February 12, 2021

CES Consultants, LLC
721 4th Street, Suite 1
Fort Lupton, Colorado 80621

Attn: Mr. Kurt Rollin

Re: Geotechnical Subsurface Exploration Report
Proposed Multi-Family Residences - Lots 2 & 3, Hamilton Subdivision
Northeast corner of 7th Street & Dahlia Avenue
Dacono, Colorado
Soilogic Project # 21-1003

Mr. Rollin:

Soilogic, Inc. (Soilogic) personnel have completed the geotechnical subsurface exploration you requested for the two (2) proposed multi-family residences to be constructed on Lots 2 & 3 of the Hamilton Subdivision, located on the northeast corner of the intersection of 7th Street and Dahlia Avenue in Dacono, Colorado. Results of our subsurface exploration and pertinent geotechnical engineering recommendations are included with this report.

We understand the new residences will be four-unit, two-story, wood-frame structures constructed over crawl spaces. Slab-on-grade floor construction is not anticipated. Foundation loads for the structures are expected to be relatively light, with continuous wall loads less than 3 kips per lineal foot and individual column loads less than 50 kips. Small grade changes are anticipated to develop finish site grades in the residence areas.

The purpose of our exploration was to describe the subsurface conditions encountered in the completed site borings and develop the test data necessary to provide recommendations concerning design and construction of the residence foundations and support of exterior flatwork and site pavements. The conclusions and recommendations outlined in this report are based on results of the completed field and laboratory testing and our experience with subsurface conditions in this area.

SITE DESCRIPTION

The multi-family residences will be constructed on the southern part of parcels of land identified as Lots 2 and 3 in the Hamilton Subdivision, located on the northeast corner of the intersection of 7th Street and Dahlia Avenue in Dacono, Colorado. At the time of our site exploration, the ground surface within the proposed construction area contained gravel surfacing and was observed to be relatively level, with the maximum difference in ground surface across the residence footprints estimated to be on the order of two (2) feet or less. Evidence of prior building construction was not observed in the proposed construction areas by Soilogic personnel at the time of our site exploration.

EXPLORATION AND TESTING PROCEDURES

To develop subsurface information in the area of the proposed residence, three (3) soil borings were extended to a depth of approximately 15 feet below present site grades within the approximate residence footprints. The boring locations were established in the field by Soilogic personnel by referencing a site plan provided by the client, by pacing and estimating angles and distances from identifiable site references. A diagram indicating the approximate boring locations is included with this report. The boring locations indicated on this diagram should be considered accurate only to the degree implied by the methods used to make the field measurements. Graphic logs of the auger borings are also included.

The test holes were advanced using 4-inch diameter continuous-flight auger, powered by a truck-mounted CME-45 drill rig. Samples of the subsurface materials were obtained at regular intervals using California barrel sampling procedures in general accordance with ASTM specification D-1586. As part of the D-1586 sampling procedure, a standard sampling barrel is driven into the substrata using a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampler a distance of 12 inches is recorded and helpful in estimating the consistency, relative density and/or hardness of the soils/bedrock encountered. In the California barrel sampling procedure, lesser disturbed samples are obtained in removable brass liners. Samples of the subsurface materials obtained in the field were sealed and returned to the laboratory for further evaluation, classification and testing.

The samples collected were tested in the laboratory to measure natural moisture content and were visually and/or manually classified in accordance with the Unified Soil Classification System (USCS). The USCS group symbols are indicated on the attached boring log. An outline of the USCS classification system is included with this report. Classification of bedrock was completed through visual and tactual observation of disturbed samples. Other bedrock types could be revealed through petrographic analysis.

As part of the laboratory testing, a calibrated hand penetrometer (CHP) was used to estimate the unconfined compressive strength of essentially-cohesive specimens. The CHP also provides a more reliable estimate of soil/bedrock consistency than tactual observation alone. Dry density, Atterberg limits, -200 wash and swell/consolidation tests were completed on selected samples to help establish specific soil/bedrock characteristics. Atterberg limits tests are used to determine soil/bedrock plasticity. The percent passing the #200 size sieve (-200 wash) test is used to determine the percentage of fine-grained materials (clay and silt) in a sample. Swell/consolidation tests are performed to evaluate soil/bedrock volume change potential with variation in moisture content. The results of the completed laboratory tests are outlined on the attached boring logs and swell/consolidation test summaries.

SUBSURFACE CONDITIONS

The materials encountered in the completed site borings can be summarized as follows. A thin mantle of vegetation and topsoil was encountered at the surface at the boring locations. The vegetative soil layer was underlain by dark brown to light brown/beige/rust lean clay with sand. The lean clay contained sand and gravel lenses with depth at the locations of borings B-2 and B-3, varied from soft to stiff in terms of consistency, exhibited no to low swell potential and low to moderate compressibility and at in-situ moisture and density conditions and extended to depths between approximately 13½ and 14½ feet below ground surface, where it was underlain by gray/olive/rust siltstone/claystone bedrock. The bedrock varied from weathered to firm in terms of relative hardness and extended to the bottom of each boring at a depth of approximately 15 feet below ground surface.

Groundwater was encountered in completed site borings at depths of about 10 to 11 feet below ground surface respectively when checked immediately after completion of drilling.

When checked six (6) days after drilling, groundwater was measured in the borings at depths of about 9 to 10 feet below grade at that time. Groundwater level information is indicated in the upper right-hand corner of the attached boring logs.

Groundwater levels will vary seasonally and over time based on weather conditions, site development, irrigation practices and other hydrologic conditions. Perched and/or trapped groundwater conditions may also be encountered at times throughout the year. Perched water is commonly encountered in soils overlying less permeable soil layers and/or bedrock. Trapped water is typically encountered within more permeable zones of layered soil and bedrock systems. The location and amount of perched/trapped water can also vary over time.

ANALYSIS AND RECOMMENDATIONS

General

Lean clay soils exhibiting low to moderate compressibility were identified in the test borings at depths near typical crawl space foundation bearing elevation. The site lean clay soils possess high in-situ moisture content, would be expected to be comparatively soft near anticipated foundation bearing elevation and would be easily disturbed by the construction activities. Care should be taken at the time of excavation to avoid disturbing all foundation bearing soils and the resultant need for corrective action. To reduce the potential of disturbance of foundation bearing soils and the requirement for corrective work, we strongly suggest the residence excavations be completed remotely.

Careful observation of the exposed foundation bearing materials should be completed at the time of construction to ensure all footing foundations will be supported on like natural materials with suitable strength and low volume change potential. If extensive zones of very soft/disturbed, high moisture content and compressible soils are encountered at that time, some overexcavation/backfill or other approved stabilization procedures may be required prior to foundation construction. The use of geotextile separation fabric in conjunction with a layer of screened/washed rock could be considered if stabilization becomes necessary. We would be happy to provide recommendations concerning subgrade stabilization at your request or should they be deemed necessary.

Site Development

All existing gravel surfacing should be completely removed from proposed building, exterior flatwork/pavement and any proposed fill areas. After stripping and completing all cuts and prior to placement of any new fill, exterior flatwork or site pavements, we recommend the exposed subgrade soils be scarified to a depth of 9 inches, adjusted in moisture content and compacted to at least 95% of the materials standard Proctor maximum dry density. The moisture content of the reconditioned subgrade soils should be adjusted to be within the range of ±2% of standard Proctor optimum moisture content at the time of compaction.

