Earthtec Engineering

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July 13, 2015

Mr. Martin Nobs
50 River Bluff Road
Elgin, IL 60120

Re: **Engineering Geology Assessment**
Lot 15, Ski Lake Estates No. 3
6640 East 1100 South
Huntsville, Utah
Job No. 145150

Mr. Nobs:

This letter summarizes our engineering geology assessment of the subject lot located in Huntsville, Weber County, Utah. Earthtec Engineering previously completed a geotechnical engineering study[1] for the subject lot. A map showing the approximate location of the subject property is included as Figure No. 1, *Vicinity Map*, at the end of this report.

Purpose

The purpose of this assessment is to address concerns and questions raised by Simon Associates, LLC and Taylor Geotechnical, third-party consultants hired by Weber County to review the referenced geotechnical report. A Project Memorandum[2] issued by Simon Associates, LLC states that it is their opinion that the subject lot is located in a geologically sensitive area. Specifically the memorandum presents the following concerns:

1. "The site is underlain by geologic unit Tn, Norwood Formation, an extremely landslide-prone geologic unit. Personally, I believe any site underlain by Tn should have a qualified engineering geologist, at a minimum, review, if not log, subsurface explorations."
2. "There are several landslides in the immediate vicinity of the site (geologic unit Qms), all within unit Tn."

The referenced memorandum also states the following: "Based on the geologic map, Norwood Formation bedrock should have been documented within a few feet of the ground surface. Alternatively, the site may be underlain by a landslide, not recognized by the engineer or delineated on the geologic map due to the scale of the geologic map.

Based on the documents reviewed and my experience in the area, specifically with the Norwood Formation, I recommend the site be treated as a geologically sensitive (e.g., hazardous) site and also be evaluated by a qualified engineering geologist."

It should be noted that at the time of the completion of the original geotechnical report for the subject lot, Weber County did not require an engineering geologic assessment, including review

[1] Geotechnical Study, Lot 15 Ski Lake Estates No. 3, 6640 East 1100 South, Huntsville, Utah; Earthtec Engineering, Project No. 145150G, June 23, 2014.

[2] Project Memorandum, Report – Geotechnical Study, Lot 15 Ski Lake Estates No. 3, 6640 East 1100 South, Huntsville, Utah, prepared by Earthtec Engineering (Project No. 145150G), dated June 23, 2014, prepared for Mr. Martin Nobs, 50 River Bluff Road, Elgin, IL 60120. To: Alan Taylor, From: David B. Simon, May 29, 2015.

by an engineering geologist, for proposed development at the location of the subject lot.

The purpose of this engineering geology assessment is to address the geologic hazards concerns raised by Weber County's consultants pertaining to the proposed development of the single family residence for the subject lot. Specifically, this assessment will address the presence of the Norwood Formation and other geologic units or features below the surface of the subject lot, evidence of any past slope movement on the lot and adjacent properties, and the potential for future slope instability based on field observations, additional subsurface exploration, additional laboratory testing of soil samples, and additional slope stability modeling performed separately by engineers from Earthtec Engineering.

Scope of Work

A project meeting to discuss the scope of the engineering geology assessment for the subject lot was held via conference call on June 15, 2015. Participating in the conference call meeting were the following individuals:

Dana Shuler, P.E., Weber County Engineering Department
David Simon, P.G., Simon Associates, LLC
Alan Taylor, P.E., Taylor Geotechnical
Karl Lundin, Lundin Homes, LLC
Mark Larsen, P.G., Earthtec Engineering

The following scope of work was completed as part of this engineering geology assessment for the subject lot:

1. A review of available, published geologic and geologic hazards maps that include the location of the subject lot and surrounding area.

2. A review of available aerial photographs of the subject lot and surrounding area. When possible, the photographs were observed in stereo pairs

3. The excavation and logging of additional test pits on the subject lot under the supervision of an experienced engineering geologist. The purpose of the additional test pits was to clarify and refine the test pit logs included in the original geotechnical study, to observe the subsurface soils and bedrock for evidence of past slope movements and other geological or structural features/conditions that could contribute to future instability, to acquire additional subsurface data to aid in the completion of a geologic cross section of the lot, and to obtain additional samples of rock and soils for laboratory analysis to aid in the completion of additional slope stability modeling.

4. The completion of a geologic cross section through the subject lot using data obtained from the subsurface explorations on the lot as well as topographic information provided by the client's building contractor.

5. The completion of this letter report summarizing the findings and conclusions of our engineering geology assessment.

The above listed individuals were all present on the subject lot on June 19, 2015 during the logging and review of two of the additional test pits that were excavated.

Site Description

The subject lot is a nearly rectangular shaped lot located on the northeast side of 1100 South Street. At the time of assessment, the lot consisted of an undeveloped parcel that was heavily vegetated with native grasses, weeds, and underbrush with a few scattered trees. The subject property slopes downward to the northeast from 1100 South Street at an average approximate grade of 26 percent. The slope of the lot is generally quite uniform with slightly steeper grades adjacent to 1100 South Street and flattening slightly on the lower portions of the lot. There is an approximate change in elevation of 82 feet across the property. The subject lot is bounded on the north and east by existing residential development, on the south by 1100 South Street, and on the west by an undeveloped lot.

Geologic Setting

The subject lot is located near the base of the northeast sloping foothills on the eastern flank of the Wasatch Mountain Range in North-Central Utah. These foothills form the southwestern margin of the Ogden Valley, a northwest to southeast trending valley located between the Wasatch Mountains to the west and the southern end of the Bear River Range to the east. The Ogden Valley is part of the Wasatch Hinterlands Section of the Middle Rocky Mountain Physiographic Province. Stokes[3] describes the Wasatch Hinterlands as a belt of mixed, moderately rugged topography located on the east side of the Wasatch Range that has varied topography, with hilly areas dominating valley areas. The Ogden Valley is currently occupied by Pineview Reservoir, a manmade lake formed by damming the Ogden River and several of its tributaries, as well as the towns of Huntsville, Eden, and Liberty.

Structurally the Ogden Valley is a down-faulted block bound on the northeast by the northwest to southeast oriented Northeastern Margin Fault and on the southwest by the northwest to southeast oriented Southwestern Margin Fault, as described by Hecker[4]. The northwest to southeast oriented North Fork Fault also runs below the central portion of the Ogden Valley. None of these faults are mapped by Hecker to be active (showing evidence of movement during Holocene (past 10,000 years) time).

The Ogden Valley was prehistorically occupied by an arm of Lake Bonneville, a Pleistocene age, fresh water lake that covered most of northwestern Utah and parts of northeastern Nevada. Sediment deposited by the lake are still present within portions of the valley and at places within the foothills surrounding the valley below the elevation of the high stand of the lake which was between approximately 5,170 and 5,200 feet above sea level. The Great Salt Lake of northwestern Utah is a remnant of ancient Lake Bonneville.

