjacent to the existing tank and will also be about 164.5 feet in diameter by 32.5 feet tall. We understand the new tank will either be a wire-wound pre-stressed concrete tank conforming to AWWA D110 Type III or a tendon prestressed concrete tank conforming to AWWA D115. The existing tank will remain in operation until the new tank is built.
Finished Floor Elevation	Reportedly 7101.45 feet
Grading/Slopes	Up to 5-feet of cut and 1-foot of fill is expected to be required to develop final grade in the proposed tank location. Final constructed slopes of a maximum of 50 percent and up to about 15 feet in height are reported to the west, and tapering to existing grades to the south of the proposed new tank location. Existing slopes along the northwest side of the proposed new tank location with slopes of up to about 2H:1V are reported to remain.
Free-Standing Retaining Walls	None reported as part of site development.

Item	Description
Below Grade Structures	Below grade structures are not planned as part of site development.
Detention Pond	Detention pond construction has not been reported for this site.

GEOTECHNICAL CHARACTERIZATION

Regional Geology

The proposed area is located within the Colorado Piedmont section of the Great Plains physiographic province. The Colorado Piedmont, formed during Late Tertiary and Early quaternary time (approximately two-million years ago), is a broad, erosional trench which separates the Southern Rocky Mountains from the High Plains. Structurally, the site lies along the western flank of the Denver Basin. During the Late Mesozoic and Early Cenozoic Periods (approximately seventy million years ago), intense tectonic activity occurred, causing the uplifting of the Front Range and associated downwarping of the Denver Basin to the east. Relatively flat uplands and broad valleys characterize the present-day topography of the Colorado Piedmont in this region.

Site Specific Geology

Surficial geologic conditions at the site, as mapped by the Colorado Geological Survey (CGS) ([1]Morgan et al., 2003), consist of pediment gravel two.

Pediment gravel two has been described as medium-red to brown, poorly sorted, moderately to poorly stratified pebble, cobble, and boulder gravel primarily derived from granitic bedrock. Basal portion of unit contains layers of clay and silt interbedded with coarse-grained sand, cobble, and rare boulder gravels. Clasts are highly weathered and are coated with a thin (0.05 in.), discontinuous rind of calcium carbonate. Matrix typically consists of feldspar and quartz sand derived from weathered clasts. Becomes richer in boulders and less stratified toward mountain front. Top of pediment gravel is 130 to 215 ft above adjacent modern streams. The unit is considered to be middle Pleistocene on the basis of local stratigraphic and physiographic position and soil development.

Surficial observations from our site visit were used in combination with the subsurface information obtained from soil borings advanced at the site to develop a site-specific geologic map. The site-specific geologic map is included as an attachment to this report.

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[1]Morgan, M.L., Siddoway, C.S., Rowley, P.D., Temple, J., Keller, J.W., Archuleta, B.H., and Himmelreich, J.W., 2003, **Geologic Map of the Cascade Quadrangle, El Paso County, Colorado**, Colorado Geological Survey, Open-File Map 03-18, scale 1:24,000.

The surficial site soils were underlain by sandstone and claystone bedrock, presumably of the Mesozoic and Paleozoic Rock Unit, starting at depths of about 3½ to great than 42 feet below existing site grades.

Typical Profile

Based on our field investigation, subsurface conditions consist of the following:

Description	Approximate Depth to Bottom of Stratum [2]	Material Encountered	Density/Stiffness/ Hardness
Stratum 1	3½ to 42 feet [1]	Sand with varying amounts of clay, silt, and gravel	Medium dense to very dense
Stratum 2	49½ feet [1]	Sandstone and claystone bedrock	Very hard

1. Includes total depths explored where borings were terminated in a stratum and the total depth is unknown.
2. Below existing ground surface.

Groundwater Conditions

The boreholes were observed while drilling and sampling for the presence and level of groundwater. Boring B-103 was left open for approximately 24 hours after drilling and sampling, and the boring was observed for the presence of groundwater again at that time. Groundwater was not observed in the borings completed at the site.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Zones of perched and/or trapped groundwater may also occur at times in the subsurface soils overlying bedrock, on top of the bedrock surface or within permeable fractures in the bedrock materials. The location and amount of perched water is dependent upon several factors, including hydrologic conditions, type of site development, irrigation demands on or adjacent to the site, seasonal fluctuations, and weather conditions.

Laboratory Testing

Laboratory test results indicate that the sand soils tested exhibit low compression when subjected to an applied load of 500 pounds per square foot (psf) at in-situ water contents. When exposed

to increases in moisture content at an applied load of 500 psf, the sand soils tested exhibit negligible to low compression followed by low to very high compression at increased loadings. It is our opinion that the sample of sand soils tested was disturbed either during sampling or sample preparation and the observed moderate to very high compression is not representative of the in-situ conditions of the on-site sand soils. Based on our experience, the on-site sand soils would be considered to exhibit low to moderate compression when subjected to increased moisture and loading conditions.

The results of laboratory testing completed for this project can be found in the **Exploration Results** section of this report.

POTENTIAL GEOLOGIC HAZARDS

Our study considered the following potential geologic hazards and their risk to impact the project site.

Unstable or Potentially Unstable Slopes and Landslide Areas

Surficial geologic conditions at the site, as mapped by the Colorado Geological Survey (CGS) ([2]White and Wait), indicates that evidence of landslide susceptibility has not been observed at the site. Slopes associated with the drainage area of Douglas Creek located approximately 350 feet northwest of the proposed tank are mapped as a landslide susceptible area. Based on the distance from the proposed tank, the relatively shallow bedrock encountered at the site, and the identified landslide susceptible area slopping away from the site, it is our opinion the risk potential for landslide areas to impact the development is low.

The location of the proposed tank appears to have previously been graded by the removal of native soils to create a relatively level area for tank construction based on the topography of the adjacent slopes and surrounding grades. The existing slopes to the west and south of the proposed tank are reported to be on the order of 2H:1V based on the provided grading plan. Apparent signs of instability of the existing slopes in the form of scarps, surficial cracking, and/or surficial instability was not observed.

We understand the planned construction consists of cutting back the existing slopes a lateral distance of about 10 to 15 feet, and final slopes will be a maximum of 50 percent. Terracon performed a global slope stability analyses, attached, at a cross section where the proposed slope is about 50 percent and about 15 feet in height. Our analyses showed that the long-term global

[2]White, J.L., and Wait, T.C., 2003, **Potential Areas of Landslide Susceptibility in Colorado Springs, El Paso County, Colorado.** Colorado Geological Survey, Map Series 42, Plate 1 of 3, scale 1:24,000.

stability of the slope is sufficient for the subsurface conditions encountered and proposed slope geometry.

Landfill, Uncontrolled, or Undocumented Fill Activity

Artificial fill soils were not encountered in our borings performed at the site. Indications of landfills (refuse and debris) were not observed in the samples collected during our field exploration.

Regrading of the site appears to have been previously performed to create a level area for the proposed tank based on the existing slope topography and surrounding grades, however it appears site grading consisted of removal of onsite soils (cut) and fill soils do not appear to have been placed based on our visual observation of the site and the information obtained from our borings. It is our opinion that the risk for artificial fill soils or landfills to impact the proposed development is low. Should artificial fill soils be encountered at the time of construction, it is our opinion that they can be remediated through conventional earthwork methods, such as removal and replacement as compacted, structural fill.

Underground Mining and Ground Subsidence

The site is not located in an area previously mapped in the Colorado Geologic Survey Subsidence Investigation Report ([3]Dames and Moore, Inc., 1985). Based on this information, it is our opinion the risk potential for underground mining and ground subsidence to impact the development is low.

Debris Flow and Debris Fan

The site is not located in an area mapped with conditions favorable for the generation and deposition of debris flows ([4]McCoy, Morgan, & Berry, 2018). Land upslope from the project site generally consists of native grasses and extends northwest approximately 350 feet up an approximately 12H:1V slope to drainage associated with Douglas Creek, and that drainage slopes away from the project site. Based on this information, it is our opinion that the potential for debris flows at the project site is considered low.

Rockfall

Evidence of rockfall was not observed on or within the immediate vicinity of the project site during our site visits. Exposed rock outcrops were not observed on the surface of the project site,

[3] Dames & Moore, Inc., **1985, Colorado Springs Subsidence Investigation for Colorado Springs**, Volume IV: Maps, State of Colorado, Division of Mined Land Reclamation

[4]McCoy, K.M., Morgan, M.L., & Berry, K.A., 2018, **Debris Flow Susceptibility Map of El Paso County, Colorado**, Colorado Geological Survey, Open-File Report 18-11, scale 1:24,000.

overhanging the project site, or located in areas that have the potential for rockfall, therefore, it is our opinion there is a low potential for rockfall to occur on the site.

Shallow Water Tables and Groundwater Springs

Based upon review of U.S. Geological Survey maps ([5]Hillier and Hutchinson, 1980), regional groundwater is expected to be encountered in alluvial deposits that are not perennially saturated, generally the groundwater table changes seasonally from depths of about 5 to 20 feet below present ground surface.

As noted in the **Geotechnical Characterization** section of this report, groundwater was not encountered in our borings completed at the site at the time of drilling, or when checked approximately 24 hours after drilling in Boring No. B-103. It is our opinion that there is a low risk of shallow groundwater impacting the development. It has been our experience that zones of perched and/or trapped groundwater may occur at times in the subsurface soils overlying bedrock, on top of the bedrock surface or within permeable fractures in the bedrock materials. The location and amount of perched water is dependent upon several factors, including hydrologic conditions, type of site development, irrigation demands on or adjacent to the site, seasonal fluctuations, and weather conditions. If encountered during construction, zones of perched and/or trapped groundwater will likely require case specific mitigation. If encountered, it is our opinion water can be mitigated during construction using conventional dewatering techniques, such as shallow trenches directing water away from the development, and the risk for groundwater to impact the proposed development is considered to be low.

Flood Prone Areas

Based on a review of the Federal Emergency Management Agency (FEMA) flood map 08041C0492G effective on December 7, 2018, the project site is located in Zone X, an area outside the 0.2% annual chance floodplain. It is our opinion that the risk of flooding on the project site is low.

Expansive Soils and Bedrock

Mapping completed by the Colorado Geological Survey ([6]Hart, 1973-1974), indicates the site is in areas associated with low swell potential. Based on mapping, our laboratory testing, and our experience in the vicinity of the project site, it is our opinion that the encountered sand soils and

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[5]Hillier, D.E., and Hutchinson, E.C., 1980, **Depth to Water Table in the Colorado Springs – Castle Rock Area, Front Range Urban Corridor, Colorado**, United States Geological Survey, Miscellaneous Investigation Series Map I-857-H, scale 1:100,000

[6]Hart, S.S., 1973-1974, **Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado**, Colorado Geological Survey, Sheet 3 of 4, scale 1:100,000.

sandstone bedrock should be considered to have negligible to low expansive potential. Claystone bedrock was encountered in one boring completed at the site at a depth of approximate 37 feet and should be considered to have low to high expansive potential. However, the potential exists for claystone bedrock to exist at other locations and at shallower depths at the site. Because steeply dipping bedrock may exist on this site, there may be areas of shallow claystone bedrock exposed during construction. To account for this possibility and the potential effects of expansive claystone bedrock, we have recommended in our Geotechnical Engineering Report that a minimum 10-foot separation be maintained between the top of bedrock and the bottom of foundations.

Based on the information listed above, and provided the recommendations listed above and in our Geotechnical Engineering Report are followed in the design and construction of the proposed tank, it is our opinion that the risk of expansive potential associated with the claystone bedrock to impact the proposed development is low.

Collapsible Soils

Mapping completed by the U.S. Geological Survey ([7]Madole) indicates the site is not located in an area that contains eolian sand deposits known to have collapse potential. Negligible to low collapse was observed in the soil samples tested when inundated with water. Based on the results of our field exploration and laboratory testing, the risk of collapsible soils to impact the development is considered low. Compressible soils, if observed at the time of construction, can be mitigated using remedial grading activities.

Steeply Dipping Bedrock

The site is mapped approximately 150 feet west of an area mapped ([8]Himmelreich Jr, and Noe, 1999) as susceptible to differential heave in expansive, steeply dipping bedrock. Our borings completed within the proposed tank footprint encountered bedrock at depths ranging from approximately 3½ feet to 37 feet below existing grade, and bedrock was not encountered in Boring No. B-104 (termination depth of 40½ feet). Additionally, rock outcroppings located approximately 1/4 mile southwest of the site appear to possess near-vertical dip direction based on our visual observations from the site. Although not observed in the bedrock samples obtained from our borings, it is our opinion that dipping bedrock is likely present at this site and we recommend the follow mitigation procedures for the proposed development.

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[7]Madole, R.F., VanSistine, D.P., Michael, J.A., 2005, **Distribution of Late Quaternary Wind-Deposited Sand in Eastern Colorado**, United States Geological Survey, Scientific Investigations Map 2875, scale 1:700,000.

[8]Himmelreich Jr., J.W., Noe, D.C., 1999, **Map of Areas Susceptible to Differential Heave in Expansive, Steeply Dipping Bedrock, City of Colorado Springs, Colorado**, Colorado Geological Survey, Map Series 32, scale 1:24,000.

- The proposed tank should not be constructed on deep foundations supported on bedrock.
- The proposed tank should be constructed on shallow foundations supported on a minimum 10-foot thick zone of structural fill, such that a minimum 10-foot separation exists between the lowest foundation element and the top of bedrock. This is anticipated to require excavation of existing bedrock within portions of the tank footprint.

Provided the recommendations listed above and in our Geotechnical Engineering Report are followed in the design and construction of the proposed tank, it is our opinion that the risk of differential heave associated with steeply dipping bedrock is low.