Fill soils required to develop the site should consist of approved low volume change (LVC) soils free from organic matter, debris and other objectionable materials. Based on results of the completed laboratory testing, it is our opinion the site lean clay could be used as fill in these areas provided the proper moisture content can be developed in these materials at the time of placement and compaction. We recommend the lean clay and/or similar soils be placed in loose lifts not to exceed 9 inches thick, adjusted in moisture content and compacted as recommended for the scarified materials above.

Care will be needed to maintain the proper moisture content in the placed fill soils prior to placement of any overlying improvements. Soils which are allowed to dry out would need to be removed and replaced or reworked in-place prior to placement of any overlying improvements. Similarly, care should be taken to avoid disturbing the reconditioned subgrade soils and placed fill soils prior to placement of any overlying improvements. Disturbed soils or soils which are allowed to become wet and softened should be removed and replaced or reworked in place prior concrete placement and/or paving.

As previously outlined, the lean clay soils encountered at this site at depths below anticipated foundation bearing elevation would be particularly subject to disturbance by the construction activities. Care should be taken to avoid disturbing all subgrade soils prior to placement of any overlying improvements. To reduce the potential of disturbance of foundation bearing soils and the requirement for corrective work, strong consideration should be given to completing the foundation excavation remotely. Soils which are allowed to dry out or become wet and softened or disturbed by the construction activities should be removed and replaced or reworked in place prior to concrete placement.

Foundations

Based on results of the completed field and laboratory testing, it is our opinion the proposed residences could be supported by conventional spread footing foundations bearing on natural, undisturbed lean clay. For design of footing foundations bearing on medium stiff to stiff lean clay with low swell potential, we recommend using a maximum net allowable soil bearing pressure of 1,250 psf.

Exterior footings shall bear a minimum of 36 inches below finished adjacent exterior grade to provide frost protection. We recommend formed strip footings have a minimum width of 12 inches and isolated pad foundations have a minimum width of 24 inches in order to facilitate construction and reduce the potential for development of eccentrically loaded footings. Actual footing widths should be designed by a structural engineer.

For design of footing foundations and foundation walls to resist lateral movement, a passive equivalent fluid pressure value of 250 pcf could be used. The top 36 inches of subgrade could be considered a surcharge load but should not be used in the passive resistance calculations. A coefficient of friction of 0.35 could be used between foundation and floor slab concrete and the bearing soils to resist sliding. The recommended passive equivalent fluid pressure value and coefficient of friction do not include a factor of safety.

We estimate settlement of footing foundations designed and constructed as outlined above and resulting from the assumed structural loads would be on the order of 1 inch or less. Differential settlement could approach the amount of total settlement estimated above. If water from any source is allowed to infiltrate the foundation bearing soils, additional movement of the foundations could occur.

Floor Slabs and Exterior Flatwork

The residence floor slabs (if any) and exterior flatwork could be supported on reconditioned natural site soils or properly placed and compacted fill or removal area backfill soils developed as outlined in the “Site Development” section of this report.

Subgrade soils expected to receive flatwork concrete should be evaluated closely immediately prior to concrete placement. If areas of disturbed, wet and softened, or dry subgrade soils are encountered at that time, reworking of those materials or removal/ replacement procedures may be required.

At this time, we understand slab-on-grade floor construction will not be utilized within the residences. However, if any floor slabs are included in the design, they should be designed and constructed as floating slabs, separated from foundation walls, columns and plumbing and mechanical penetrations by the use of block outs or appropriate isolation material. Additionally, we recommend all garage partition walls supported above slabs-on-grade be constructed as floating walls to help reduce the potential for differential slab-to-foundation movement causing distress in upper sections of the structures. A minimum one and one-half (1½) inch void space is recommended beneath all floating walls. Special attention to door and stair framing, drywall installation and trim carpentry should be taken to isolate those elements from the floor slab, allowing for some differential floor slab-to-foundation movement to occur without transmitting stresses to the overlying structures.

Depending on the type of floor covering and floor covering adhesive used in finished slab-on-ground areas (if any), a vapor barrier may be required immediately beneath the floor slabs to maintain flooring product manufacturer warranties. A vapor barrier would help reduce the transmission of moisture through the floor slabs. However, the unilateral moisture release caused by placing concrete on an impermeable surface can increase slab curl. The amount of slab curl can be reduced by careful selection of an appropriate concrete mix. Slab curl cannot be eliminated. We recommend the owner, architect and flooring contractor consider the performance of the slab in conjunction with the proposed flooring products to help determine if a vapor barrier will be required and where best to position the vapor barrier in relation to the floor slab. Additional guidance and recommendations concerning slab-on-grade design can be found in American Concrete Institute (ACI) section 302.

Exterior flatwork will experience some movement subsequent to construction as the subgrade soils increase in moisture content. Based on results of the completed field and laboratory testing, we expect the amount of movement of exterior flatwork supported on reconditioned natural site soils and/or properly placed and compacted fill with no to low swell potential would be limited. Care should be taken to ensure that when exterior flatwork moves, positive drainage will be maintained away from the residences.

Crawl Space Construction

As a precaution, we recommend a perimeter drain system be constructed around any crawl space areas to help reduce the potential for water infiltration into the crawl space areas of the residences and/or the development of hydrostatic pressures behind the foundation walls. The perimeter drain system should consist of a 4-inch diameter perforated drain pipe surrounded by a minimum of six (6) inches of free-draining gravel. A filter fabric should be considered around the free-draining gravel or perforated pipe to reduce the potential for an influx of fine-grained soils into the system. The invert of the drain pipe, at its high point, should be placed at approximate foundation bearing level, run around the interior or exterior perimeters of the crawl space areas with a minimum slope of ⅛-inch per foot to facilitate efficient water removal and should discharge to sump pump and pit systems. Care should be taken at the time of perimeter drain installation to avoid disturbing those soils providing support to the residence footing foundations (extending down at a 1:1 slope from the bottom edges of the footings).

As an additional precaution, we recommend a vapor barrier be installed in crawl space areas in order to help maintain in-situ soil moisture conditions and reduce the potential for migration of soil moisture into the crawl space areas. Subgrades in the crawl space areas should be sloped to drain to the perimeter drain system. The owner/client should consider consulting with a mold prevention specialist for additional precautions that could be implemented to reduce the potential for development of moist air conditions in the crawl space areas of the structures.

Backfill placed adjacent to foundation walls should consist of LVC potential and relatively impervious soils free from organic matter, debris and other objectionable materials. The natural site lean clay could be used as backfill in this area, provided the proper moisture content in those materials at the time of placement and compaction. We recommend the site lean clay and/or similar backfill soils be placed in loose lifts not to exceed 9 inches thick, adjusted in moisture content and compacted as previously outlined in this report.

Excessive lateral stresses can be imposed on foundation walls when using heavier mechanical compaction equipment. We recommend compaction of unbalanced foundation wall backfill soils be completed using light mechanical or hand compaction equipment.

Lateral Earth Pressures

For design of below-grade walls where preventative measures have been taken to reduce the potential for development of hydrostatic loads on the walls, we recommend using an at-rest equivalent fluid pressure value of 65 pounds per cubic foot. A modified active equivalent fluid pressure of 55 pounds per cubic foot could be used for partially restrained conditioned where some rotation of the below-grade walls must occur to develop the active earth pressure state. That rotation can result in cracking of the below-grade walls typically in between corners and other restrained points. The amount of deflection of the top of the wall can be estimated at 0.5% times the height of the wall.

Variables that affect lateral earth pressures include but are not limited to the shrink/swell potential of the backfill soils, backfill compaction and geometry, wetting of the backfill soils, surcharge loads and point loads developed in the backfill materials. The recommended equivalent fluid pressure values do not include a factor of safety or an allowance for hydrostatic loads. Use of expansive soil backfill, excessive compaction of the wall backfill or surcharge loads placed adjacent to the below-grade walls can add to the lateral earth pressures causing the equivalent fluid pressure values used in design to be exceeded.