The geology at the location of the subject lot and surrounding area has been mapped by King,

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[3] Stokes, W. L., 1986, Geology of Utah; Utah Museum of Natural History, University of Utah and Utah Geological and Mineral Survey, Department of Natural Resources, p. 242-243.

[4] Hecker, S., 1993, Quaternary Tectonics of Utah With Emphasis on Earthquake-Hazard Characterization: Utah Geological Survey, Bulletin 127, p. 79.

Yonkee, and Coogan[5]. The geology at the location of the subject lot as shown on the referenced map is Lake Bonneville fine-grained deposits (Map Unit Qlf, upper Pleistocene) overlying older deposits of the Norwood Formation (Map Unit Tn, lower Oligocene and upper Eocene). The Norwood Formation is extensive along the margins of the Ogden Valley, the Morgan Valley to the south, and in the hilly terrain between the valleys. The formation is known to be very prone to experiencing landslide activity. Several landslides (Map Units Qmsy and Qms) are mapped approximately 200 to 360 feet to the east of the subject lot on the referenced geologic map. These mapped landslides appear to have occurred within the Norwood Formation. No landslide deposits or features are mapped on or immediately adjacent to the subject lot on the referenced map. However, the literature accompanying the referenced map states that some landslides and other slope failure features may not have been mapped due to scale. A portion of the referenced geologic map that includes the location of the subject property and surrounding area is included as Figure No. 2, *Site Geologic Map*, at the end of this report. It should be noted that the geologic units included on Figure No. 2 are only those mapped at the location of the subject lot and immediate surrounding areas.

Geologic Hazards Maps

The landslide map[6] of the Ogden 30' x 60' quadrangle was also reviewed as part of this assessment. The landslide map shows no landslides or landslide features on or adjacent to the subject lot. The nearest mapped landslide to the subject lot is approximately 2,000 feet to the south. However, it should be noted that some landslides may not have been included on the referenced landslide map due to scale.

No other geologic hazards maps were reviewed as part of this assessment.

Aerial Photographs

Available aerial photographs obtained from the Utah Geological Survey's Aerial Imagery Collection[7] were reviewed. The only available photos covering the location of the subject property and surrounding area were taken in 1946 at a scale of 1:20,000. The resolution of the 1946 aerial photographs was found to be poor and our review of the photos did not reveal any useful information. More recent aerial images of the subject property and surrounding area were viewed via the internet at www.google.earth.com. The reviewed photographs were taken in the years 1993, 1997, 2004, 2006, 2009, 2011, and 2014. None of the reviewed recent photographs show any evidence of landslide activity or related slope movements at or surrounding the subject property.

As part of this assessment, we also attempted to locate available LiDAR imagery of the subject area, however, no LiDAR imagery covering the location could be found.

Geologic Site Reconnaissance

On June 19, 2015 a professional geologist with Earthtec Engineering conducted a reconnaissance of the subject lot and adjacent, surrounding areas. The purpose of the reconnaissance was to observe the subject lot and adjacent, surrounding areas for surficial evidence of past or ongoing slope movements related to possible landslide activity as well as

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[5] King, J.K., Yonkee, W.A., and Coogan, J.C., 2008, Interim Geologic Map of the Snow Basin Quadrangle and Part of the Huntsville Quadrangle, Davis, Morgan, and Weber Counties, Utah; Utah Geological Survey, Open-File Report 536, Map Scale 1:24,000.

[6] Elliott, A.H., and Harty, K.M., 2010, Landslide Maps of Utah, Ogden 30' x 60' Quadrangle; Utah Geological Survey, Map 246DM, Plate 6 of 46, Scale 1:100,000.

[7] https://geodata.geology.utah.gov/imagery/, Photos AAJ-2B-28 and AAJ-2B-29, Scale 1:20,000.

other potential geologic hazards. Our reconnaissance did not reveal any evidence of surficial features on or immediately adjacent to the subject lot, including scarps, hummocky terrain, ground cracking, disturbed vegetation, slumps, significant cracking in adjacent paved roads, or noticeable distress to nearby houses or landscaping, that would indicate recent or ongoing slope movement. Several houses have been constructed on the mapped landslides to the east of the subject lot. We did not observe any noticeable distress to the exteriors of the structures or in landscaped areas on these lots. Additionally, no significant cracking or other signs of distress were observed in the pavement of 1100 South Street both adjacent to the subject lot and in the areas where the street crosses the mapped landslides to the east and southeast of the subject lot.

No other surficial evidence of past or ongoing hazardous geologic activity was observed on or adjacent to the subject lot. No scarps related to past earthquake-induced surface rupture were observed. No apparent landslide or debris flow deposits were observed at the surface. No rockfall clasts or rockfall source areas were observed on or near the lot. No springs or groundwater seeps were observed on the subject lot or adjacent properties.

Additional Subsurface Exploration

At the time of the original geotechnical report for the subject lot, two test pits where excavated on the lot and logged by a geotechnical engineer with Earthtec Engineering. The original test pits were designated as TP-1 and TP-2 in the referenced geotechnical report and the approximate locations of the test pits were shown on a aerial photograph of the lot included in the report. On June 19, 2015, two additional test pits were excavated on the subject lot using a track-mounted excavator. These additional test pits were designated as TP-3 and TP-4. The approximate locations of the original test pits and the additional test pits on the lot are shown on Figure No. 3, *Site Plan and Locations of Test Pits*, at the end of this report. The additional test pits (TP-3 and TP-4) were logged by an experienced engineering geologist from Earthtec Engineering. As previously discussed, a representative from the Weber County Engineering Department as well as the third-party geotechnical engineer and engineering geologist, retained by the County, were present on-site on the afternoon of June 19th to observe the test pits and review the logs. On June 22, 2015, a geotechnical engineer from Earthtec Engineering returned to the lot with the excavator and oversaw the excavation of an addition test pit (TP-5) in the area of the proposed house on the lot as well as extending TP-3 down slope to the elevation of TP-4. This was done to provide additional subsurface observation in order to better understand the shallow subsurface geology at the site. Test Pit TP-5 and the extension of TP-3 were not logged but were photographed by the engineer. In addition to observing and logging the test pits, additional samples were obtained from TP-3 and TP-4 for the purpose of providing additional lab testing data to aid in additional slope stability modeling for the subject lot. All of the test pits on the lot were back-filled following the completion of our field work on June 22nd.