Hillside and Streamside Overlay

The site is within the hillside overlay according to the City of Colorado Springs, Hillside Overlay Map, dated August 2008, and will be subject to the applicable reviews and permits. The site is not located within the streamside overlay according to the City of Colorado Springs, Streamside Overlay Map, dated March 2009.

Radon

We are not aware of any basements or low-lying areas being incorporated into the design of the development. Additionally, the proposed structure will be uninhabited. Radon is often found in basements, crawl spaces, or other low-lying, poorly ventilated areas. The risk for lowest floor radon collection to impact the development is likely low.

Shallow Bedrock

Very hard bedrock was encountered on the project site at depths of about 3½ to greater than 40½ feet (maximum exploration depth in Boring B-104) below existing ground surface. Shallow foundations placed on structural fill to support the new developments are expected to encounter bedrock within portions of the site. For excavations that will encounter bedrock, specialized equipment and/or techniques may be required. It is our opinion that equipment and techniques exist to extend excavations into bedrock, and the risk of shallow bedrock to cause differential foundation movement is considered low provided the recommendations contained herein and in our Geotechnical Engineering Report are followed during construction. We recommend the owner solicit bedrock excavations requests from local excavation contractors to provide recommended equipment, means, and methods to properly excavate bedrock at this site.

Erosion

The surficial soils are likely susceptible to wind and water erosion. It is our opinion that the risk of erosion impacting the site is low if disturbed areas are re-vegetated after construction, and slopes are faced with erosion protection such as concrete or grouted rip-rap. However, additional regrading and maintenance may be required if erosion begins to affect site grades after

construction. Water or other methods may be needed for dust suppression during construction. We recommend a maintenance plan be developed and followed to observe completed slopes after development and make appropriate as needed repairs due to erosion. Further, because the site is located within the hillside overlay area we understand a Grading and Erosion Control Plan will be required.

Faults

The closest fault is the Rampart Range Fault, located approximately 0.35 miles west of the project site, and a series of associated, inferred faults that traverse the project area. The Rampart Range Fault is a Quaternary age fault with a normal sense of movement and no assumed movement in the past 30 to 50 ka ([9]Dickson). Colorado has previously been mapped as an area with very low seismic risk and is currently rated to have low to moderate earthquake hazard. Based on the low seismicity in the project area, it is our opinion that the risk of earthquakes affecting the development is low.

GENERAL COMMENTS

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

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

Our services and any correspondence or collaboration are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for

[9]Dickson, P.A., 1986, Investigation of the Rampart Range fault at the Air Force Academy trench site, Colorado Springs, Colorado, in Rogers, W.P., and Kirkham, R.M., eds., Contributions to the Colorado tectonics and seismicity – A 1986 update: Colorado Geological Survey Special Publication 28, p. 172-185

information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

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

ATTACHMENTS

Contents:

Site Location
Site Location with Geology Overlay
Site-Specific Geologic Map
Site Location with Potential Areas of Landslide Susceptibility
Site Location with Dipping Bedrock Overlay
Exploration Plan with Aerial Overlay
Exploration Plan with Development Plan Overlay
Exploration and Testing Procedures
Photography Log
Exploration Results
Supporting Information

Note: All attachments are one page unless noted above.

SITE LOCATION

Wilson Tank Replacement ■ Colorado Springs, CO
July 27, 2021 ■ Terracon Project No. 23215020

Terracon GeoReport

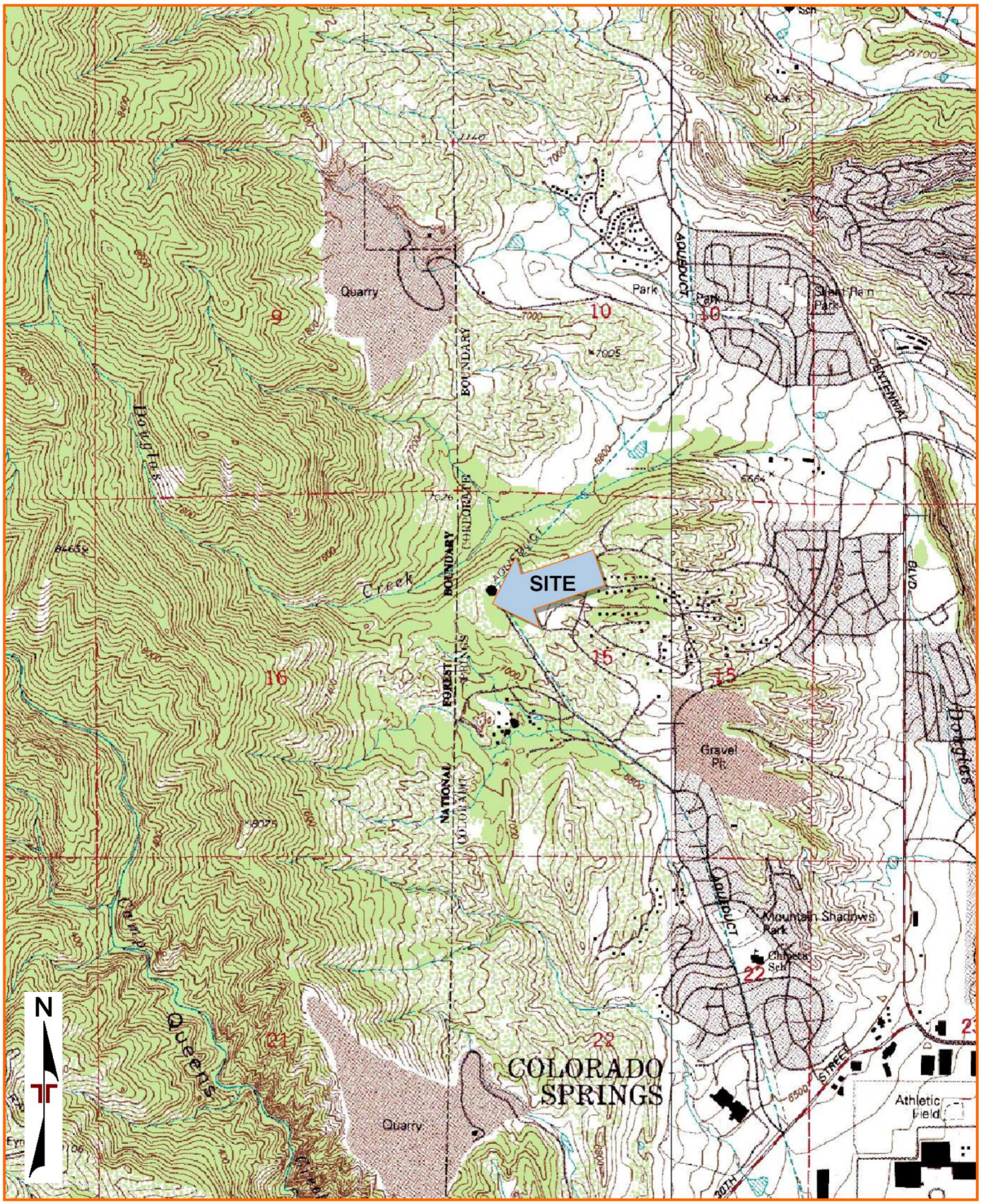


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
QUADRANGLES INCLUDE: CASCADE, CO (1/1/1994) and PIKEVIEW, CO (1/1/1994).

SITE LOCATION WITH GEOLOGIC OVERLAY

Wilson Tank Replacement ■ Colorado Springs, CO
July 27, 2021 ■ Terracon Project No. 23215020

Terracon GeoReport

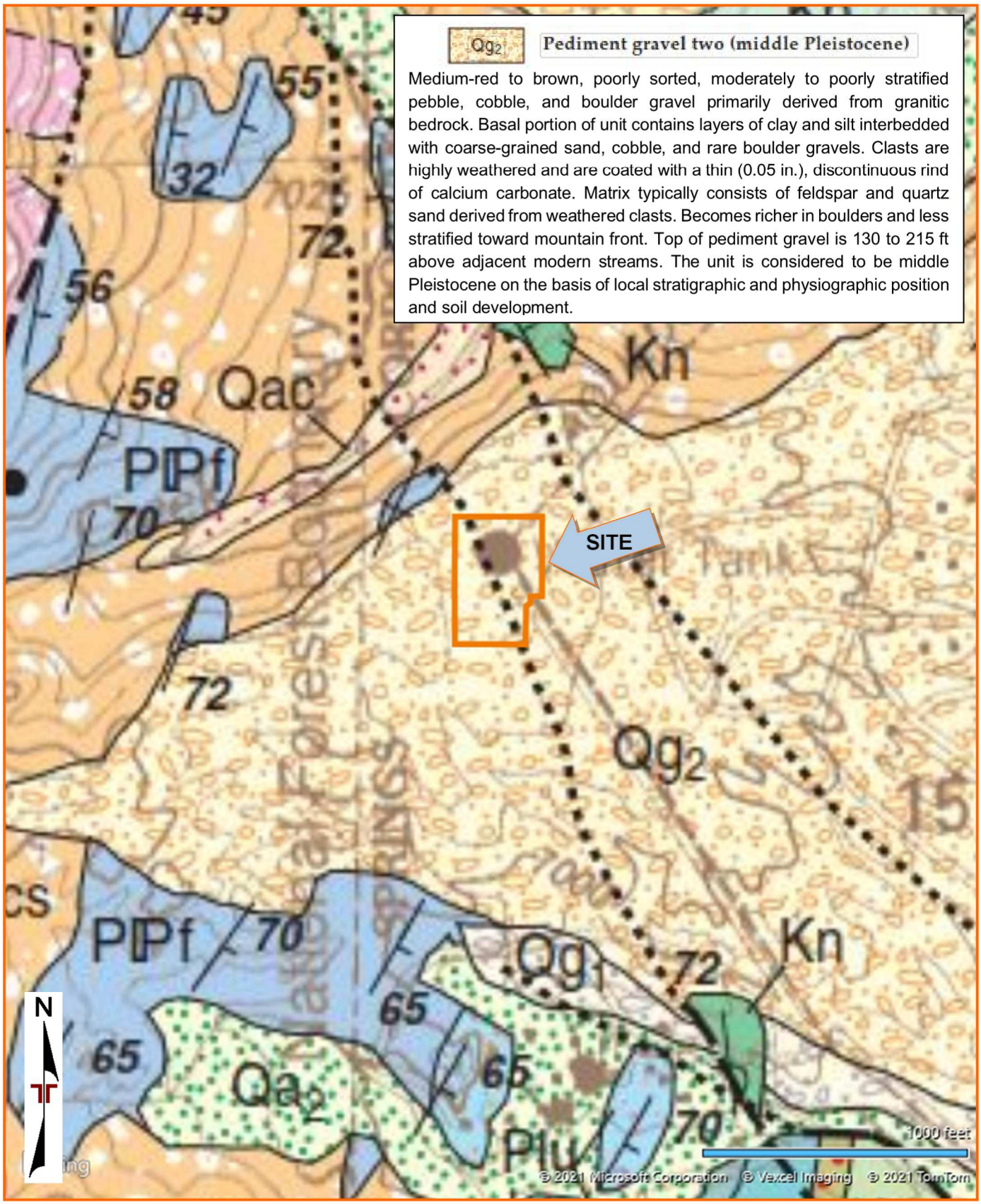


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Surficial geology as mapped by Matthew L. Morgan, Christine S. Siddoway, Peter D. Rowley, Jay Temple, John W. Keller, Bonny Hawkins Archuleta, and John W. Himmelreich Jr., 2003, GEOLOGIC MAP OF THE CASCADE QUADRANGLE, EL PASO COUNTY, COLORADO, COLORADO GEOLOGIC SURVEY, OPEN FILE REPORT OF-03-18. SCALE 1:24,000

SITE-SPECIFIC GEOLOGIC MAP

Wilson Tank Replacement ■ Colorado Springs, CO
July 27, 2021 ■ Terracon Project No. 23215020