Asphaltic and Portland Cement Concrete Pavements

Site pavements could be supported directly on reconditioned natural site soils and/or properly placed and compacted fill developed as outlined in the "Site Development" section of this report. The site lean clay would be subject to low remolded shear strength. A resistance value (R-value) of 5 was estimated for the site lean clay and used in the pavement section design. Traffic loading on site pavements is expected to consist of areas of low volumes of automobiles and light trucks as well as areas of heavier trash, delivery and occasional emergency vehicle traffic. Equivalent 18-kip single axle loads (ESAL's) were estimated for the quantity of site traffic anticipated. Two (2) general design classifications are outlined below in Table I. Standard duty pavements could be considered in automobile parking areas. Heavy duty pavements should be considered for access drives and other areas of the site expected to receive heavier trash, delivery and emergency truck traffic.

Proofrolling of the pavement subgrades should be completed to help identify unstable areas. Depending on the in-place moisture content of the subgrade soils immediately prior to paving, the time of year when construction occurs and other hydrologic conditions, stabilization of the subgrade soils may become necessary to develop a suitable paving platform. Isolated areas of subgrade instability can be mended on a case-by-case basis. If more widespread subgrade instability is observed at the time of proofrolling, we recommend consideration be given to stabilization of the pavement subgrades with Class C fly ash. If stabilization is required, additional evaluation of the subgrade soluble sulfate content should be completed in stabilization areas. With the increase in support strength developed by the fly ash stabilization procedures, it is our opinion some credit for the stabilized zone could be included in the pavement section design, reducing the required thickness of overlying asphaltic concrete and aggregate base course. Pavement section design options incorporating some structural credit for the stabilized subgrade soils are outlined below in Table 1. Fly ash-stabilization can also eliminate some of the uncertainty associated with attempting to pave late in the season and during periods of inclement weather.

Pavement section design options are outlined below in Table 1. Alternative pavement sections could be considered and we would be happy to discuss any alternatives at your request. It has been our experience that full-depth asphaltic concrete pavement sections typically do not perform as well as structurally equivalent composite pavement sections in areas of lean clay subgrade soils and we do not recommend full-depth asphalt sections be constructed for this project. Alternative pavement sections could be considered and we would be happy to discuss any alternatives at your request.

TABLE 1 – PAVEMENT SECTION DESIGN

	Standard Duty	**Heavy Duty**
Option A – Composite		
Asphaltic Concrete (Grading S or SX)	4”	5”
Aggregate Base (Class 5 or 6)	6”	8”
Option B – Composite on Stabilized Subgrade		
Asphaltic Concrete (Grading S or SX)	3”	4”
Aggregate Base (Class 5 or 6)	4”	6”
Fly Ash Stabilized Subgrade	12”	12”
Option C – Portland Cement Concrete Pavement	5”	6”

Asphaltic concrete should consist of a bituminous plant mix composed of a mixture of aggregate, filler, binders and additives (if required) meeting the design requirements of the Town of Dacono or other governing entity. Aggregate used in the asphaltic concrete should meet specific gradation requirements such as Colorado Department of Transportation (CDOT) grading S (¾-inch minus) or SX (½-inch minus) specifications. Hot mix asphalt designed using "Superpave" criteria should be compacted to within 92 to 96% of the materials Maximum Theoretical Density. Aggregate base should be consistent with CDOT requirements for Class 5 or Class 6 aggregate base, placed in loose lifts not to exceed 9 inches thick and compacted to at least 95% of the materials standard Proctor maximum dry density.

If fly ash stabilization procedures will be completed, we recommend the addition of 12% Class 'C' fly ash based on component dry unit weights. A 12-inch-thick stabilized zone should be constructed by thoroughly blending the fly ash with the in-place subgrade soils. Some "fluffing" of the finish subgrade level should be expected with the stabilization procedures. The blended materials should be adjusted in moisture content to within the range of ±2% of standard Proctor optimum moisture content and compacted to at least 95% of the material's standard Proctor maximum dry density within two (2) hours of fly ash addition.

For areas subjected to truck turning movements and/or concentrated and repetitive loading such as dumpster or truck parking and loading areas, we recommend consideration be given to the use of Portland cement concrete pavement with a minimum thickness of 6 inches. The concrete used for site pavements should be air entrained and have a minimum 28-day compressive strength of 4,000 psi. Woven wire mesh or fiber entrained concrete should be considered to help in the control of shrinkage cracking.

The proposed pavement section designs do not include an allowance for excessive loading conditions imposed by heavy construction vehicles or equipment. Heavily loaded concrete or other building material trucks and construction equipment can cause some localized distress to site pavements. The recommended pavement sections are minimums and periodic maintenance efforts should be expected. A preventative maintenance program can help increase the service life of site pavements.

Drainage

Positive drainage is imperative for satisfactory long-term performance of the proposed residences and associated site improvements. We recommend positive drainage be developed away from the structures during construction and maintained throughout the life of the site improvements, with twelve (12) inches of fall in the first 10 feet away from the residences. Shallower slopes could be considered in hardscape areas. In the event that poor or negative drainage develops adjacent to the residences over time, the original grade and associated positive drainage outlined above should be immediately restored.

Care should be taken in the planning of landscaping to avoid features which could result in the fluctuation of the moisture content of the foundation bearing and/or flatwork subgrade soils. We recommend watering systems be placed a minimum of 5 feet away from the perimeters of the site structures and be designed to discharge away from all site improvements. Gutter systems should be considered to help reduce the potential for water ponding adjacent to the buildings, with the gutter downspouts, roof drains or scuppers extended to discharge a minimum of 5 feet away from structural, flatwork and pavement elements. Water which is allowed to pond adjacent to site improvements can result in unsatisfactory performance of those improvements over time.

GENERAL COMMENTS

This report was prepared based upon the data obtained from the completed site exploration, laboratory testing, engineering analysis and any other information discussed. The completed borings provide an indication of subsurface conditions at the boring locations only. Variations in subsurface conditions can occur in relatively short distances away from the borings. This report does not reflect any variations which may occur across the site or away from the borings. If variations in the subsurface conditions anticipated become evident, the geotechnical engineer should be notified immediately so that further evaluation can be completed and when warranted, alternative recommendations provided.

The scope of services for this project does not include either specifically or by implication any biological or environmental assessment of the site or identification or prevention of pollutants or hazardous materials or conditions. Other studies should be completed if concerns over the potential of such contamination or pollution exist.

The geotechnical engineer should be retained to review the plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications. The geotechnical engineer should also be retained to provide testing and observation services during construction to help determine that the design requirements are fulfilled.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with the generally accepted standard of care for the profession. No warranties express or implied, are made. The conclusions and recommendations contained in this report should not be considered valid in the event that any changes in the nature, design or location of the project as outlined in this report are planned, unless those changes are reviewed and the conclusions of this report modified and verified in writing by the geotechnical engineer.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the enclosed information or if we can be of further service to you in any way, please do not hesitate to contact us.

Very Truly Yours,
Soilogic, Inc.