Subsurface Conditions

Logs of test pits TP-1 and TP-2 are included in the referenced geotechnical report previously completed for the subject lot. As previously discussed, the representative logs of Test Pits TP-3 and TP-4 were completed in the field on June 19th and later refined in the office. The completed logs of TP-3 and TP-4 are included at the end of this report as Figure Nos. 4 and 5, Test Pit Logs. The northwest walls of the test pits were logged at a scale of 1 inch equals 5 feet using typical logging methods. Detailed descriptions of the soils and rock exposed in the test pits are included on Figure Nos. 4 and 5.

As shown on Figure No. 4, TP-3 exposed approximately 1½ to 2 feet of relatively well-formed, modern topsoil (Soil "A" Horizon) at the surface (Unit 1, Figure No. 4). The topsoil was formed on what is interpreted to be slope wash deposits consisting of sandy Lean Clay (CL) (Unit 2, Figure No. 4) observed to be approximately 2½ to 5 feet thick at the location of the test pit. No significant internal stratification was observed within the slope wash deposits and the in-situ soils were estimated to be soft to medium stiff. Underlying the slope wash deposits, and extending to the base of the test pit which was approximately 16½ feet below the surface at its deepest point, we observed thin to moderately bedded deposits of Silty Sand (SM) with thin layers of interbedded Silt (ML) and occasional Lean Clay (CL) layers. These deposits (Unit 3, Figure No. 4) are interpreted to be lacustrine deposits of the Bonneville lake cycle and correlate with mapped Unit Qlf mapped by King and others (2008). Bedding within Unit 3 was measured to dip (apparent) down to the northeast at between approximately 3 and 8 degrees. The Bedding was observed to be continuous and relatively undisturbed through the length of the test pit. Bedding in the upper portion of Unit 3 at the contact with Unit 2 was observed to be truncated by the overlying material of Unit 2 suggesting that the contact is likely an erosional unconformity. No planes of shearing or zones of gouge suggesting past slope movements were observed within TP-3. It should be noted that TP-3 was excavated just down-slope of the location of the previous TP-2. In TP-2 a layer of gravel (logged as "sandstone" in the referenced geotechnical report) was encountered between the near-surface slope wash deposits and the underlying lacustrine deposits. However, this gravel bed was not encountered in TP-3. It is our interpretation that the gravel bed observed in TP-2 may be a lense of granular slope wash material or older debris flow deposits placed on the underlying lacustrine deposits.

As shown on Figure No. 5, TP-4 exposed similar near surface topsoil and slope wash deposits (Units 1 and 2, Figure No. 5) as those observed in TP-3. Underlying the slope wash deposits in TP-4 we observed an approximately 1 to 2½ foot thick gravel bed (Unit 3, Figure No. 5). According to the engineer who logged the gravel bed (logged as "sandstone") in TP-2, this gravel bed in TP-4 appeared very similar to the gravel bed in TP-2. The gravel bed was comprised predominantly of angular to subangular, pebble to small cobble sized sandstone clasts that were generally clast supported. The matrix of the gravel bed included some pinhole voids. Unit 3 was observed to thin up-slope in the test pit suggesting it may pinch out upslope from the test pit. As with the gravel bed observed in TP-2, Unit 3 in TP-4 is interpreted to be a bed or lense of granular slope wash material or older debris flow deposits. This gravel bed was not encountered in TP-1 down-slope of TP-4. Underlying Unit 3 in TP-4 we encountered beds of the Norwood Formation (Unit 4, Figure No. 5) extending to the base of the test pit at approximately 16½ feet below the surface at its deepest point. The beds of the Norwood formation observed in TP-4 consisted of sandy Lean Clay (CL) and sandy Elastic Silt (MH) grading downward to Poorly Graded Gravel with Silty Sand (GP-GM). The gravels in the lower portion of the test pit may be a weathered sandstone bed and displayed some weak bedding structure. A lense of Silty Sand (SM) (Unit 4a, Figure No. 5) was observed in the exposed Norwood Formation Deposits. Bedding in the observed Norwood Formation deposits was measured to dip (apparent) down to the northeast at between 10 and 13 degrees. The bedding in the exposed Norwood Formation deposits in TP-4 was observed to be continuous and relatively undisturbed through the length of the test pit. No evidence of slip or shearing, or zones of gouge, was observed in the exposed soils and bedrock (Norwood Formation). None of the beds or bedding contacts within the exposed Norwood Formation appeared to be a slip plane.

The extension of TP-3 down-slope to the elevation of TP-4 on the lot showed that the lacustrine sands (Unit 3, Figure No. 4) thinned down slope and eventually pinched out at the elevation of TP-4 where the gravel bed (Unit 3, Figure No. 5) was encountered below the overlying slope wash deposits. TP-5 excavated adjacent to the southwest side of the footprint of the proposed house exposed approximately 1 to 2 feet of topsoil followed by approximately 4 feet of the previously observed sandy lean clay slope wash deposits which were followed by bedded lacustrine sands of the Bonneville lake cycle extending to the base of the test pit at approximately 12 feet below the adjacent ground surface.

Groundwater was not encountered in any of the test pits excavated on the subject lot. No significant evidence of sustained high water table elevations, such as iron oxide staining or secondary carbonate deposition, was observed in the test pits.

Based on the subsurface information obtained from the test pits and our geologic interpretations, a geologic cross section through the subject lot was produced. The cross section is included at the end of this report as Figure No. 6, Geologic Cross Section. The line of cross section through the lot is shown on Figure No. 3 as A – A'. Several assumptions were made in the completion of the cross section. First, due to the fact that the gravel beds/lenses observed immediately below the near-surface slope wash deposits in TP-2 and TP-4 were not observed in any of the other test pits we decided to show the gravels as two separate lenses at the elevations of TP-2 and TP-4. It is our opinion, that, due to relatively small thickness of the gravels and their apparent lack of lateral continuity across the lot, the gravels will not likely have significant influence on slope stability on the lot. Second, the depth of the lacustrine sands encountered in TP-2, TP-3, and TP-5 was not determined as none of these test pits penetrated the sands. We did observe that the sands thinned and pinched out down-slope of TP-3. As such, the base of the lacustrine sands shown on the cross section is inferred primarily based on the depth of TP-3 and the grade of the slope, however, the sands may be thicker than shown below the southwestern portion of the lot. And lastly, the thickness of the Norwood Formation below the lot could not be determined. So, for the purposes of the cross section, it was assumed that the Norwood formation extends through the remainder of the profile shown on Figure No. 6.

Copies of the geologic cross section, as well as the test pit logs for TP-3 an TP-4, were provided to, and discussed with, engineers from Earthtec Engineering who are performing additional slope stability analysis for the site (separate letter report). Information from the cross section and logs, as well as laboratory testing on the additional soil samples obtained from TP-3 and TP-4, were used to model the slope as part of the additional stability analysis.