Terracon GeoReport

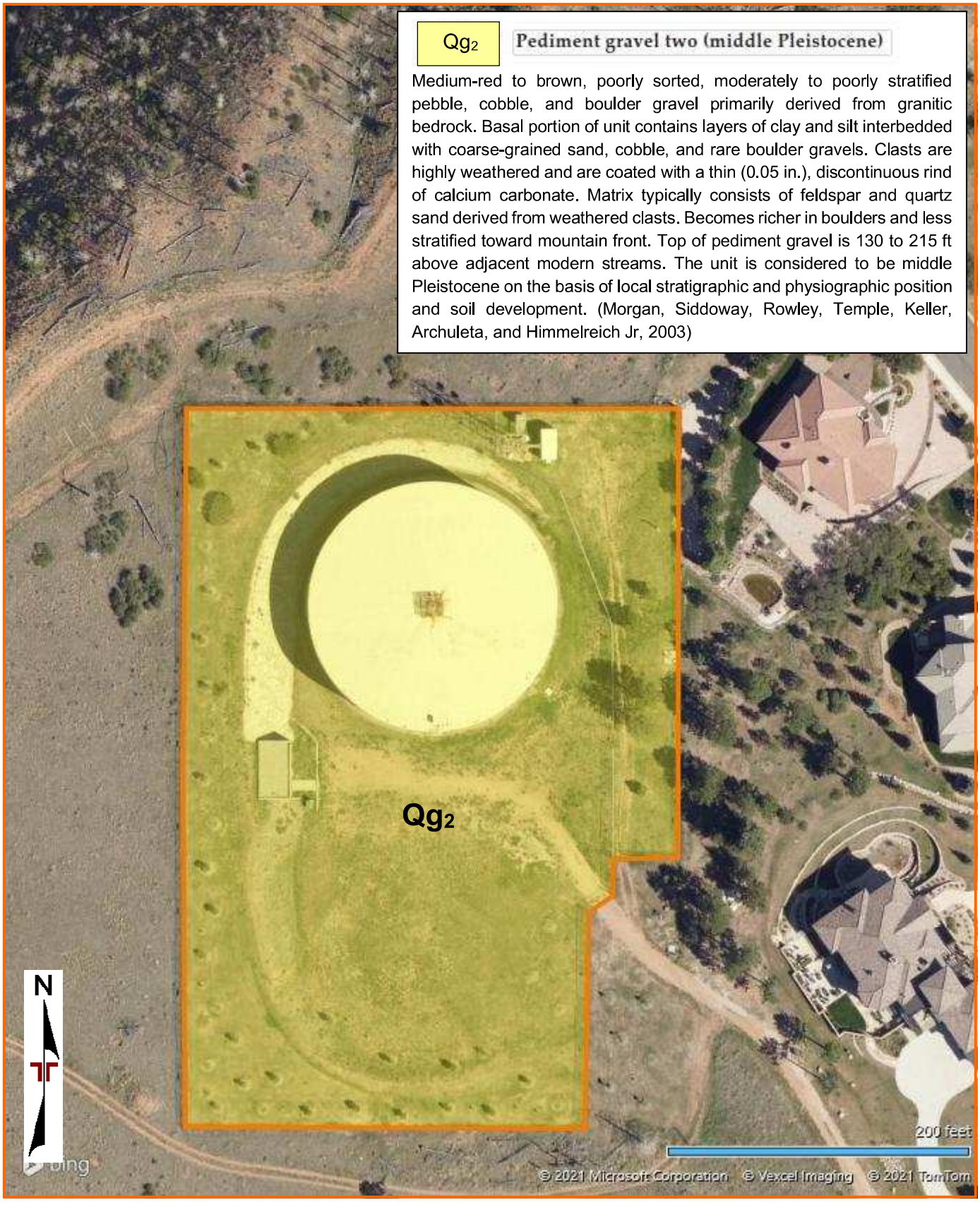


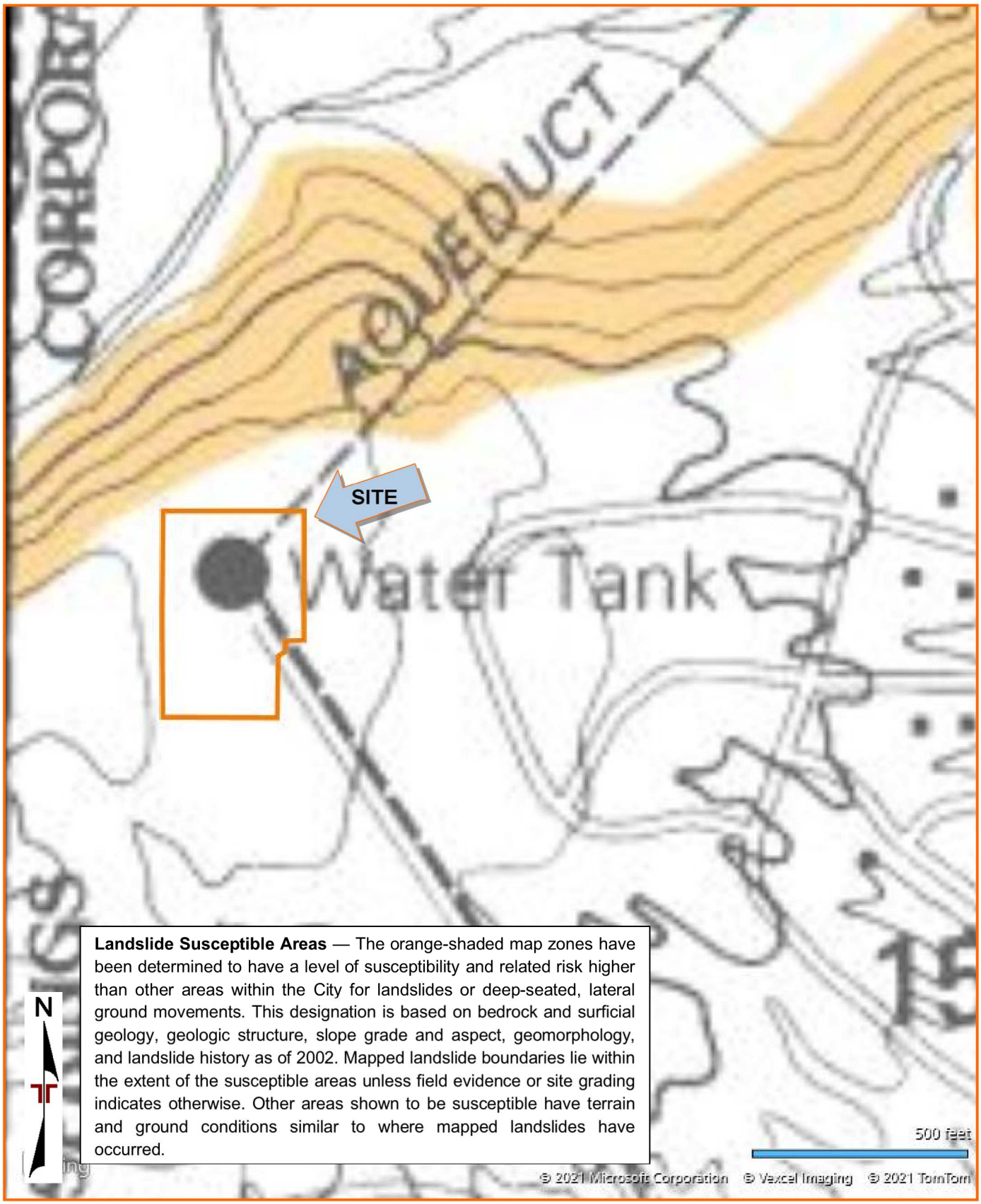
DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

SITE LOCATION WITH LANDSLIDE OVERLAY

Wilson Tank Replacement ■ Colorado Springs, CO
July 27, 2021 ■ Terracon Project No. 23215020

Terracon GeoReport



Landslide Susceptible Areas — The orange-shaded map zones have been determined to have a level of susceptibility and related risk higher than other areas within the City for landslides or deep-seated, lateral ground movements. This designation is based on bedrock and surficial geology, geologic structure, slope grade and aspect, geomorphology, and landslide history as of 2002. Mapped landslide boundaries lie within the extent of the susceptible areas unless field evidence or site grading indicates otherwise. Other areas shown to be susceptible have terrain and ground conditions similar to where mapped landslides have occurred.

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

OVERLAY BY WHITE, J.L., AND WAIT, T.C., 2003, POTENTIAL AREAS OF LANDSLIDE SUSCEPTIBILITY IN COLORADO SPRINGS, EL PASO COUNTY, COLORADO, COLORADO GEOLOGICAL SURVEY, MAP SERIES 42, PLATE 1 OF 3, SCALE 1:24,000.

SITE LOCATION WITH DIPPING BEDROCK OVERLAY

Wilson Tank Replacement ■ Colorado Springs, CO
July 27, 2021 ■ Terracon Project No. 23215020

Terracon GeoReport

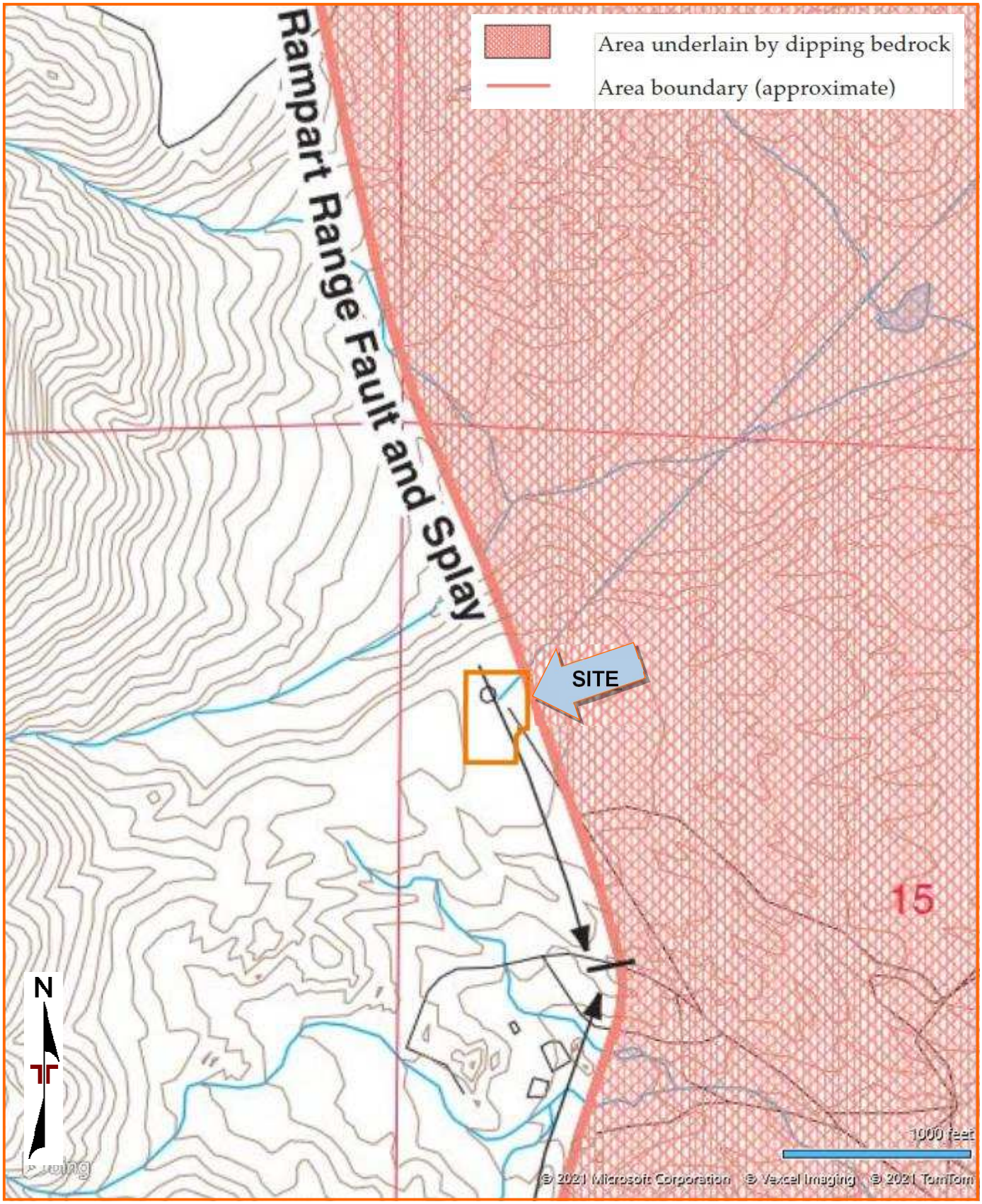


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

OVERLAY BY HIMMELREICH, J.W., Jr, AND NOE, D.C., 1999, MAP OF AREAS SUSCEPTIBLE TO DIFFERENTIAL HEAVE IN EXPANSIVE, STEEPLY DIPPING BEDROCK, CITY OF COLORADO SPRINGS, COLORADO, COLORADO GEOLOGICAL SURVEY, MAP SERIES 32, PLATE 1 OF 1, SCALE 1:24,000.

EXPLORATION PLAN WITH AERIAL OVERLAY

Wilson Tank Replacement ■ Colorado Springs, Colorado
July 29, 2021 ■ Terracon Project No. 23215020

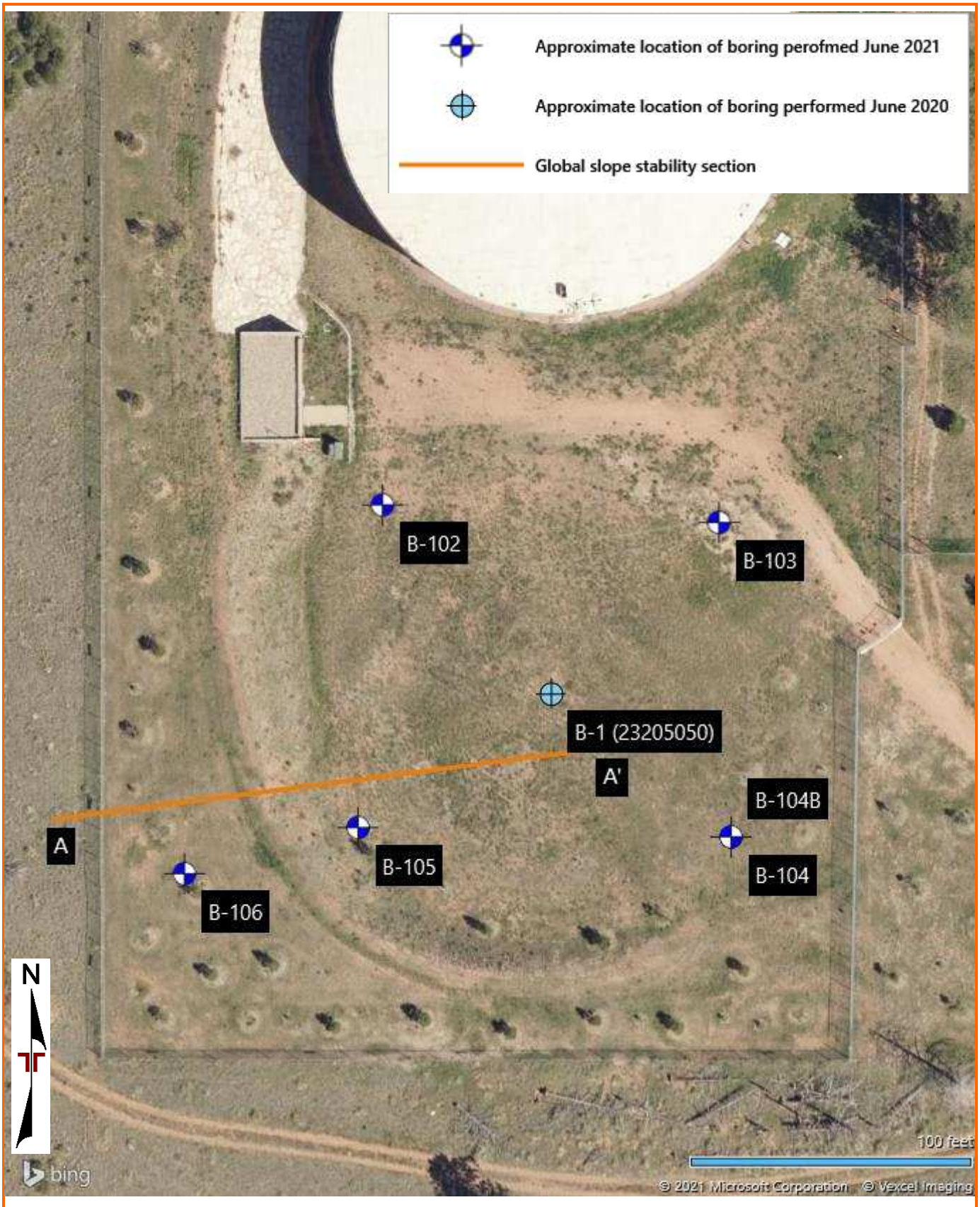


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION PLAN WITH SITE PLAN OVERLAY