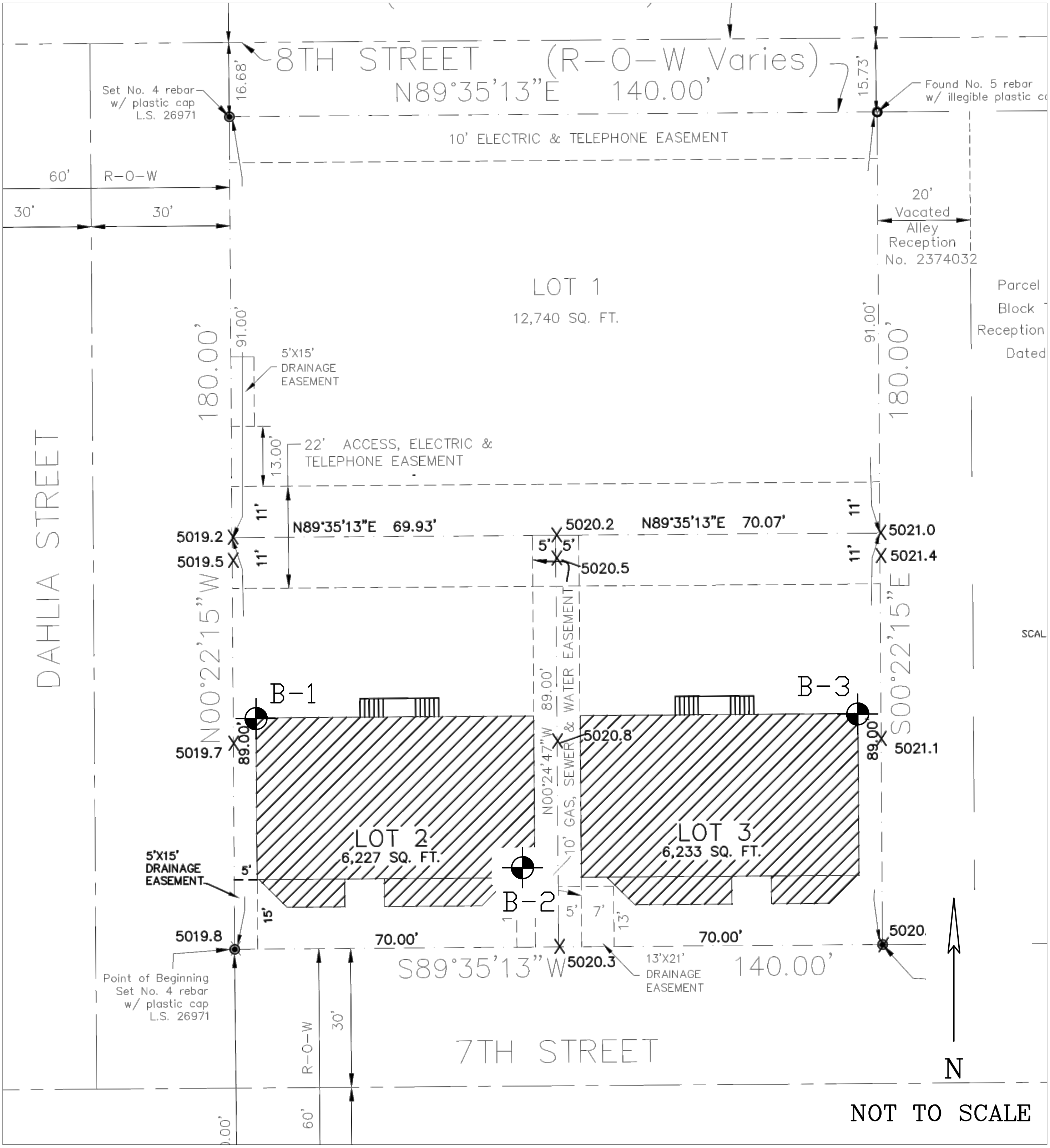
Darrel DiCarlo, P.E.
Senior Project Engineer

Reviewed by:

Wolf von Carlowitz, P.E.
Principal Engineer

FEBRUARY 2021
PROJECT #21-1003

BORING LOCATION DIAGRAM



LOTS 2 & 3, HAMILTON SUBDIVISION

NORTHEAST CORNER OF 7TH STREET & DAHLIA AVENUE, DACONO, COLORADO

LOTS 2 & 3, HAMILTON SUBDIVISION

NE CORNER OF 7^{TH} STREET & DAHLIA AVENUE, DACONO, COLORADO
Project # 21-1003
February 2021

LOG OF BORING B-1

Sheet	1/1	Drilling Rig:	CME 45	Water Depth Information	
Start Date	1/26/2021	Auger Type:	4" CFA	During Drilling	10.0'
Finish Date	1/26/2021	Hammer Type:	Automatic	After Drilling	10.0'
Surface Elev.	-	Field Personnel:	JL / BM	6 Days After Drilling	9.0'

USCS	SOIL DESCRIPTION	Depth (ft)	Sampler	"N"	MC (%)	DD (pcf)	Estimated q_u (psf)	% Swell @ 500 psf	Swell Pressure (psf)	Atterberg Limits LL	Atterberg Limits PI	% Passing # 200 Sieve (%)
	4" GRAVEL SURFACING	-										
		1										
		-										
		2										
		-										
		3										
		-										
		4										
		-										
		5	**CS**	**12**	**21.7**	**98.7**	**4000**	**None**	**<500**	**-**	**-**	**-**
		-										
CL	LEAN CLAY with SAND	6										
	dark to light brown, beige, rust	-										
	soft to stiff	7										
		-										
		8										
		-										
		9										
		-										
		10	**CS**	**4**	**25.1**	**100.0**	**1000**	**None**	**<500**	**-**	**-**	**-**
		-										
		11										
		-										
		12										
		-										
		13										
		-										
	SILTSTONE/CLAYSTONE	14										
	gray, olive, rust	-										
	firm	**15**	**CS**	**26**	**18.4**	**112.7**	**9000+**	**-**	**-**	**-**	**-**	**-**
	BOTTOM OF BORING @ 15.0'	-										
		16										
		-										
		17										
		-										
		18										
		-										
		19										
		-										
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		25										

LOTS 2 & 3, HAMILTON SUBDIVISION

NE CORNER OF 7TH STREET & DAHLIA AVENUE, DACONO, COLORADO

Project # 21-1003

February 2021

LOG OF BORING B-2

Sheet	1/1	Drilling Rig:	CME 45	Water Depth Information	
Start Date	1/26/2021	Auger Type:	4" CFA	During Drilling	11.0'
Finish Date	1/26/2021	Hammer Type:	Automatic	After Drilling	11.0'
Surface Elev.	-	Field Personnel:	JL / BM	6 Days After Drilling	9.5'

USCS	SOIL DESCRIPTION	Depth (ft)	Sampler	"N"	MC (%)	DD (pcf)	Estimated q_u (psf)	% Swell @ 500 psf	Swell Pressure (psf)	Atterberg Limits LL	Atterberg Limits PI	% Passing # 200 Sieve (%)
	4" GRAVEL SURFACING	-										
		1										
		-										
		2										
		-										
		3	CS	16	18.2	106.0	9000+	0.1%	1000	-	-	-
		-										
		4										
		-										
		5	CS	10	25.4	96.6	<500	None	<500	37	19	85.1%
		-										
CL	LEAN CLAY with SAND	6										
	dark to light brown, beige, rust	-										
	medium stiff to stiff	7										
		-										
		8										
		-										
		9										
		-										
		10	CS	6	23.3	101.6	1000	-	-	-	-	-
		-										
		11										
		-										
		12										
SP-SM	with SAND and GRAVEL lenses	-										
		13										
		-										
	SILTSTONE/CLAYSTONE	14										
	gray, olive, rust	-										
	firm	**15**	CS	31	21.7	106.5	5000	-	-	-	-	-
	BOTTOM OF BORING @ 15.0'	-										
		16										
		-										
		17										
		-										
		18										
		-										
		19										
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		-										
		25										