Geologic Hazards

Based on the researched information, field observations and data, and our geologic interpretations discussed above, we make the following conclusions regarding the potential for the subject lot to be impacted by hazardous geologic conditions or events.

Landslides

Although the landslide-prone Norwood Formation was observed underlying the subject lot, no evidence of past landslide movement was observed on the surface or in the subsurface explorations at the lot. Additionally, no landslide deposits or features have been mapped on, or immediately adjacent to, the subject lot. The results of the slope stability analysis for the lot completed at the time of the referenced geotechnical report showed factors of safety for both static and seismic conditions that were above the minimum factors of safety of 1.5 and 1.0, respectively. Additional slope stability analysis (separate letter report) completed in conjunction with this assessment also showed similar factors of safety that were above the minimum required for both static and seismic conditions.

Based on the evidence and analysis presented above, it is our opinion that the potential for landslide activity to impact the proposed development on the subject lot is relatively low.

However, as stated in the referenced geotechnical report, it should be clearly understood that slope movements or even failure can still occur if the slope is undermined or the slope soils become saturated. The property owner and the owner's representatives should be made aware of the risks should these or other conditions occur that could saturate or erode/undermine the soils. Surface water should be directed away from the top and bottom of the slope, the slope should be vegetated with drought resistant plants, and sprinklers should not be placed on the face of the slope.

Surface Fault Rupture and Related Ground Deformation

No evidence of past surface fault rupture was observed on the lot or surrounding areas. No known active faults are mapped crossing, adjacent to, or projecting toward the location of the subject lot. The nearest mapped active fault appears to be the Weber segment of the Wasatch Fault Zone approximately 7.4 miles to the west. It is our opinion that the potential for surface fault rupture and related ground deformation to impact development on the subject lot is relatively low. All seismic design recommendations presented in the referenced geotechnical report should be implement in the design and construction of the proposed house on the lot.

Debris Flow and Alluvial Fan Flooding

The subject lot does not appear to be located on an active alluvial fan or in, or adjacent to, or at the mouth of an active drainage channel or ravine. Based on these observations, it is our opinion that the potential for debris flows and/or alluvial fan flooding to impact the subject lot is relatively low.

Rockfall

No rockfall clasts were observed on the subject lot or adjacent areas and no rockfall source areas are located up-slope from the subject lot. Based on these observations, the subject lot is not located in an active or past rockfall run out zone and the potential for this hazard to impact the subject lot is relatively low.

Problematic Soil Conditions

Combination soil types, moisture-sensitive soils, or other problematic soil conditions may be present below the proposed house footprint on the lot. The referenced geotechnical report for the lot provides recommendations for addressing problematic soil conditions. We recommend that an engineer or geologist from Earthtec Engineering be allowed to observe the completed foundation excavation prior to construction of footings to determine if problematic soil conditions are present.

Other Geologic Hazards

It is our opinion that the potential for other geologic hazards to impact the subject lot is relatively low. This opinion is based on the regional and local geologic setting as well as our observations of the conditions at the site and surrounding area.

Conclusions

Based on our research, observations, interpretations, and analysis, the subject lot appears to be suitable for the proposed development from a geologic hazards perspective. All recommendations presented in the referenced geotechnical report and addendum letter for the subject lot should be followed.

It must be understood by all developers, property owners, and residents of the subject lot that the lot is located in a geologically sensitive area where there are inherent risks associated with development. The professional opinions, conclusions and recommendations presented in this report are intended to provide a factor of safety in relation to potential geologic hazards sufficient to reduce the risk to human life. However, potential structural damage, as well as significant damage to road ways and utilities within the development, due to the potential inherent or unseen hazards at the site, cannot be totally mitigated due to the location of the site within a potential geologically sensitive area and the inherent level of uncertainty associated with analyzing and predicting such hazards. Therefore, by choosing to build and/or reside on the subject lot, the property owner(s) and/or residents should be informed of, understand, and accept the inherent risks associated with building and living in a geologically sensitive area.

General Conditions

The exploratory observations and data presented in this report were collected to provide engineering geology analysis for this project. The explorations may not be indicative of subsurface conditions outside the study area or between points explored, and thus have a limited value in depicting subsurface conditions for hazard analysis and prediction or contractor bidding. Variations from the conditions portrayed in the explorations may occur which may be sufficient to require modifications in the conclusions and recommendations of this report. If during construction, conditions are different than presented in this report, please advise us so that additional observations, analysis, and recommendations can be made as warranted.

The engineering geology assessment as presented in this letter report was conducted within the limits prescribed by our client, with the usual thoroughness and competence of the engineering geology profession in the area. No warranty or representation, either expressed or implied, is intended in our proposals, contracts, reports or letters.