Wilson Tank Replacement ■ Colorado Springs, Colorado
July 29, 2021 ■ Terracon Project No. 23215020

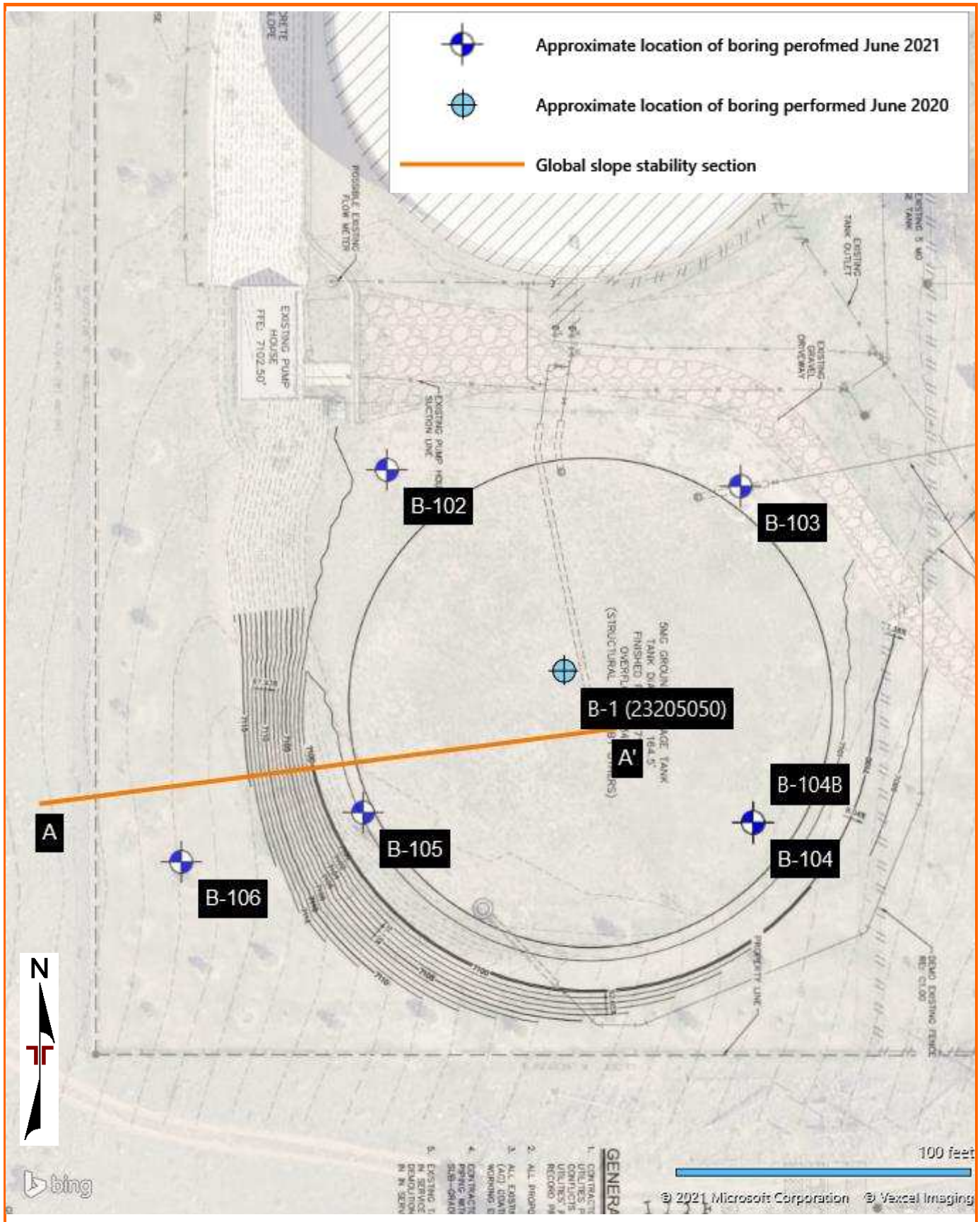


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

OVERLAY IS 90% GRADING AND EROSION AND CONTROL PLAN BY KIMLEY HORN DATED NOVEMBER 18, 2021.

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet)	Location
6	31 to 49.5	Planned tank area (B-1, B-102 to B-106)

Boring Layout and Elevations: We used handheld GPS equipment to locate borings with an estimated horizontal accuracy of ±20 feet. Approximate elevations were obtained by interpolation from the 60% Site and Grading Plan dated September 21, 2021, provided by Kimley-Horn.

Subsurface Exploration Procedures: We advanced the soil borings with a truck-mounted drill rig using continuous flight augers. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration was recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. A 3-inch outer diameter split-barrel sampling spoon with 2.5-inch inner diameter ring lined sampler was used for sampling in the upper 14 to 19 feet. Ring-lined, split-barrel sampling procedures were similar to standard split spoon sampling procedure; however, blow counts were recorded for 6-inch intervals for a total of 12 inches of penetration. The samples were placed in appropriate containers, taken to our soil laboratory for testing, and classified by a geotechnical engineer. We did not encounter groundwater in our borings during drilling and sampling or when checked approximately 24 hours after drilling in Boring No. B. For safety purposes, all borings were backfilled with auger cuttings after their completion.

Our exploration team prepared field boring logs as part of standard drilling operations which included the sampling depths, penetration distances, and other relevant sampling information. Field logs include visual classifications of materials encountered during drilling, and our interpretation of subsurface conditions between samples. Final boring logs, prepared from field logs, represent the geotechnical engineer's interpretation, and include modifications based on observations and laboratory tests.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil and rock strata, as necessary, for this project. The following testing was performed:

- Water content
- Unit dry weight
- Atterberg limits
- Grain size analyses
- Consolidation/expansion
- Chemical Analyses – pH, Sulfates, Chloride Ion, Electrical Resistivity

The laboratory testing program included examination of the soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System. Rock classification was performed using locally accepted procedures.

PHOTOGRAPHY LOG

Near Proposed Tank Location Facing North

Near Proposed Tank Location Facing West

Near Proposed Tank Location Facing South

Near Proposed Tank Location Facing East

EXPLORATION RESULTS

Contents:

Boring Logs (B-1 (23205050), B-102 through B-105, B-104B, and B-106)
Atterberg Limits (2 pages)
Grain Size Distribution (2 pages)
Consolidation/Swell (3 pages)
Corrosivity (2 pages)

Note: All attachments are one page unless noted above.

BORING LOG NO. B-1 (23205050)

PROJECT: Wilson Tank Replacement

CLIENT: Kimley-Horn & Associates Inc
Denver, CO

SITE: 6570 Alabaster Way
Colorado Springs, CO

LOCATION See Exploration Plan

Latitude: 38.9215° Longitude: -104.8849°

MODEL LAYER	GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, fine to coarse grained, reddish brown, loose to medium dense	5			5-11				
						6-7	1			
						6-12	1	107		
			10			9-17	3		NP	11
			15			5-9	3	112		
			20			3-2-3 N=5	2			
			25			2-4-5 N=9	2			
		27.0	30			50/1" N=50/1"	2			
2		**SANDSTONE**, fine to coarse grained, reddish brown, very hard	35			50/2" N=50/2"	3			
			40			50/3" N=50/3"	6			
			45			50/1" N=50/1"	5			
		49.5				50/1" N=50/1"	6			
		Boring Terminated at 49.5 Feet								

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

Hammer Type: Automatic

Advancement Method:
4-inch Solid Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

Testing of 2-foot sample not performed.
Sample disturbed at 4 feet; unit weight not obtained.
Sample disturbed at 9 feet; unit weight not obtained.

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 06-25-2020 | Boring Completed: 06-25-2020

Drill Rig: CME-55 | Driller: Vine Laboratories

Project No.: 23205050

BORING LOG NO. B-102

PROJECT: Wilson Tank Replacement

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

SITE: 6570 Alabaster Way
Colorado Springs, Colorado

LOCATION See Exploration Plan

Latitude: 38.9217° Longitude: -104.8852°

Approximate Surface Elev.: 7101 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DESCRIPTION
1		0	7101	**WELL GRADED SAND WITH GRAVEL (SW)**, fine to coarse grained, reddish brown, medium dense, trace silt
		3.5	7097.5+/-	
2		3.5	7097.5+/-	**SANDSTONE**, fine to coarse grained, reddish brown, very hard
		34.5	7066.5+/-	
				Boring Terminated at 34.5 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
			8-12	1			
5			50/4"				
			50/2"	2	136		
10			50/3"	3	102		
15			50/5"	3	137		
			50/2"	3	107		
20							
25			50/2" N=50/2"	4			
30			50/1" N=50/1"	4			
			50/5" N=50/5"	7			

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

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

2-foot sample disturbed; dry unit weight not obtained.
4-foot sample disturbed; dry unit weight not obtained.

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 06-23-2021 | Boring Completed: 06-23-2021

Drill Rig: CME-55 | Driller: Vine Laboratories

Project No.: 23215020

BORING LOG NO. B-103

PROJECT: Wilson Tank Replacement

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

SITE: 6570 Alabaster Way
Colorado Springs, Colorado

LOCATION See Exploration Plan

Latitude: 38.9216° Longitude: -104.8847°

Approximate Surface Elev.: 7101 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		0.0	7101+/-								
							7-7	4	113		
				5			13-10	1	103		
							21-25	1	111		
				10			14-4	2	119	17-14-3	24
				15			14-19	3	114	NP	15
				20			23-30	2	112	16-13-3	27
				25			6-16-17 N=33	3			
				30			17-19-20 N=39	2			
				35			36-27-18 N=45	2			
		6.0	7095+/-								
							50/5" N=50/5"	5			
2		37.0	7064+/-								
		39.5	7061.5+/-								

WELL GRADED SAND WITH GRAVEL (SW), fine to coarse grained, reddish brown, loose to medium dense

SILTY SAND WITH GRAVEL (SM), fine to coarse grained, reddish brown, loose to dense

CLAYSTONE, reddish brown, very hard

Boring Terminated at 39.5 Feet

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

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with soil cuttings after delayed water levels were measured.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered at the time of drilling or when checked approximately 24 hours after drilling

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 06-23-2021 | Boring Completed: 06-23-2021

Drill Rig: CME-55 | Driller: Vine Laboratories

Project No.: 23215020

BORING LOG NO. B-104

PROJECT: Wilson Tank Replacement

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

SITE: 6570 Alabaster Way
Colorado Springs, Colorado

LOCATION See Exploration Plan

Latitude: 38.9213° Longitude: -104.8847°

Approximate Surface Elev.: 7101 (Ft.) +/-

MODEL LAYER	DEPTH	ELEVATION (Ft.)		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1	0	7101	**CLAYEY SAND (SC)**, fine to coarse grained, reddish brown, medium dense, trace gravel, with rootlets								
	3.5	7097.5+/-	**WELL GRADED SAND WITH GRAVEL (SW)**, fine to coarse grained, reddish brown, medium dense to dense, trace silt				9-20	4	117		
				5			10-15	1			
							9-21	21			
				10			11-20	2	107		
				15			11-21	2	107		
				20			22-23	2	116	NP	3
				25			8-15-11 N=26	4			
				30			17-15-15 N=30	4			
				35			12-14-16 N=30	5			
	40.5	7060.5+/-		40			7-11-11 N=22	4			
			Boring Terminated at 40.5 Feet								

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

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

2-foot sample disturbed; dry unit weight not obtained.
4-foot sample disturbed; dry unit weight not obtained.