LOTS 2 & 3, HAMILTON SUBDIVISION

NE CORNER OF 7TH STREET & DAHLIA AVENUE, DACONO, COLORADO

Project # 21-1003

February 2021

LOG OF BORING B-3

Sheet	1/1	Drilling Rig:	CME 45	Water Depth Information	
Start Date	1/26/2021	Auger Type:	4" CFA	During Drilling	10.0'
Finish Date	1/26/2021	Hammer Type:	Automatic	After Drilling	10.0'
Surface Elev.	-	Field Personnel:	JL / BM	6 Days After Drilling	10.0'

USCS	SOIL DESCRIPTION	Depth (ft)	Sampler	"N"	MC (%)	DD (pcf)	Estimated q_u (psf)	% Swell @ 500 psf	Swell Pressure (psf)	Atterberg Limits LL	Atterberg Limits PI	% Passing # 200 Sieve (%)
	4" GRAVEL SURFACING	-										
		1										
		-										
		2										
		-										
		3										
		-										
		4										
		-										
		5	**CS**	**11**	**22.8**	**99.6**	**2000**	**None**	**<500**	**-**	**-**	**-**
		-										
CL	LEAN CLAY with SAND	6										
	dark to light brown, beige, rust	-										
	medium stiff to stiff	7										
		-										
		8										
		-										
		9										
		-										
		10	**CS**	**6**	**24.4**	**95.7**	**<500**	**None**	**<500**	**-**	**-**	**-**
		-										
		11										
		-										
		12										
		-										
		13										
SP-SM	with SAND and GRAVEL lenses	-										
		14										
		-										
	SILTSTONE/CLAYSTONE, weathered	**15**	**CS**	**18**	**21.3**	**105.9**	**9000+**	**-**	**-**	**-**	**-**	**-**
	BOTTOM OF BORING @ 15.0'	-										
		16										
		-										
		17										
		-										
		18										
		-										
		19										
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		24										
		-										
		25										

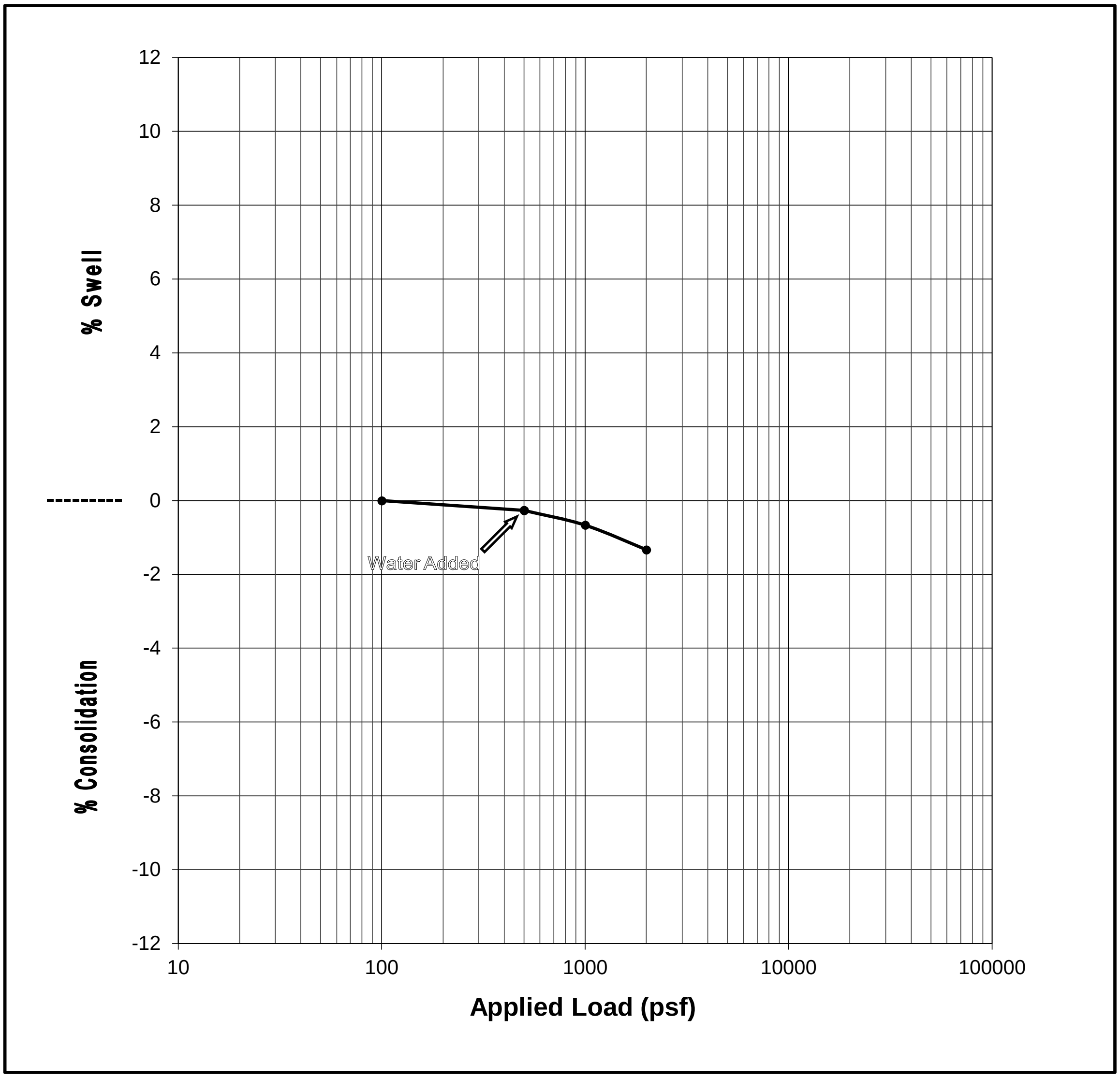
LOTS 2 & 3, HAMILTON SUBDIVISION

NE CORNER OF 7TH STREET & DAHLIA AVENUE, DACONO, COLORADO

Project # 21-1003

February 2021

SWELL/CONSOLIDATION TEST SUMMARY



Sample ID: B-1 @ 4

Sample Description: Brown Lean Clay with Sand (CL)

Initial Moisture	21.7%	Liquid Limit	-
Final Moisture	21.8%	Plasticity Index	-
% Swell @ 500 psf	None	% Passing #200	-
Swell Pressure (psf)	<500	Dry Density (pcf)	98.7