Closure

We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

Respectfully;
EARTHTEC ENGINEERING

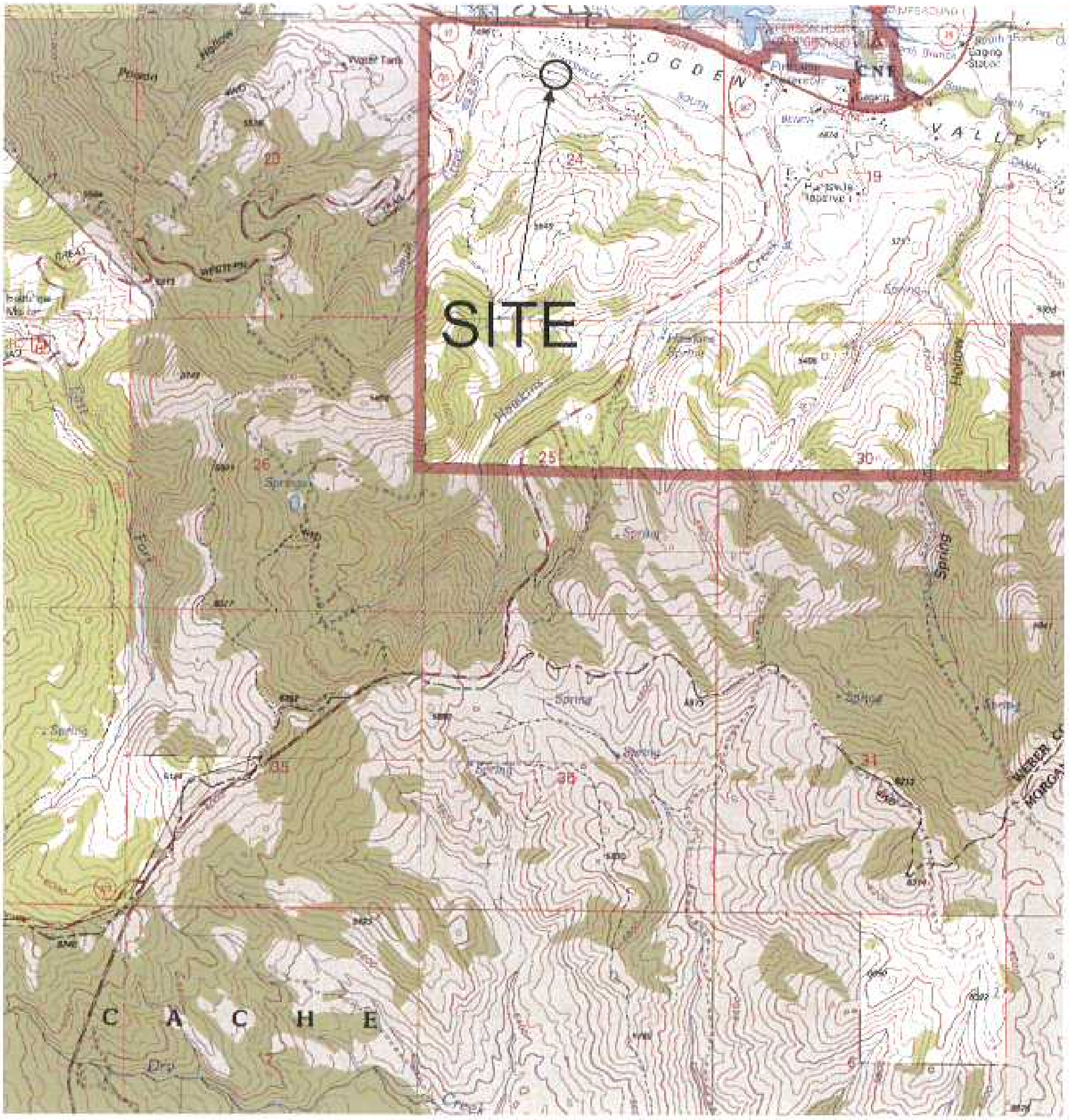
Mark C. Larsen, P.G.
Project Geologist

Timothy A. Mitchell, P.E.
Geotechnical Engineer

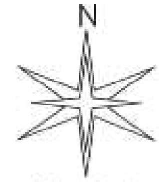
Attachments:

Figure No. 1 Vicinity Map
Figure No. 2 Site Geologic Map
Figure No. 3 Site Plan and Locations of Test Pits
Figure No. 4 Test Pit Log, TP-3
Figure No. 5 Test Pit Log, TP-4
Figure No. 6 Geologic Cross Section

VICINITY MAP
LOT 15, SKI LAKE ESTATES NO. 3
6640 EAST 1100 SOUTH
HUNTSVILLE, UTAH

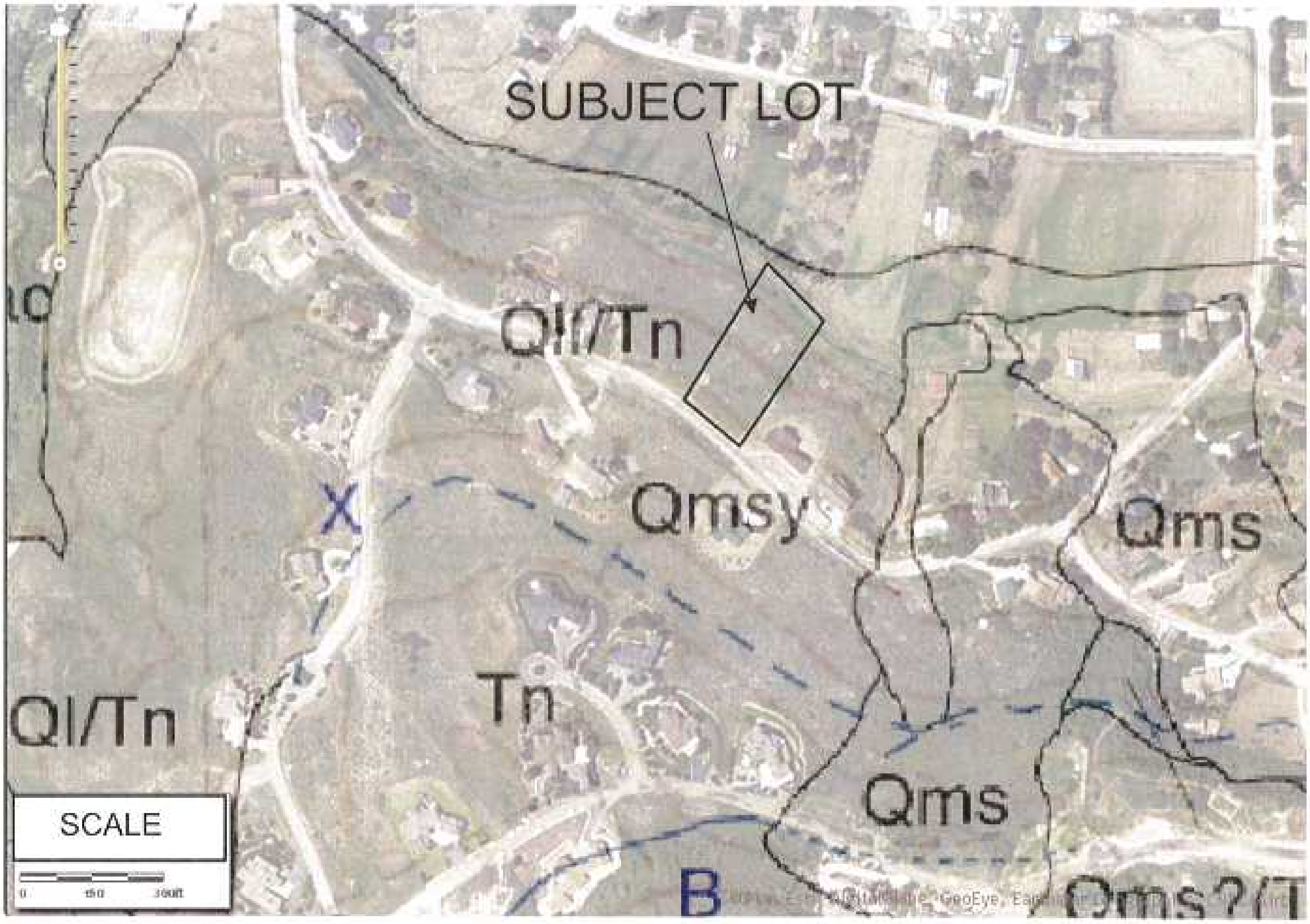


*Map from USGS 7.5 Minute "Snow Basin, Utah" Quadrangle



PROJECT NO.: 145150	Earthtec Engineering	FIGURE NO.: 1

SITE GEOLOGIC MAP
LOT 15, SKI LAKE ESTATES NO. 3
6640 EAST 1100 SOUTH
HUNTSVILLE, UTAH



* Map and unit descriptions from: King, J.K., Yonkee, W.A., and Coogan, J.C., 2008, Interim Geologic Map of the Snow Basin Quadrangle and Part of the Huntsville Quadrangle, Davis, Morgan, and Weber Counties, Utah; Utah Geological Survey, Open-File Report 536, Map Scale 1:24,000.