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 06-23-2021 | Boring Completed: 06-23-2021

Drill Rig: CME-55 | Driller: Vine Laboratories

Project No.: 23215020

BORING LOG NO. B-104B

PROJECT: Wilson Tank Replacement

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

SITE: 6570 Alabaster Way
Colorado Springs, Colorado

LOCATION See Exploration Plan

Latitude: 38.9213° Longitude: -104.8847°

Approximate Surface Elev.: 7101 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		0	7101								
		3.5	7097.5+/-								
				5							
				10							
				15							
				20							
				25							
				30							
				35							
				40							
		42.0	7059+/-								
2				45			50/4" N=50/4"				
		49.5	7051.5+/-				50/3" N=50/3"				

SANDSTONE, fine to coarse grained, reddish brown, very hard

CLAYEY SAND (SC), fine to coarse grained, reddish brown, medium dense, trace gravel, with rootlets

WELL GRADED SAND WITH GRAVEL (SW), fine to coarse grained, reddish brown, medium dense to dense, trace silt

Boring Terminated at 49.5 Feet

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

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 07-29-2021 | Boring Completed: 07-29-2021

Drill Rig: CME-55 | Driller: Terracon

Project No.: 23215020

BORING LOG NO. B-105

PROJECT: Wilson Tank Replacement

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

SITE: 6570 Alabaster Way
Colorado Springs, Colorado

LOCATION See Exploration Plan

Latitude: 38.9213° Longitude: -104.8852°

Approximate Surface Elev.: 7102 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1											
			WELL GRADED SAND WITH GRAVEL (SW), fine to coarse grained, reddish brown, medium dense								
							16-18	2	110		
				5			16-19	2	106		
							10-18	2	112		
				10			14-6	2	131	NP	3
							20-21	2			
		17.0	7085+/-	15							
2			**SANDSTONE**, fine to coarse grained, reddish brown, very hard, with clay and trace gravel	20			50/2"	3	89		
				25			50/1"	4			
							50/3"	8			
		31.0	7071+/-	30							
			Auger Refusal at 31 Feet								

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

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

14-foot sample disturbed; dry unit weight not obtained.
Unit weight tested at 19 feet appears low for material tested, sample likely disturbed.

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4172 Center Park Dr
Colorado Springs, CO

Boring Started: 06-23-2021 | Boring Completed: 06-23-2021

Drill Rig: CME-55 | Driller: Vine Laboratories

Project No.: 23215020

BORING LOG NO. B-106

PROJECT: Wilson Tank Replacement

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

SITE: 6570 Alabaster Way
Colorado Springs, Colorado

LOCATION See Exploration Plan

Latitude: 38.9213° Longitude: -104.8854°

Approximate Surface Elev.: 7115 (Ft.) +/-

MODEL LAYER	DEPTH	ELEVATION (Ft.)	DESCRIPTION
1	0	7115+/-	**CLAYEY SAND (SC)**, fine to coarse grained, reddish brown, medium dense
	3.5	7111.5+/-	**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, fine to coarse grained, reddish brown, medium dense to very dense
	42.0	7073+/-	
2	42.0	7073+/-	**SANDSTONE**, fine to coarse grained, reddish brown, very hard, with clay
	49.5	7065.5+/-	
	49.5	7065.5+/-	***Boring Terminated at 49.5 Feet***

DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
0						
		14-8	5.2	109		
5		19-18	1.4			
		19-20	1.3			
10		19-16	3.0	107	NP	8
15		17-20	2.1	114		
20		18-22	2.0	113		
25		25-25-18 N=43	1.8			
30		25-26-30 N=56	1.6			
35		23-27-25 N=52	3.8			
40		18-14-23 N=37	7.7			
45		35-50/3" N=50/3"	8.5			
		50/4" N=50/4"	4.0			

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

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not encountered

Terracon
4172 Center Park Dr
Colorado Springs, CO

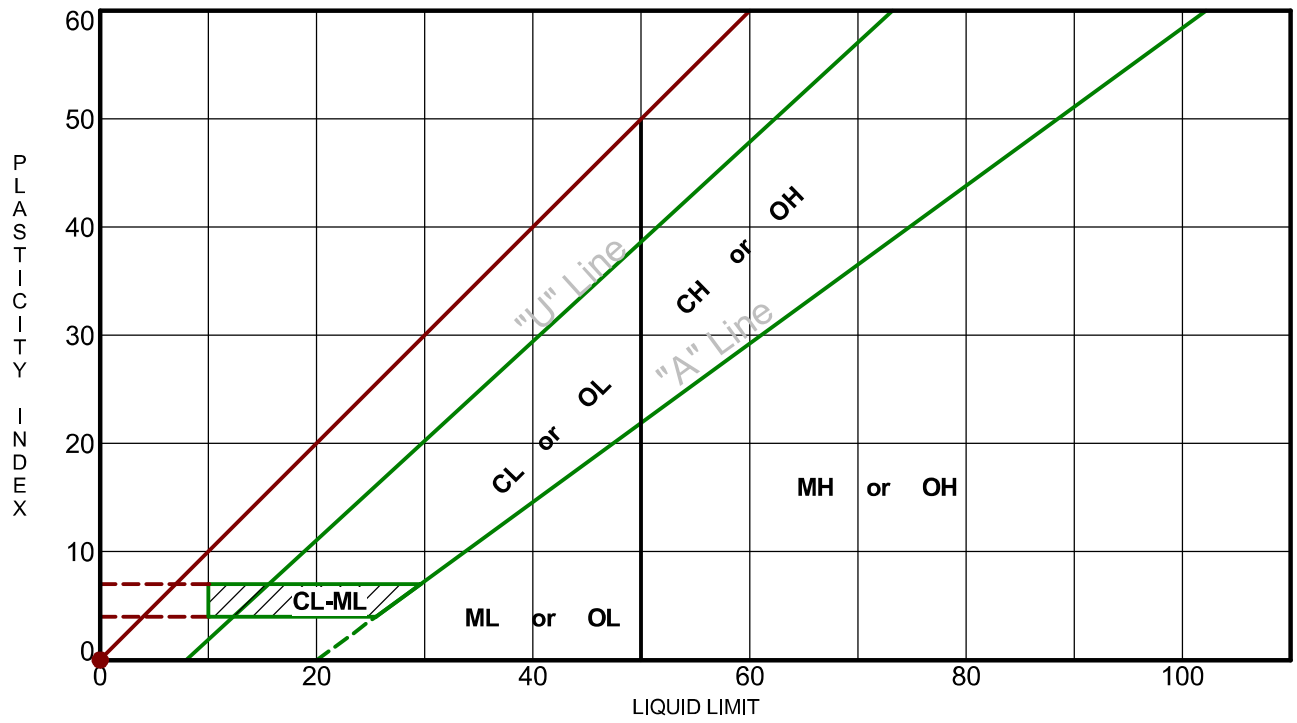
Boring Started: 07-29-2021 | Boring Completed: 07-29-2021

Drill Rig: CME 550 | Driller: Vine Laboratories

Project No.: 23215020

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
● B-1	9 - 10	NP	NP	NP	11.5	SW-SM	WELL-GRADED SAND with SILT and GRAVEL

PROJECT: CSU Wilson Tank Replacement

SITE: 6570 Alabaster Way
Colorado Springs, CO

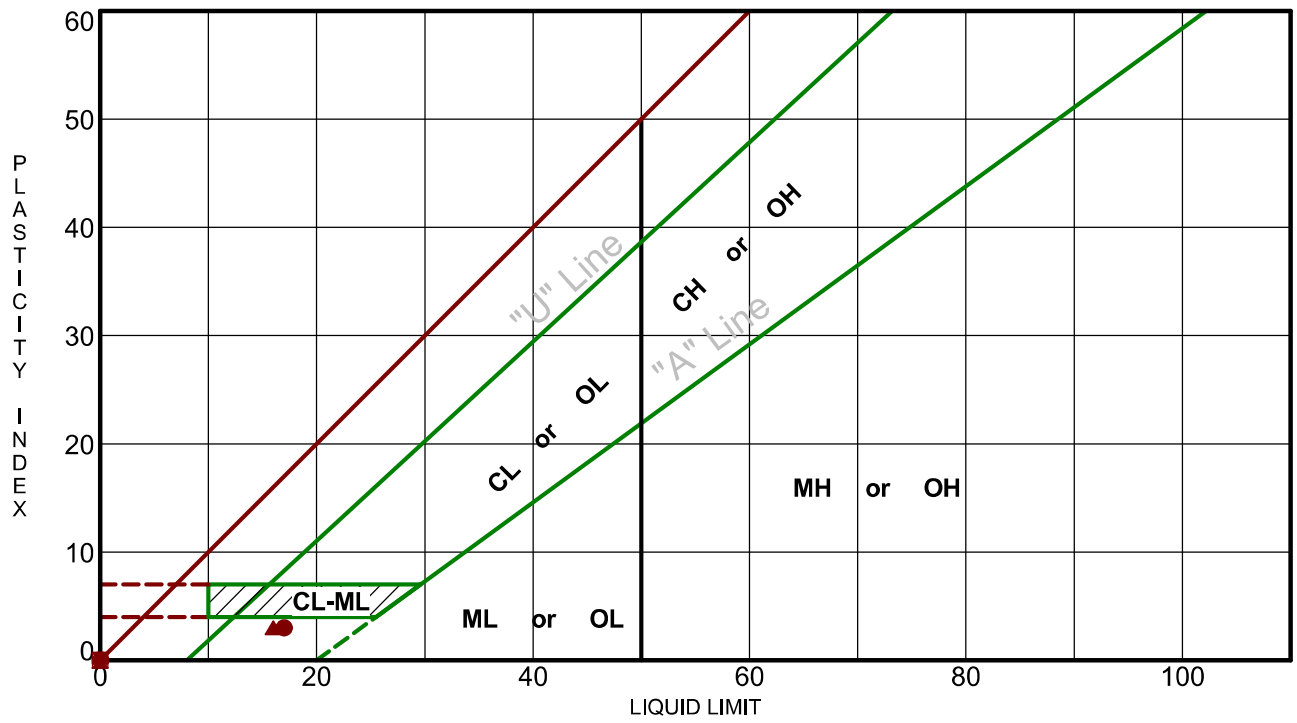
Terracon
4172 Center Park Dr
Colorado Springs, CO

PROJECT NUMBER: 23205050

CLIENT: Kimley-Horn & Associates Inc
Denver, CO

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth	LL	PL	PI	Fines	USCS	Description
●	B-103	9 - 10	17	14	3	24.3	SM	SILTY SAND
⊠	B-103	14 - 15	NP	NP	NP	14.5	SM	SILTY SAND with GRAVEL
▲	B-103	19 - 20	16	13	3	26.8	SM	SILTY SAND
★	B-104	19 - 20	NP	NP	NP	3.3	SW	WELL-GRADED SAND with GRAVEL
⊙	B-105	9 - 10	NP	NP	NP	3.1	SW	WELL-GRADED SAND with GRAVEL
✿	B-106	9 - 10	NP	NP	NP	7.6	SW-SM	WELL-GRADED SAND with SILT and GRAVEL

PROJECT: Wilson Tank Replacement

PROJECT NUMBER: 23215020

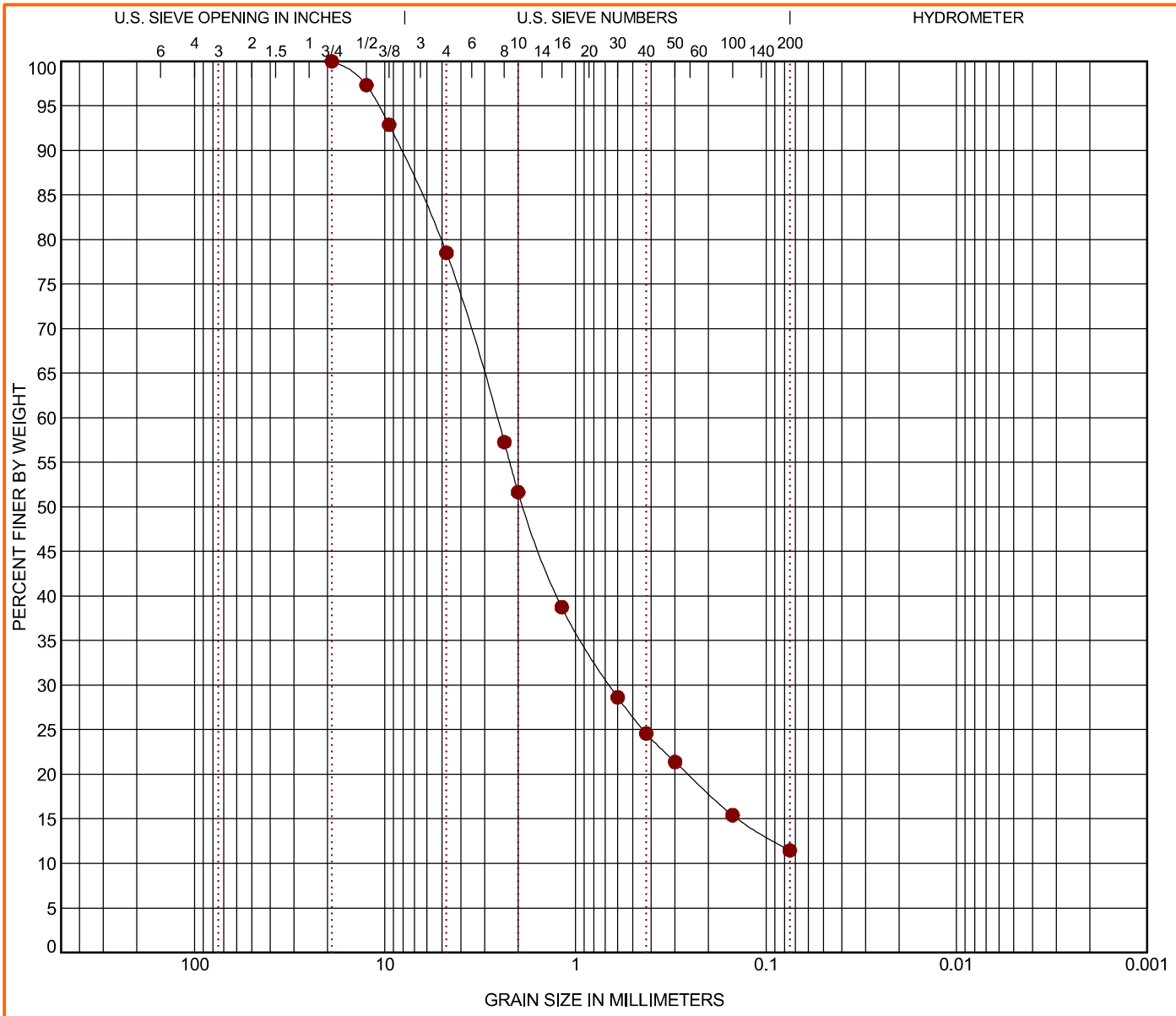
SITE: 6570 Alabaster Way
Colorado Springs, Colorado