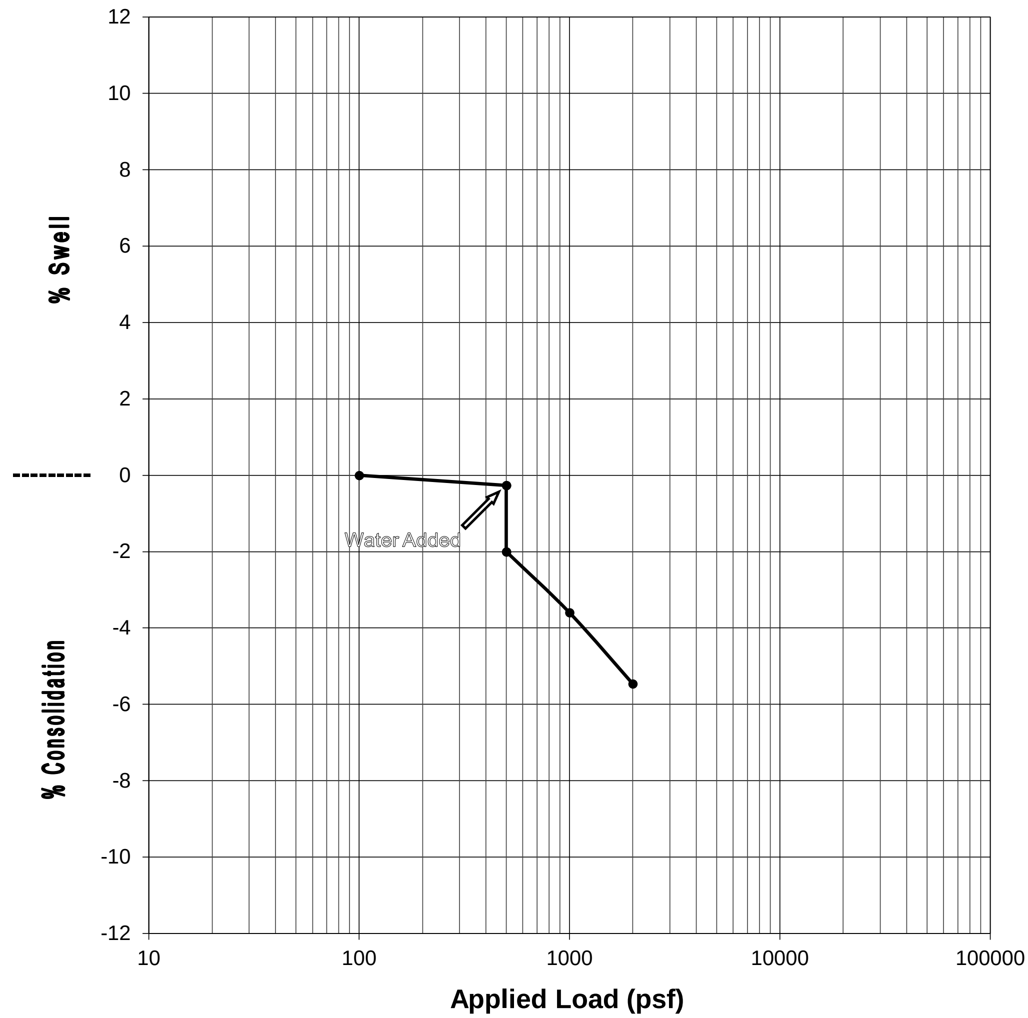
LOTS 2 & 3, HAMILTON SUBDIVISION

NE CORNER OF 7TH STREET & DAHLIA AVENUE, DACONO, COLORADO

Project # 21-1003

February 2021

SWELL/CONSOLIDATION TEST SUMMARY



Sample ID: B-1 @ 9

Sample Description: Light Brown Lean Clay with Sand (CL)

(disturbed sample)

Initial Moisture	25.1%	Liquid Limit	-
Final Moisture	22.4%	Plasticity Index	-
% Swell @ 500 psf	None	% Passing #200	-
Swell Pressure (psf)	<500	Dry Density (pcf)	100.0

LOTS 2 & 3, HAMILTON SUBDIVISION

NE CORNER OF 7TH STREET & DAHLIA AVENUE, DACONO, COLORADO

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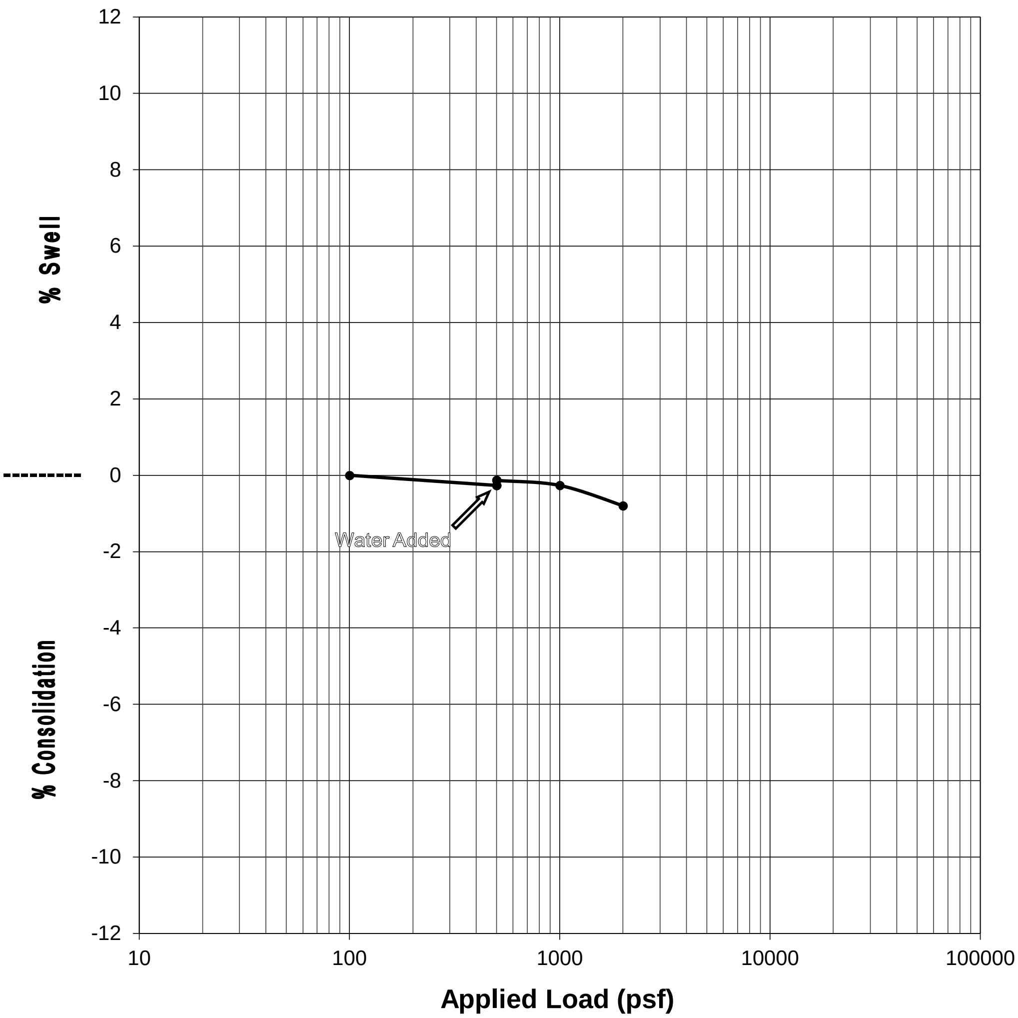
February 2021

SWELL/CONSOLIDATION TEST SUMMARY



Sample ID: B-2 @ 2

Sample Description: Brown Lean Clay with Sand (CL)

Initial Moisture	18.2%	Liquid Limit	-
Final Moisture	18.8%	Plasticity Index	-
% Swell @ 500 psf	0.1%	% Passing #200	-
Swell Pressure (psf)	1,000	Dry Density (pcf)	106.0