<u>Mapped Geologic Units in the Vicinity of the Subject Lot</u>

Qms, Qmsy – Landslide and slump deposits. Qms – likely Holocene and/or upper Pleistocene. Qmsy – post Lake Bonneville.

Ql – Lake Bonneville Deposits (undivided) - upper Pleistocene. Silt, clay, sand, and cobbly gravel.

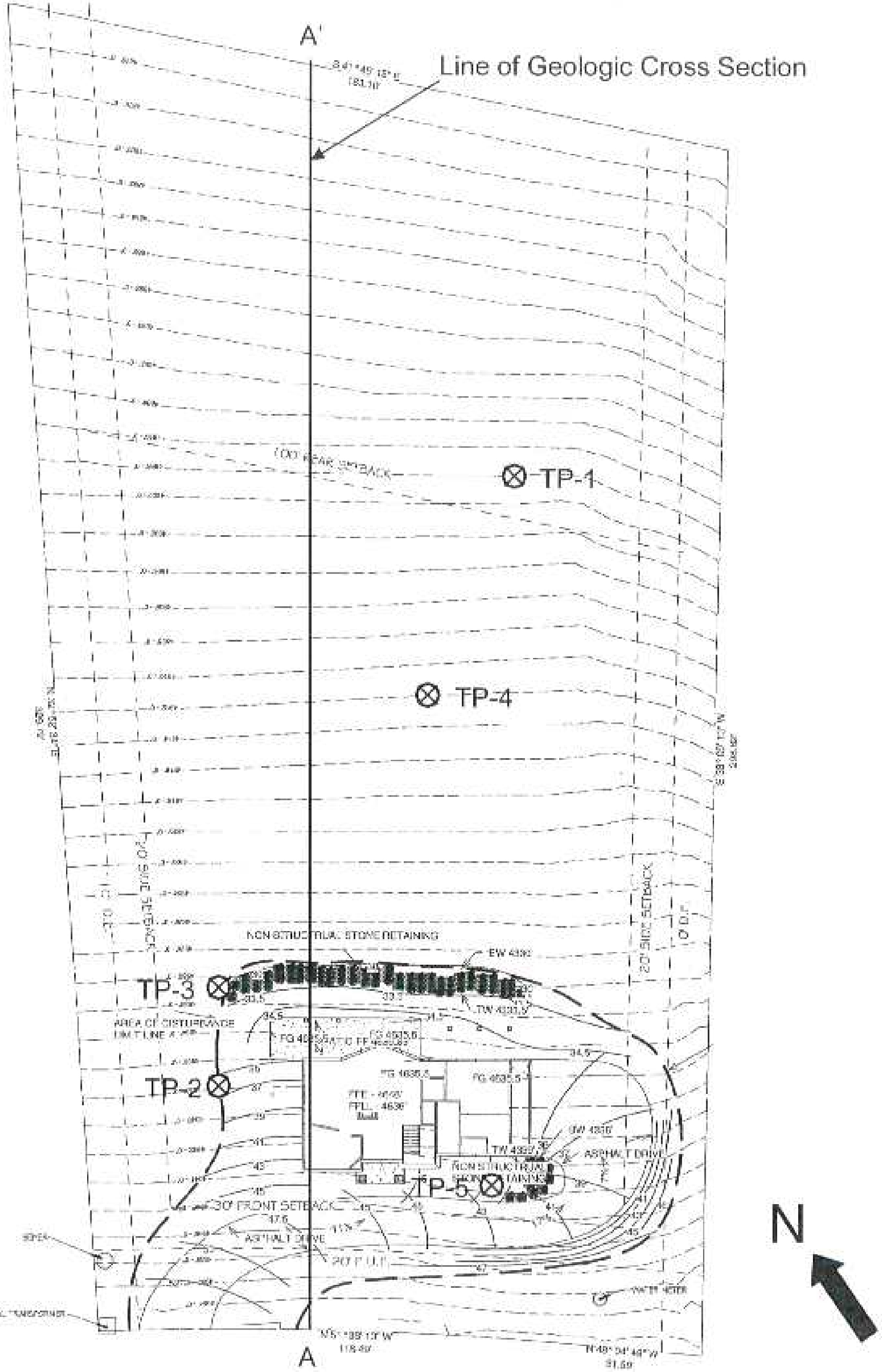
Qlf – Lake Bonneville Fine-Grained Deposits – upper Pleistocene. Mostly silt, clay, and fine sand (typically eroded from shallow Norwood Formation).

Tn – Norwood Formation – lower Oligocene and upper Eocene. Altered tuff (claystone), tuffaceous siltstone, sandstone, and conglomerate.

Ql/Tn and Qlf/Tn denotes Lake Bonneville deposits over Norwood Formation.