Terracon
4172 Center Park Dr
Colorado Springs, CO

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
B-1	9 - 10	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	3	NP	NP	NP	2.88	44.42

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
B-1	9 - 10	19	2.582	0.657		0.0	21.5	67.1		11.5	

PROJECT: CSU Wilson Tank Replacement

PROJECT NUMBER: 23205050

SITE: 6570 Alabaster Way
Colorado Springs, CO

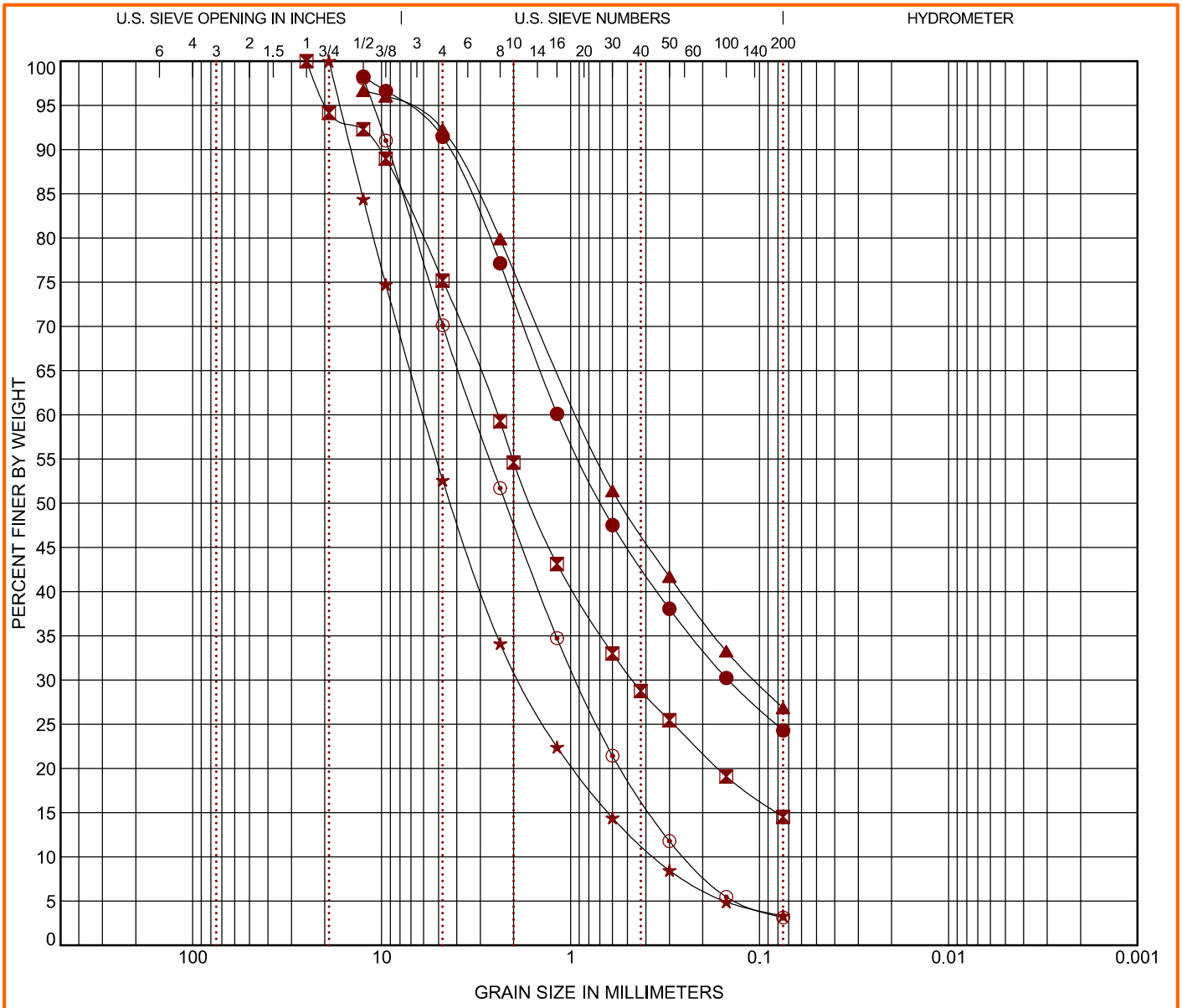
Terracon
4172 Center Park Dr
Colorado Springs, CO

CLIENT: Kimley-Horn & Associates Inc
Denver, CO

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 23205050 DENVER_CSU WILSON TANK - CHECKED OUT NDH.GPJ TERRACON_DATATEMPLATE.GDT 7/15/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-103	9 - 10	SILTY SAND (SM)	1.6	17	14	3		
⊠	B-103	14 - 15	SILTY SAND with GRAVEL (SM)		NP	NP	NP		
▲	B-103	19 - 20	SILTY SAND (SM)	2.0	16	13	3		
★	B-104	19 - 20	WELL-GRADED SAND with GRAVEL (SW)	1.9	NP	NP	NP	1.59	16.69
⊙	B-105	9 - 10	WELL-GRADED SAND with GRAVEL (SW)	1.8	NP	NP	NP	1.08	13.11

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-103	9 - 10	12.5	1.173	0.146			6.8	67.1		24.3	
⊠	B-103	14 - 15	25	2.436	0.47		0.0	24.8	60.7		14.5	
▲	B-103	19 - 20	12.5	0.907	0.106			4.4	65.4		26.8	
★	B-104	19 - 20	19	5.989	1.849	0.359	0.0	47.4	49.3		3.3	
⊙	B-105	9 - 10	12.5	3.234	0.927	0.247		27.9	67.0		3.1	

PROJECT: Wilson Tank Replacement

PROJECT NUMBER: 23215020

SITE: 6570 Alabaster Way
Colorado Springs, Colorado

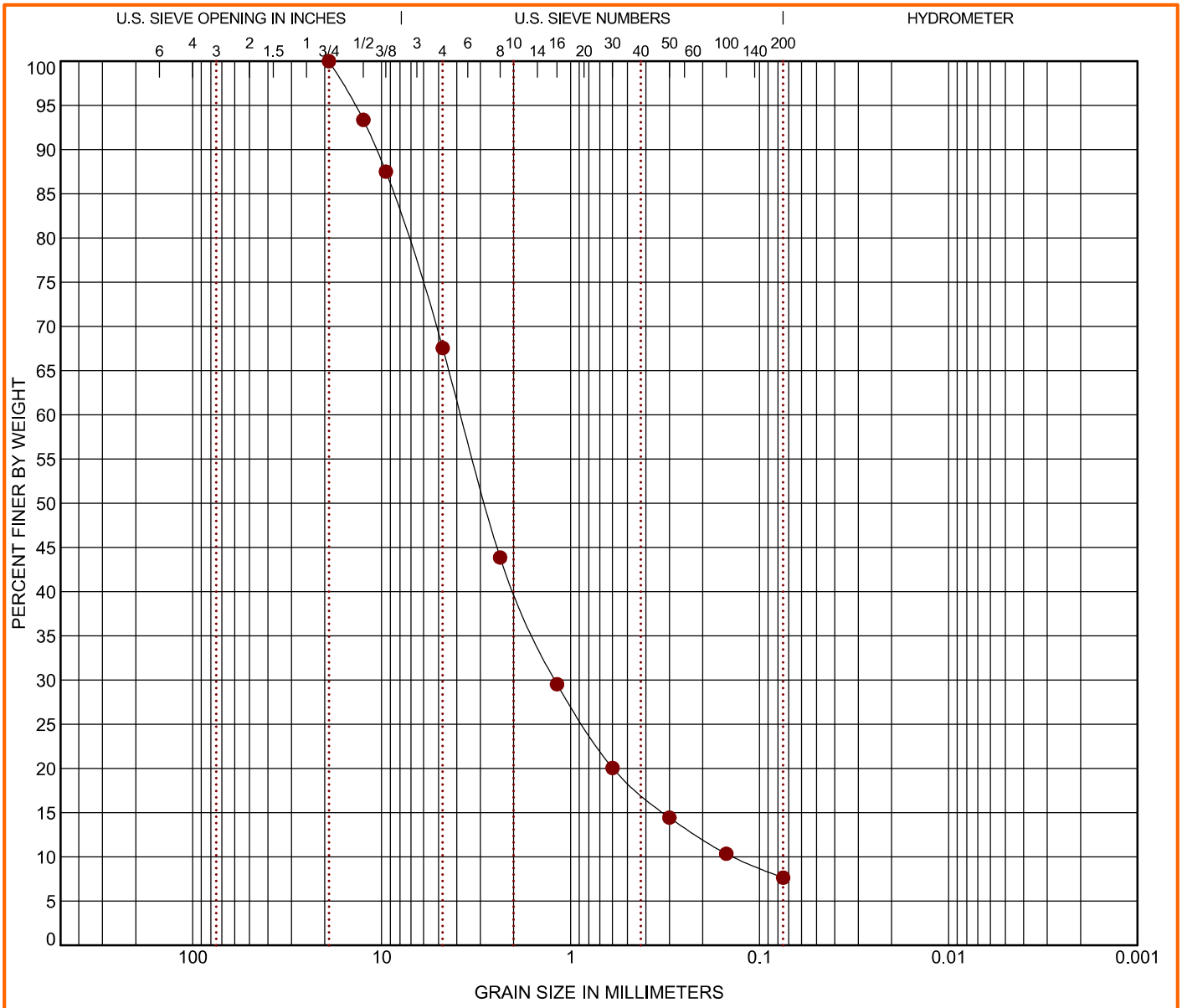
Terracon
4172 Center Park Dr
Colorado Springs, CO

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 23215020 WILSON TANK REPLA.GPJ TERRACON_DATATEMPLATE.GDT 10/22/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
B-106	9 - 10	WELL-GRADED SAND with SILT and GRAVEL (SW-SM)	3.0	NP	NP	NP	2.80	27.72

Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
B-106	9 - 10	19	3.801	1.208	0.137	0.0	32.4	59.9		7.6	

PROJECT: Wilson Tank Replacement

SITE: 6570 Alabaster Way
Colorado Springs, Colorado

Terracon
4172 Center Park Dr
Colorado Springs, CO

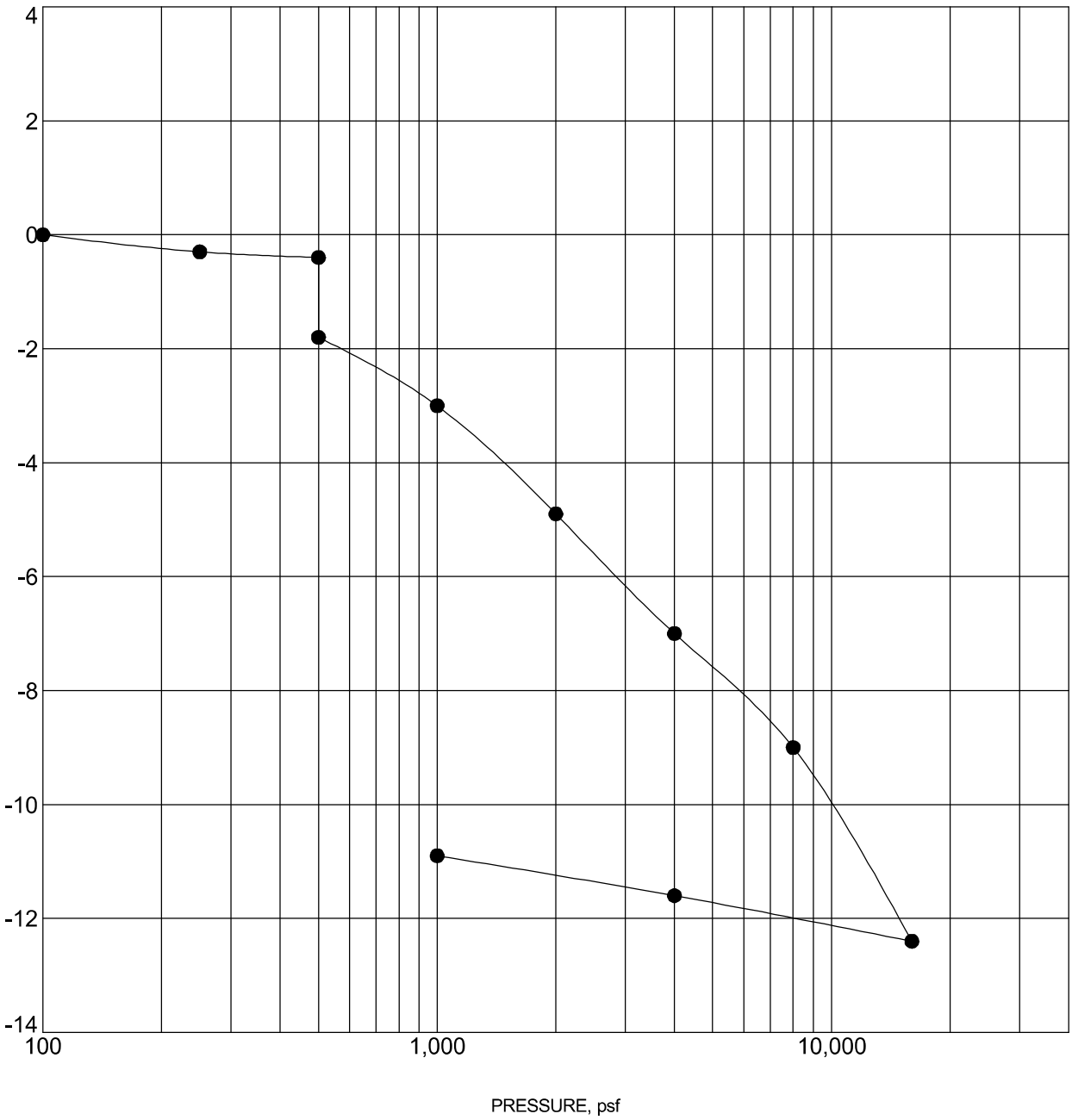
PROJECT NUMBER: 23215020

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 23215020 WILSON TANK REPLA.GPJ TERRACON_DATATEMPLATE.GDT 10/22/21

SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification			Classification	γ_d, pcf	WC, %
●	B-103	9 - 10 ft	SILTY SAND(SM)	119	2

NOTES: Sample inundated with water at 500 pounds per square foot (psf).