LOTS 2 & 3, HAMILTON SUBDIVISION

NE CORNER OF 7TH STREET & DAHLIA AVENUE, DACONO, COLORADO

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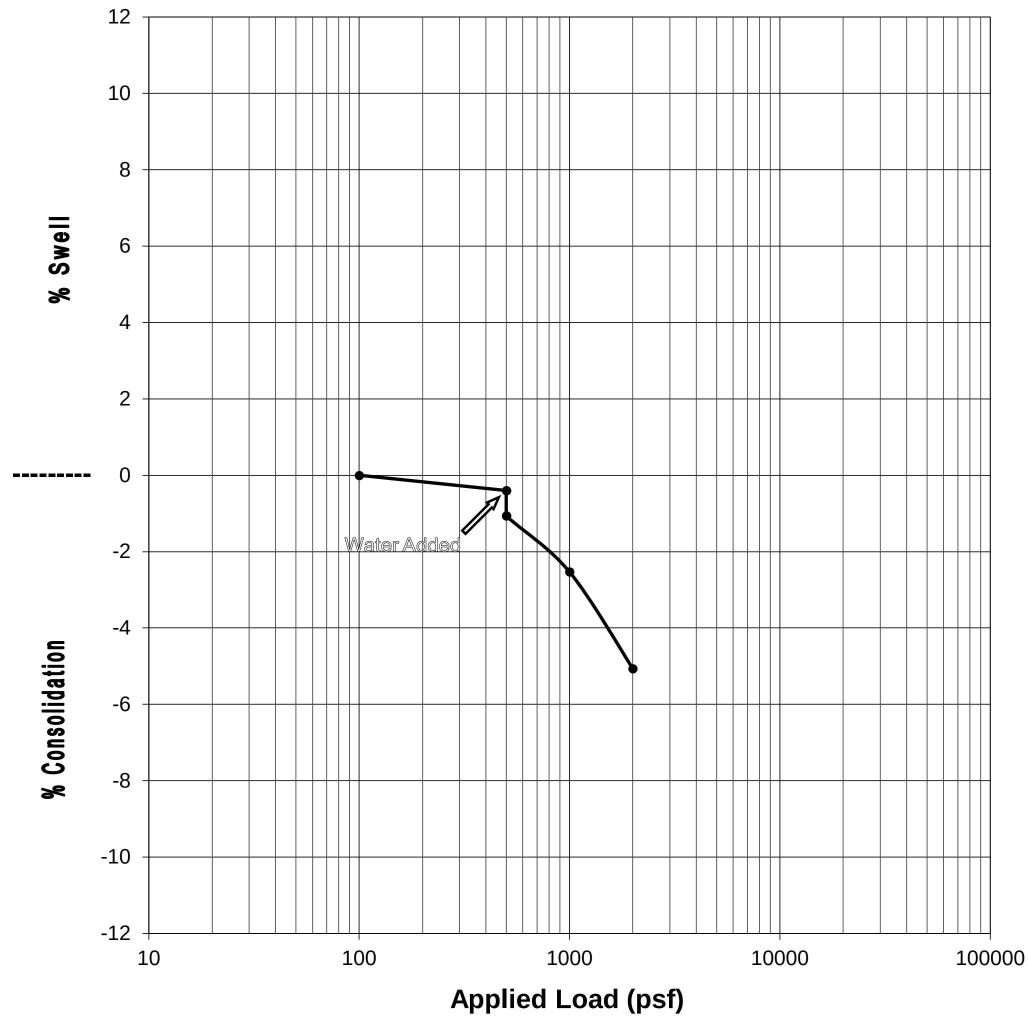

Sample ID: B-2 @ 4

Sample Description: Brown Lean Clay with Sand (CL)

Initial Moisture	25.4%	Liquid Limit	37
Final Moisture	24.0%	Plasticity Index	19
% Swell @ 500 psf	None	% Passing #200	85.1%
Swell Pressure (psf)	<500	Dry Density (pcf)	96.6

LOTS 2 & 3, HAMILTON SUBDIVISION

NE CORNER OF 7TH STREET & DAHLIA AVENUE, DACONO, COLORADO

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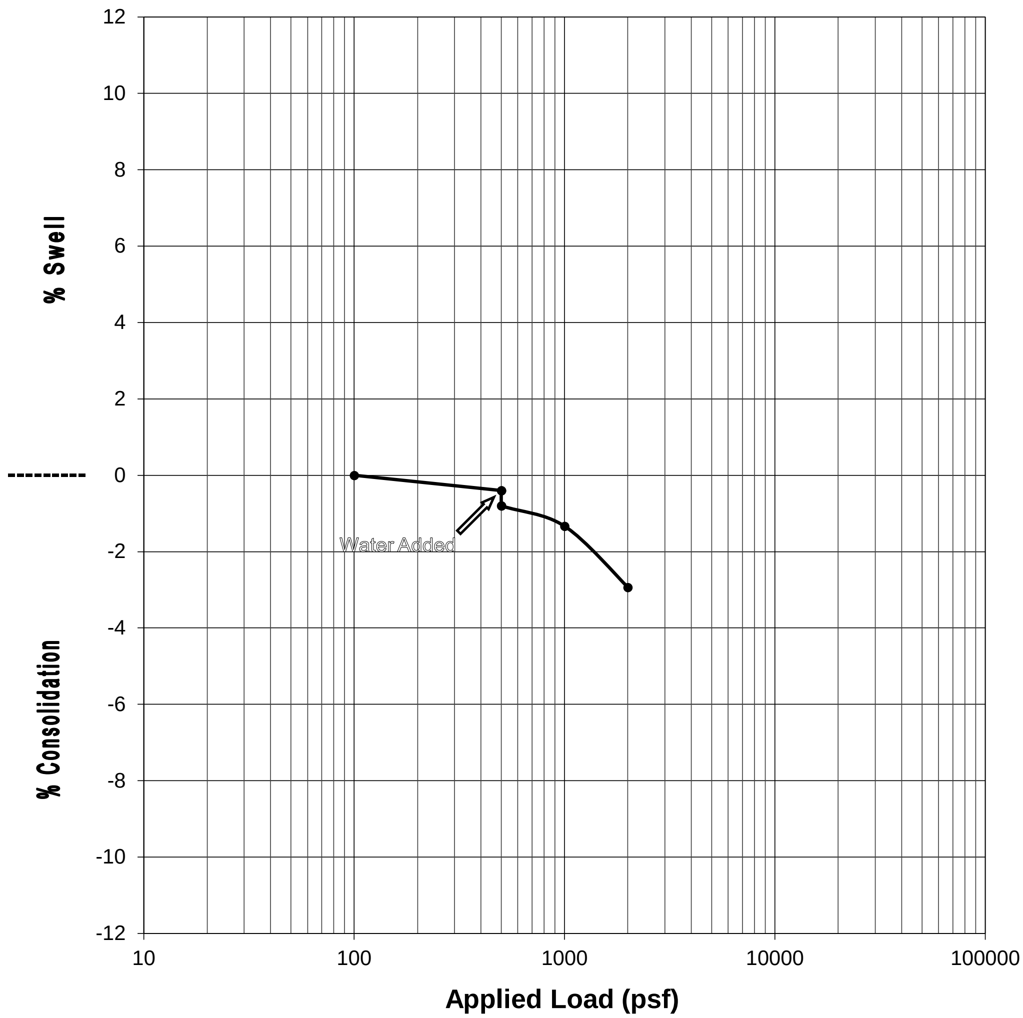
SWELL/CONSOLIDATION TEST SUMMARY



Sample ID: B-3 @ 4

Sample Description: Brown Lean Clay with Sand (CL)

Initial Moisture	22.8%	Liquid Limit	-
Final Moisture	23.8%	Plasticity Index	-
% Swell @ 500 psf	None	% Passing #200	-
Swell Pressure (psf)	<500	Dry Density (pcf)	99.6