PROJECT NO.: 145150	Earthtec Engineering	FIGURE NO.: 2

SITE PLAN AND LOCATIONS OF TEST PITS
LOT 15, SKI LAKE ESTATES NO. 3
6640 EAST 1100 SOUTH, HUNTSVILLE, UTAH



Scale
1 Inch = 40 ft

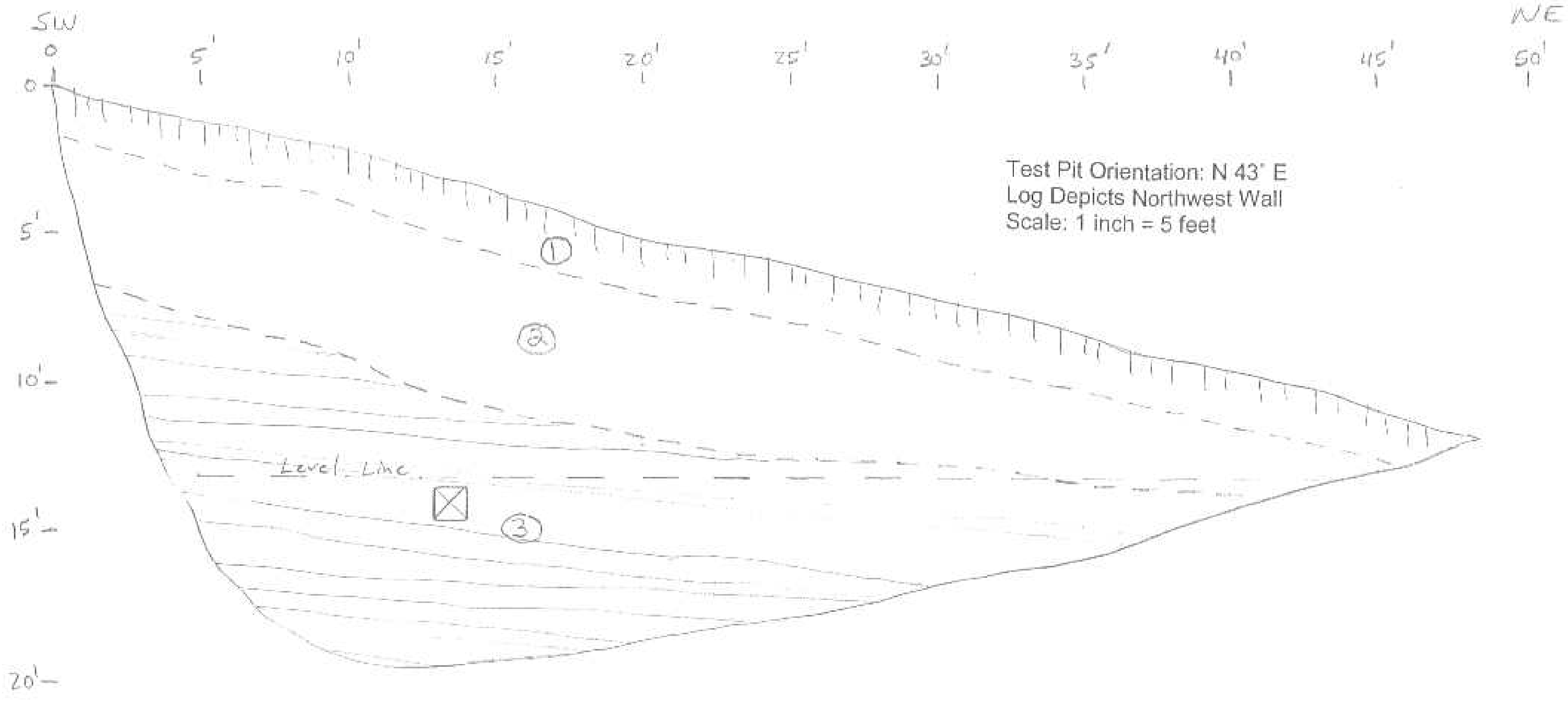
*Provided by Client

PROJECT NO.: 145150		**FIGURE NO.:** 3

Test Pit Log, TP-3, Lot 15, Ski Lake Estates No. 3

6640 East 1100 South, Huntsville, Utah

Logged by: Mark Larsen, P.G., Earthtec Engineering, June 19, 2015



Test Pit Orientation: N 43° E
Log Depicts Northwest Wall
Scale: 1 inch = 5 feet

Soil Units

1. Modern Topsoil, Soil "A" Horizon - Formed on Unit 2, silty clay with organic matter including roots, slightly moist, dark brown.

2. Slope Wash Deposits/ Soil "B" Horizon – Sandy Lean Clay (CL), moist, light brown, soft to medium stiff (estimated), massive – no significant stratification. Upper portion of unit may be a Soil "B" Horizon forming below Unit 1. Likely Holocene based on Stratigraphy.

3. Lacustrine Deposits of the Bonneville Lake Cycle – Interbedded Silty Sand (SM), sandy Silt (ML), and minor Lean Clay (CL), slightly moist, grayish-tan, medium dense to dense (estimated), thin to moderately bedded, bedding has an apparent dip down to the northeast at between 3 and 8 degrees and is generally continuous and undisturbed. Upper Pleistocene based on mapping by King, Yonkee, and Coogan (2008), correlates with mapped unit Qlf.