PROJECT: Wilson Tank Replacement

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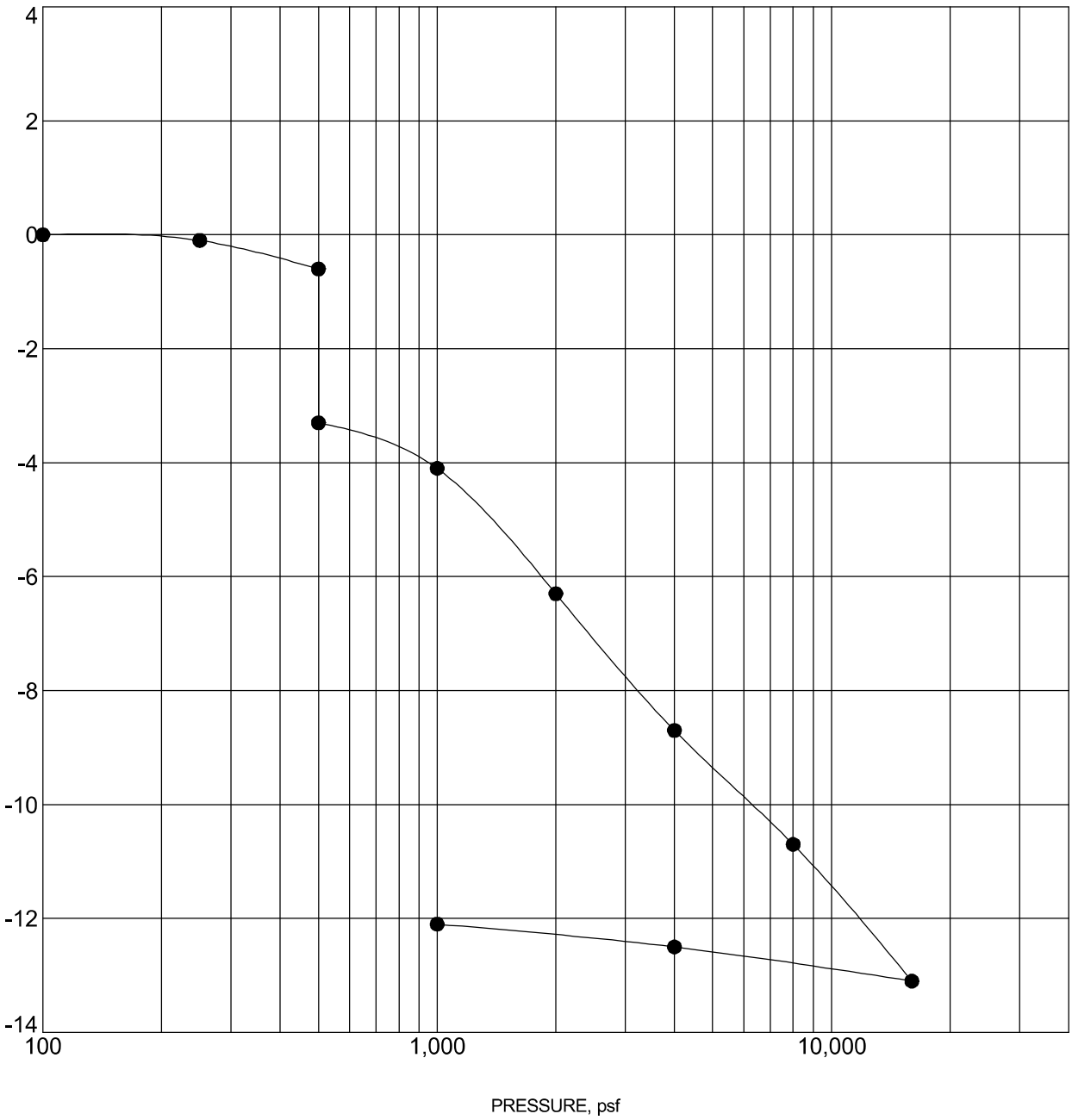
CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification			Classification	γ_d, pcf	WC, %
●	B-103	19 - 20 ft	SILTY SAND(SM)	112	2

NOTES: Sample inundated with water at 500 pounds per square foot (psf).

PROJECT: Wilson Tank Replacement

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Colorado Springs, Colorado

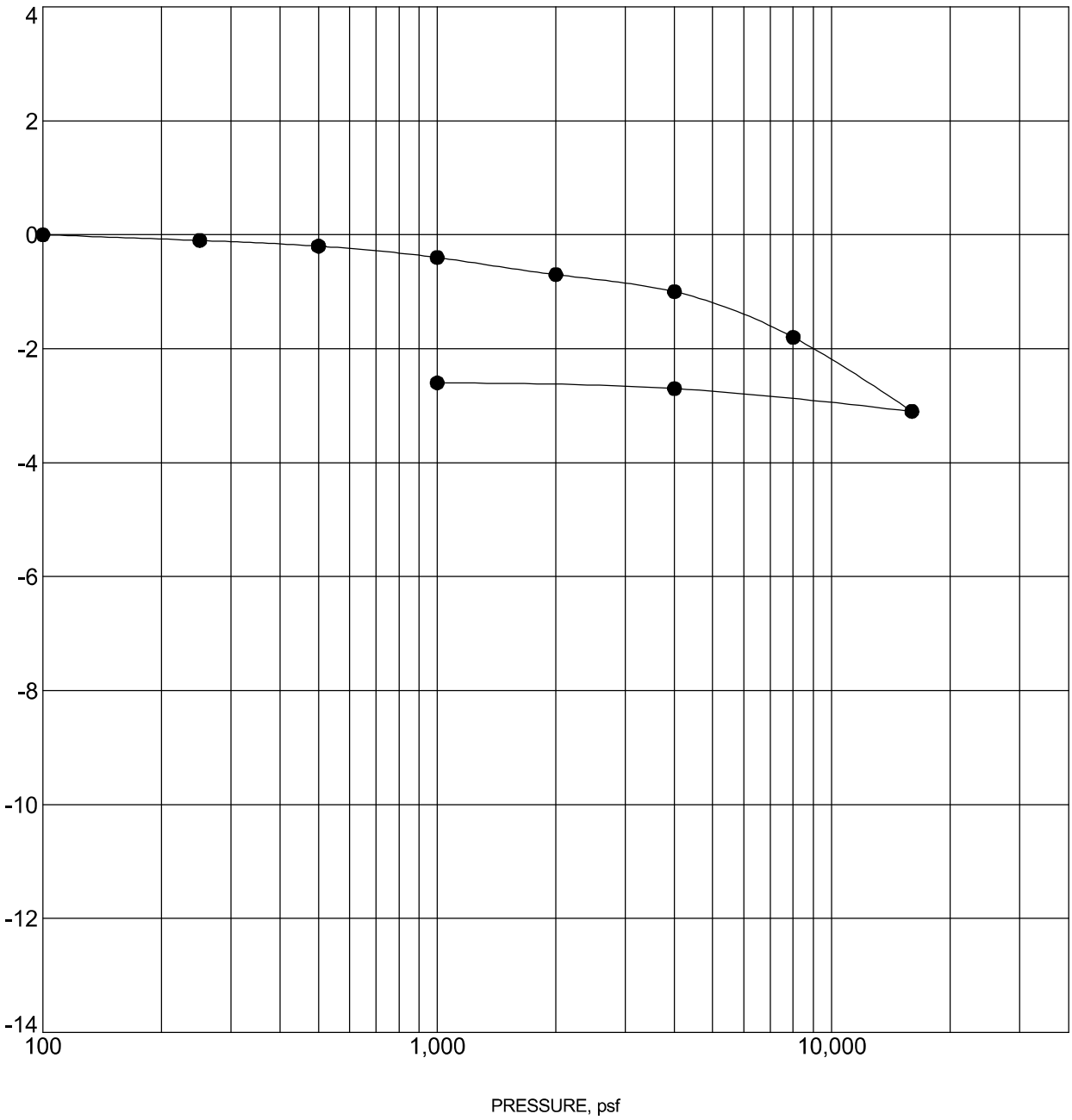
Terracon
4172 Center Park Dr
Colorado Springs, CO

PROJECT NUMBER: 23215020

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

SWELL CONSOLIDATION TEST

ASTM D4546



Specimen Identification			Classification	γ_d, pcf	WC, %
●	B-105	19 - 19.5 ft	WELL GRADED SAND WITH GRAVEL (SW)	89	3

NOTES: Sample inundated with water at 500 pounds per square foot (psf).

PROJECT: Wilson Tank Replacement

SITE: 6570 Alabaster Way
Colorado Springs, Colorado

Terracon
4172 Center Park Dr
Colorado Springs, CO

PROJECT NUMBER: 23215020

CLIENT: Kimley-Horn and Associates Inc
Denver, Colorado

Colorado Analytical LABORATORIES, INC.

Analytical Results

TASK NO: 200629032

Report To: Rob Hernandez
Company: Terracon, Inc. - Colo Springs
4172 Center Park Drive
Colo. Springs CO 80916

Bill To: Rob Hernandez
Company: Terracon, Inc. - Accounts Payable
18001 W. 106th St
Suite 300
Olathe KS 66061

Task No.: 200629032
Client PO:
Client Project: CSU Wilson Tank 23205050

Date Received: 6/29/20
Date Reported: 7/6/20
Matrix: Soil - Geotech

Customer Sample ID B-1 @ 1
Lab Number: 200629032-01

Test	Result	Method
Chloride - Water Soluble	**0.0017 %**	AASHTO T291-91/ ASTM D4327
pH	**7.8 units**	AASHTO T289-91
Resistivity	**7955 ohm.cm**	AASHTO T288-91
Sulfate - Water Soluble	**0.002 %**	AASHTO T290-91/ ASTM D4327

Abbreviations/ References:

AASHTO - American Association of State Highway and Transportation Officials.
ASTM - American Society for Testing and Materials.
ASA - American Society of Agronomy.
DIPRA - Ductile Iron Pipe Research Association Handbook of Ductile Iron Pipe.

DATA APPROVED FOR RELEASE BY

Colorado Analytical LABORATORIES, INC.

Analytical Results

TASK NO: 210629008

Report To: Tyler Compton
Company: Terracon, Inc. - Colo Springs
4172 Center Park Drive
Colo. Springs CO 80916

Bill To: Tyler Compton
Company: Terracon, Inc. - Accounts Payable
18001 W. 106th St
Suite 300
Olathe KS 66061

Task No.: 210629008
Client PO:
Client Project: Wilson Tank Replacement 23215020

Date Received: 6/29/21
Date Reported: 7/6/21
Matrix: Soil - Geotech

Customer Sample ID B-103 @ 1-5ft
Lab Number: 210629008-01

Test	Result	Method
Chloride - Water Soluble	**0.0002 %**	AASHTO T291-91/ ASTM D4327
pH	**7.7 units**	AASHTO T289-91
Resistivity	**6743 ohm.cm**	AASHTO T288-91
Sulfate - Water Soluble	**< 0.001 %**	AASHTO T290-91/ ASTM D4327

Abbreviations/ References:

AASHTO - American Association of State Highway and Transportation Officials.
ASTM - American Society for Testing and Materials.
ASA - American Society of Agronomy.
DIPRA - Ductile Iron Pipe Research Association Handbook of Ductile Iron Pipe.

DATA APPROVED FOR RELEASE BY

SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System
Global Slope Stability Results

Note: All attachments are one page unless noted above.