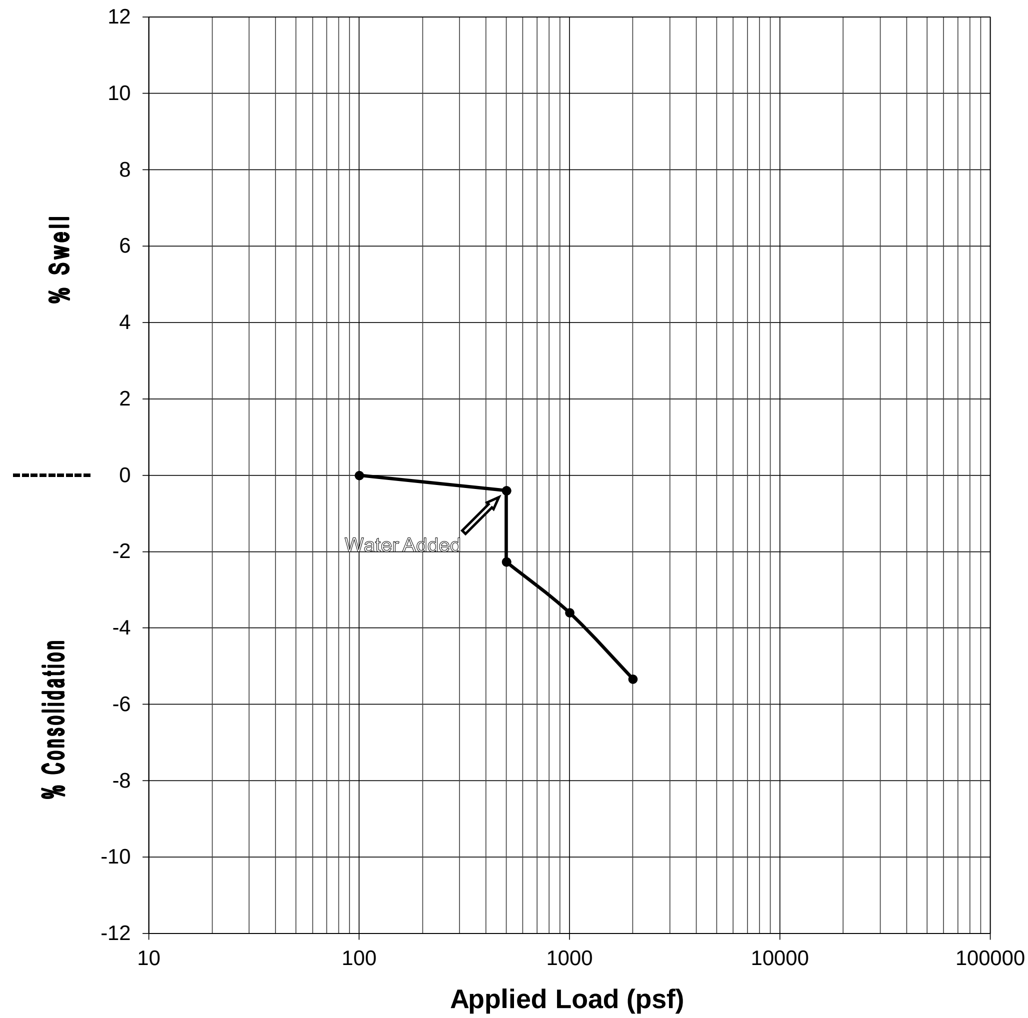
LOTS 2 & 3, HAMILTON SUBDIVISION

NE CORNER OF 7TH STREET & DAHLIA AVENUE, DACONO, COLORADO

Project # 21-1003

February 2021

SWELL/CONSOLIDATION TEST SUMMARY



Sample ID: B-3 @ 9

Sample Description: Light Brown Lean Clay with Sand (CL)

(disturbed sample)

Initial Moisture	24.4%	Liquid Limit	-
Final Moisture	21.6%	Plasticity Index	-
% Swell @ 500 psf	None	% Passing #200	-
Swell Pressure (psf)	<500	Dry Density (pcf)	95.7

SOILOGIC

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: 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 ≥ 4 and 1 ≤ Cc ≤ 3[E]	GW	Well graded gravel[F]
			Cu < 4 and/or 1 > Cc > 3[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 ≥ 6 and 1 ≤ Cc ≤ 3[E]	SW	Well graded sand[I]
			Cu < 6 and/or 1 > Cc > 3[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" line[J]	CL	Lean clay[K,L,M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K,L,M]
		Organic	**Liquid limit - oven dried** / **Liquid limit - not dried** < 0.75	OL	Organic clay[K,L,M,N]
					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 / Liquid limit - not dried < 0.75	OH	Organic clay[K,L,M,P]
					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-in. (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] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[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.

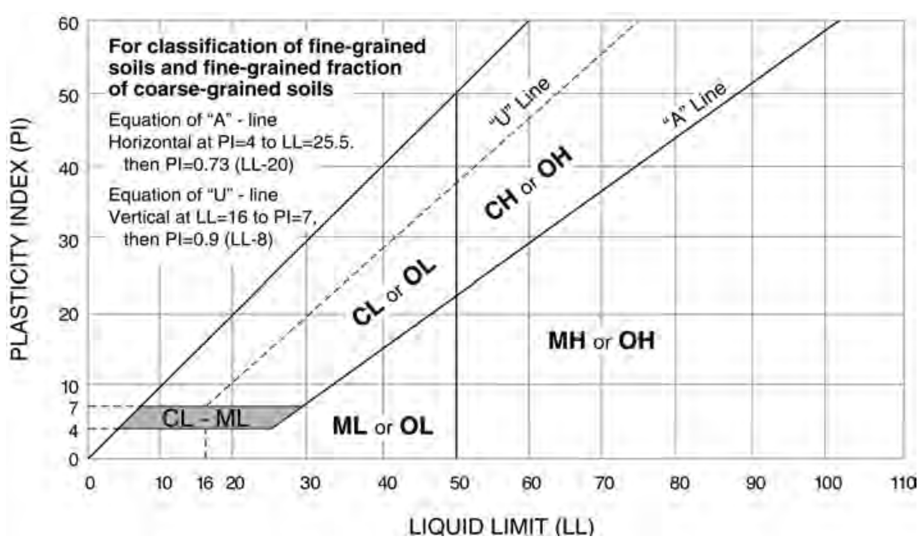
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[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.



GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1⅜" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2.5" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
CS:	California Barrel - 1.92" I.D., 2.5" O.D., unless otherwise noted	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value". For 2.5" O.D. California Barrel samplers (CB) the penetration value is reported as the number of blows required to advance the sampler 12 inches using a 140-pound hammer falling 30 inches, reported as "blows per inch," and is not considered equivalent to the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling
WCI:	Wet Cave in	WD:	While Drilling
DCI:	Dry Cave in	BCR:	Before Casing Removal
AB:	After Boring	ACR:	After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

FINE-GRAINED SOILS

(CB) Blows/Ft.	(SS) Blows/Ft.	Consistency
< 3	0-2	Very Soft
3-5	3-4	Soft
6-10	5-8	Medium Stiff
11-18	9-15	Stiff
19-36	16-30	Very Stiff
> 36	> 30	Hard

COARSE-GRAINED SOILS

(CB) Blows/Ft.	(SS) Blows/Ft.	Relative Density
0-5	< 3	Very Loose
6-14	4-9	Loose
15-46	10-29	Medium Dense
47-79	30-50	Dense
> 79	> 50	Very Dense

BEDROCK

(CB) Blows/Ft.	(SS) Blows/Ft.	Consistency
< 24	< 20	Weathered
24-35	20-29	Firm
36-60	30-49	Medium Hard
61-96	50-79	Hard
> 96	> 79	Very Hard

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Terms of Other Constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Terms of Other Constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifiers	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

SOILOGIC