Key to Log Symbols

Sharp Contact -

Gradational Contact –

Soil "A" Horizon –

Gravel Clasts –

Representative Bedding –

Location of Disturbed Bag Sample –

Level Line –

LICENSED PROFESSIONAL GEOLOGIST
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MARK CURTIS LARSEN
STATE OF UTAH

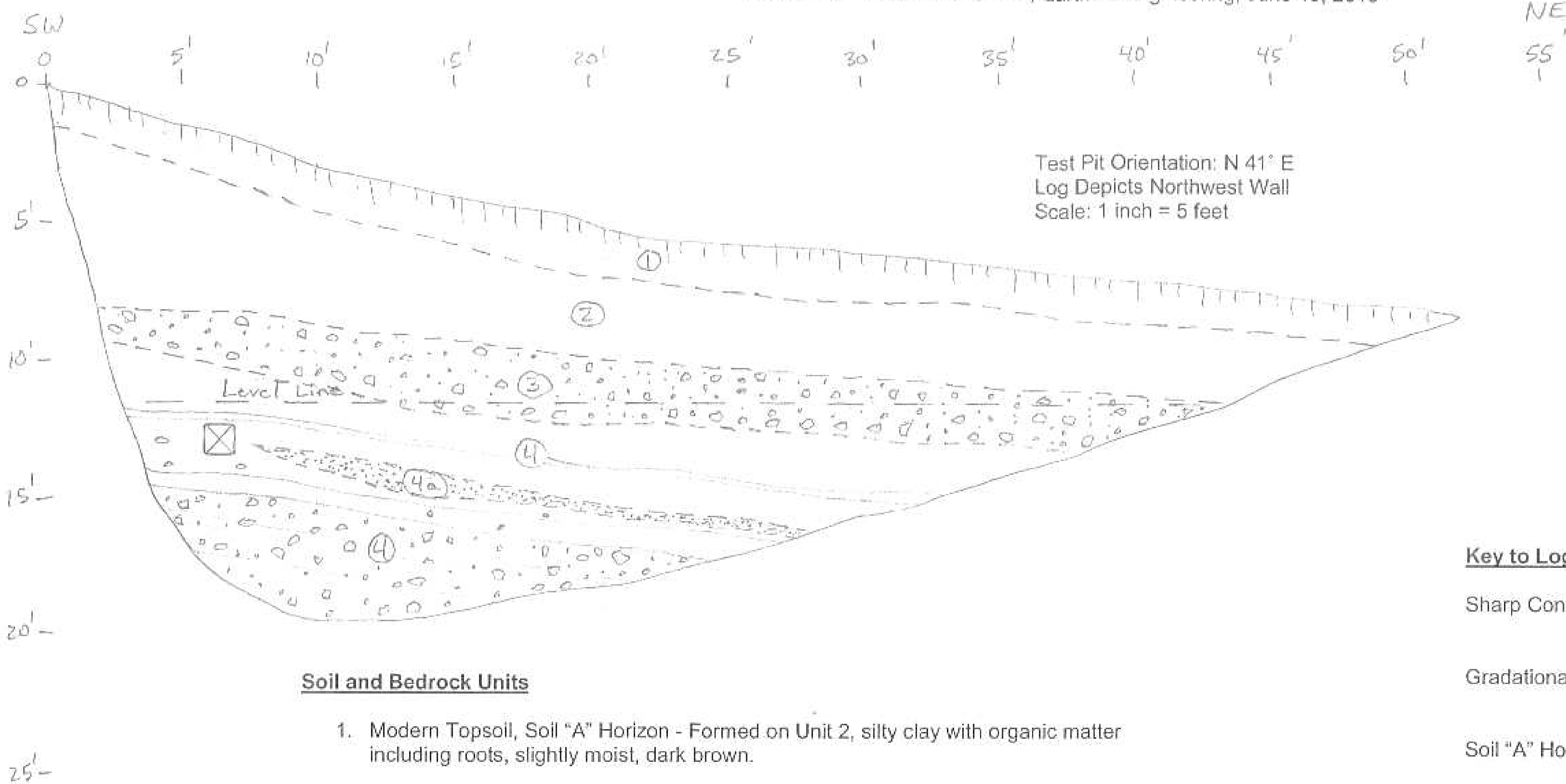
Job No. 145150

Figure No. 4

Test Pit Log, TP-4, Lot 15, Ski Lake Estates No. 3

6640 East 1100 South, Huntsville, Utah

Logged by: Mark Larsen, P.G., Earthtec Engineering, June 19, 2015



Soil and Bedrock Units

1. Modern Topsoil, Soil "A" Horizon - Formed on Unit 2, silty clay with organic matter including roots, slightly moist, dark brown.

2. Slope Wash Deposits/ Soil "B" Horizon – Sandy Lean Clay (CL), moist, light brown, soft to medium stiff (estimated), massive – no significant stratification. Upper portion of unit may be a Soil "B" Horizon forming below Unit 1. Likely Holocene based on stratigraphy.

3. Debris Flow/ Slope Wash Deposits – Poorly Graded Gravel with Silty Sand (GP-GM), slightly moist, grayish tan, dense (estimated), predominantly angular to subangular sandstone clasts, clasts are pebble to small cobble in size, mostly matrix supported, some pin-hole voids in the matrix. Holocene to upper Pleistocene based on stratigraphy.

4. Norwood Formation – Sandy Lean Clay (CL) and sandy Elastic Silt (MH) grading downward to a Poorly Graded Gravel with Silty Sand (GP-GM) that may be a weathered sandstone bed, slightly moist, olive brown to grayish brown. Clays and silts are generally stiff to very stiff (estimated), thin to moderately bedded, bedding has an apparent dip down to the northeast at between 10 and 13 degrees, bedding is generally continuous and relatively undisturbed. The gravels are predominantly angular to subangular sandstone clasts in a silty sand matrix and mostly clast supported. The gravels display some weakly-formed bedding. Lower Oligocene and upper Eocene based on mapping by King, Yonkee, and Coogan (2008), correlates with mapped unit Tn.

   4a. Sand lense within Unit 4 - Silty Sand (SM), slightly moist, light brown, dense (estimated). Lense dips (apparent) Northeast at about 10 degrees.

Key to Log Symbols

Sharp Contact -

Gradational Contact –

Soil "A" Horizon –

Gravel Clasts –

Representative Bedding –

Location of Disturbed Bag Sample –

Level Line -

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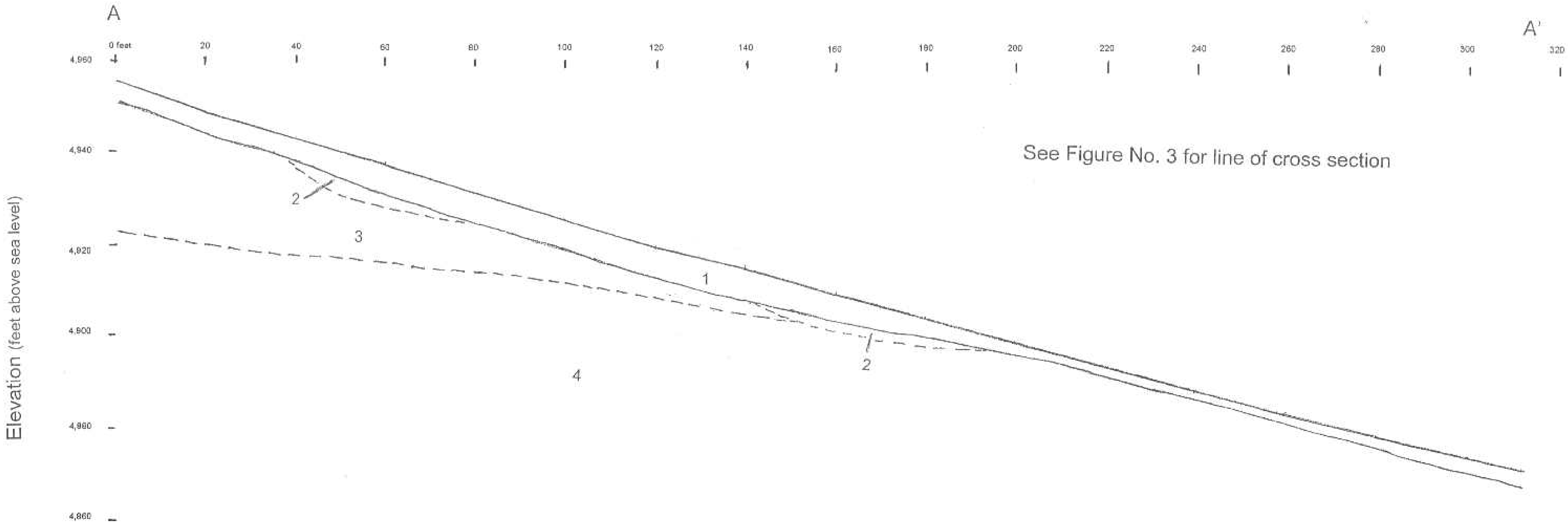
Figure No. 5

Geologic Cross Section
Lot 15, Ski Lake Estates No. 3
6640 East 1100 South, Huntsville, Utah



Key

1 – Topsoil and slope wash deposits, undivided (Units 1 and 2, Figure Nos. 4 and 5).

2 – Gavel lenses, older debris flow/ slope wash deposits (Unit 3, Figure No. 5). Unit was also observed in TP-2 during the original geotechnical study.

3 – Lacustrine sand of the Bonneville lake cycle (Unit 3, Figure No. 4). Thickness is unknown and is inferred on the cross section.

4 - Norwood Formation (Unit 4, Figure No. 5). Thickness is unknown.

Inferred Contact – – – – – – – –

Well defined contact - ————————

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Figure No. 6