GENERAL NOTES

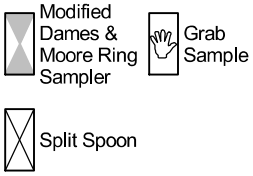
DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Wilson Tank Replacement ■ Colorado Springs, Colorado

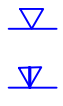
Terracon Project No. 23215020

Terracon GeoReport

SAMPLING



WATER LEVEL



Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Cave In Encountered

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
UC	**Unconfined Compressive Strength**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance				BEDROCK		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3	< 30	< 20	Weathered
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4	30 - 49	20 - 29	Firm
Medium Dense	10 - 29	19 - 58	Medium Stiff	0.50 to 1.00	4 - 8	5 - 9	50 - 89	30 - 49	Medium Hard
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18	90 - 119	50 - 79	Hard
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42	> 119	>79	Very Hard
			Hard	> 4.00	> 30	> 42			

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

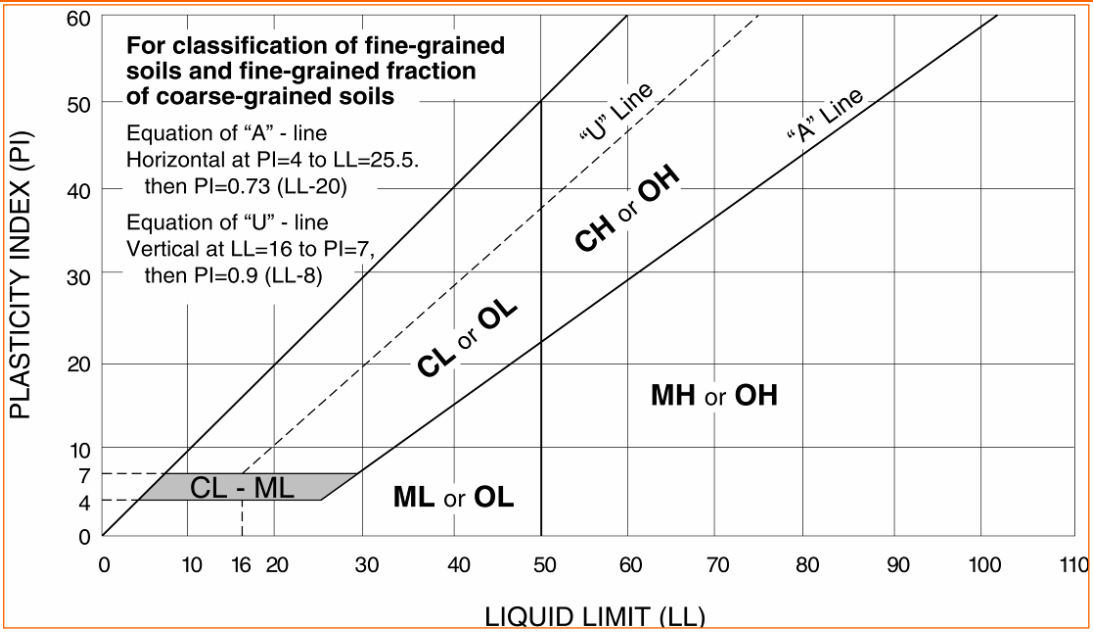
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

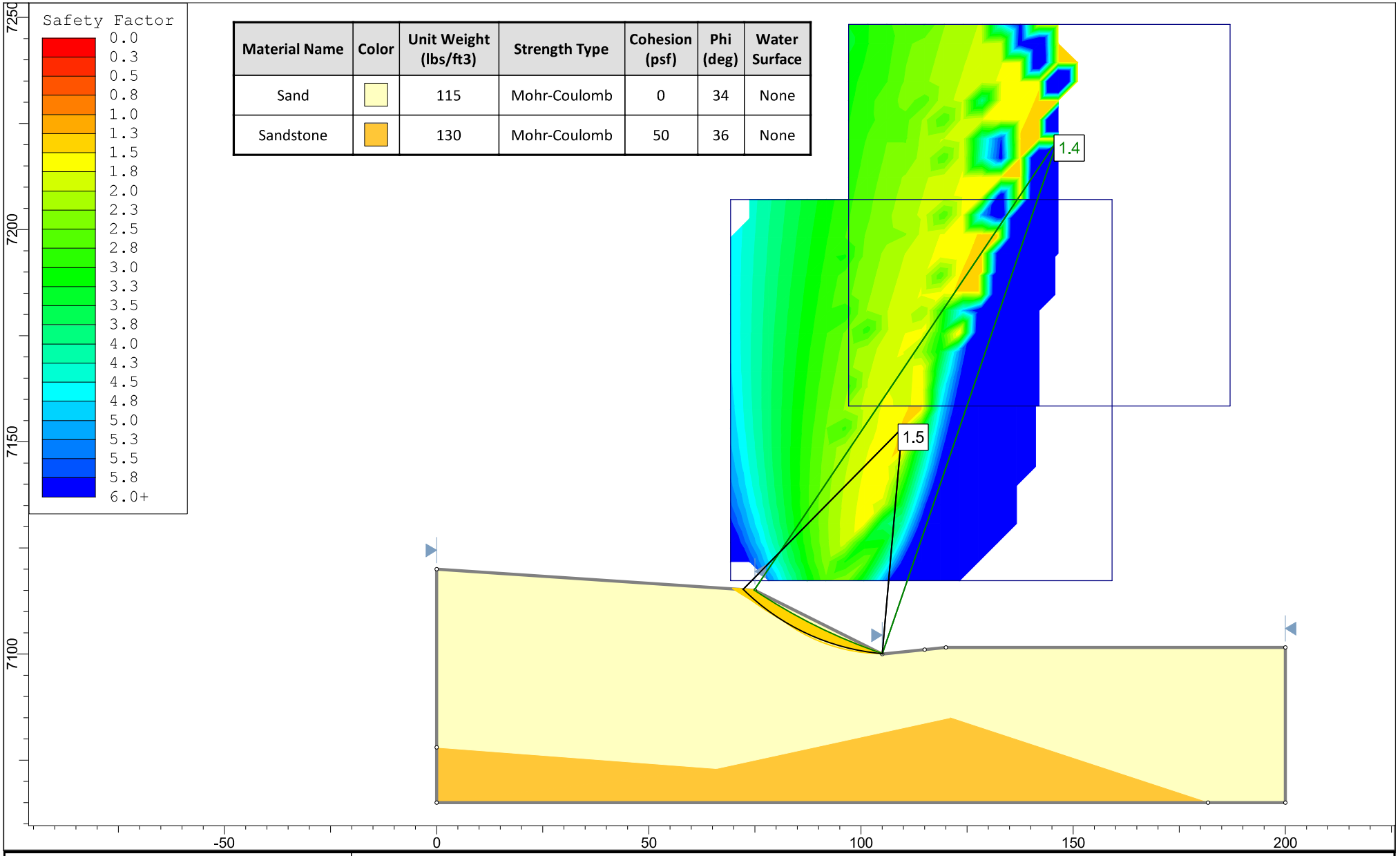
[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.





Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
Sand		115	Mohr-Coulomb	0	34	None
Sandstone		130	Mohr-Coulomb	50	36	None

Project	23215020 - Wilson Tank Replacement		
Analysis Description	Section A-A', 50 percent slope		
Drawn By	TAC	Scale 1:375	Company Terracon
Date	10/21/2021, 9:07:43 PM		

SLIDEINTERPRET 6.039

COLORADO GEOLOGICAL SURVEY

1801 Moly Road
Golden, Colorado 80401
303.384.2655

Karen Berry
State Geologist

August 31, 2021

William Gray
Planning and Community Development
30 S. Nevada Avenue, Suite 105
P.O. Box 1575, MC 155
Colorado Springs, CO 80901

Location:
N½ SW¼ NW¼ Sec. 15
T13S, R67W of the 6th PM
38.9221°, -104.8849°

Subject: **CSU Wilson Tank Site Development Plan and Final Plat, AR DP 21-00526 and AR FP 21-00527, Colorado Springs, El Paso County, CO, CGS Unique No. EP-22-0013**

Dear William,

The Colorado Geological Survey (CGS) has reviewed the CSU Wilson Tank site development plan and final plat referral. We understand the applicant proposes a new water storage tank and associated site improvements at 6570 Alabaster Way. With this referral, CGS received a request for review (Emails dated August 19, 2021), Application (Kimley Horn and Associates, Inc., July 29, 2021), Development Plan (Kimley Horn, undated), Drainage Report (Kimley Horn, July 30, 2021), and Preliminary Geologic Hazards Study (Terracon Consultants, Inc., July 27, 2021). Terracon references a Geotechnical Engineering Report in their Geologic Hazards study; however, this study was not provided in the referral documents.

The site is not within any known landslides or mapped Colorado Springs landslide-susceptible area (White and Wait, 2003). CGS agrees with Terracon's assessment (page i) that the potential geologic hazards at the site that may impact the proposed development include the potential to encounter localized man-made slope instability and steeply dipping bedrock within foundation bearing elevations. Kimley Horn's development plan and available LiDAR show slopes around 50 percent descending toward the proposed tank. Terracon indicates on page 5, "Apparent signs of instability of the existing slopes in the form of scarps, surficial cracking, and/or surficial instability was not observed."

Terracon's assessment of the geologic hazards are valid; CGS offers the following comments/concerns and recommendations:

Site-Specific Geology: Terracon references the Pikeview 7.5 Quadrangle Geologic Map (Thornson, J.P., Carroll, C.J., and Morgan, M.L., 2001) on page 3 of the report. However, the Cascade 7.5 Quadrangle Geologic Map (Morgan et al., 2004), which encompasses the project area, is presented in the site attachments. The Cascade Quadrangle should also be referenced in the report.

Faulting: Terracon ***does not*** address the Rampart Range Fault, which is less than ½ mile from the site, nor the series of faults that may traverse the project area (Morgan et al., 2004, Geologic Map of the Cascade Quadrangle, El Paso County, Colorado, CGS). **CGS recommends Terracon discuss the hazards associated with the structural features (faults) shown on the Cascade Quadrangle that traverse within and near the site in the report**. CGS also recommends that appropriate seismic factors be incorporated in the design of the proposed tank structure.

Slope Stability Analysis: As noted on page 5 of Terracon's report, "The existing and proposed relatively steep slopes along the west and south sides of the proposed tank create a risk for localized man-made unstable slopes at this location." CGS agrees with Terracon's recommendation that "a slope stability analysis be performed to confirm the long term stability of the slopes." The slope stability analysis ***must*** be based on soil/bedrock geometry along the length of the slope section, shear strength values measured from site-specific samples and laboratory testing, and groundwater levels that may be anticipated in the area (perched conditions). Also, seismic factors should be included in the analysis that considers the Rampart Range Fault zone.

Dipping Bedrock: The site is located within the Hillside Overlay and is mapped about 150 feet west of an area mapped as susceptible to differential heave in expansive, steeply dipping bedrock (>30º). Terracon encountered bedrock at depths ranging from 3½ to 37 feet below the existing grade. CGS agrees with Terracon's assessment that "Although not observed in the bedrock samples obtained from our borings, it is our opinion that dipping bedrock is likely present at this site." We also agree with Terracon's recommendation "The proposed tank should be constructed on shallow foundations supported on a minimum 10-foot thick zone of structural fill, such that a minimum 10-foot separation exists between the lowest foundation element and the top of bedrock." **CGS recommends that Terracon provide material properties (gradation specifications, use of on-site vs. import materials, etc.), earthwork recommendations for the structural fill material, and potential movement estimates (total and differential)** if not provided in the Geotechnical Engineering Report. In addition, the project team and contractor should anticipate difficult excavation conditions within the on-site bedrock.

Geo-Hazard Disclosure Statement: Per the City ordinance, the statement (as presented on sheet 1 of the development plan) must list the geologic hazards identified at this site. **We recommend that the City require the disclosure statement to follow the ordinance by listing the identified geologic hazards at the site**.

In summary, **CGS has no objection to approval of the development plan and final plat provided Terracon's recommendations are adhered to, and CGS's comments and suggestions presented in this letter are addressed**.

Thank you for the opportunity to review and comment on this project. If you have questions or require further review, please call me at 303-384-2632 or email acrandall@mines.edu.

Sincerely,

Amy Crandall

Amy Crandall, P.E.
Engineering Geologist

COLORADO GEOLOGICAL SURVEY

1801 Moly Road
Golden, Colorado 80401
303.384.2655

Karen Berry
State Geologist

January 14, 2022

William Gray
Planning and Community Development
30 S. Nevada Avenue, Suite 105
P.O. Box 1575, MC 155
Colorado Springs, CO 80901

Location:
N½ SW¼ NW¼ Sec. 15
T13S, R67W of the 6th PM
38.9221°, -104.8849°

Subject: **CSU Wilson Tank Site Development Plan and Final Plat, AR DP 21-00526 and AR FP 21-00527, Colorado Springs, El Paso County, CO, CGS Unique No. EP-22-0013**

Dear William,

The Colorado Geological Survey (CGS) has reviewed the CSU Wilson Tank site development plan and final plat resubmittal. With this resubmittal, CGS received a request for review (Email dated December 29, 2021), Comment Response Letter (Kimley Horn and Associates, Inc., December 13, 2021), Development Plan (Kimley Horn, undated), Drainage Report (Kimley Horn, July 30, 2021), Geologic Hazards Study (Terracon Consultants, Inc. (Terracon), Revised November 18, 2021), and Geotechnical Engineering Report (Terracon, Revised November 18, 2021).

Terracon's revised geologic hazards report and geotechnical engineering report adequately address our previous comments and concerns. For example, Terracon's slope stability analysis presented in the geotechnical engineering report for the proposed slopes and the discussion of long-term slope stability address our concerns regarding the steep slopes along the west and south sides of the proposed tank. Terracon's recommendations for surficial slope stability (page 15) should be strictly adhered to. Specifically, "Irrigated landscaping should not be used on or near the crest of slopes" and "Slopes should be re-vegetated as soon as possible after grading and protected from erosion until vegetation is established."

Provided Terrcon's recommendations are adhered to, **CGS has no objection to approval of the development plan and final plat**.

Geo-Hazard Disclosure Statement: Per the City ordinance, the statement (as presented on sheet 1 of the development plan) must list the geologic hazards identified at this site and reference Terracon's most up-to-date geologic hazard report (November 18, 2021). **We recommend that the City require the disclosure statement to follow the ordinance by listing the identified geologic hazards at the site**.

Thank you for the opportunity to review and comment on this project. If you have questions or require further review, please call me at 303-384-2632 or email acrandall@mines.edu.

Sincerely,

Amy Crandall

Amy Crandall, P.E.
Engineering Geologist