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GEOTECHNICAL STUDY
LOAN PEAK RESIDENTIAL DEVELOPMENT
10700 NORTH STATE ROAD 146 (CANYON ROAD)
CEDAR HILLS, UTAH

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation for the proposed Loan Peak Residential Development located at approximately 10700 North and State Road 146 (Canyon Road) in Cedar Hills, Utah. The general location of the site, with respect to existing roadways is shown on Figure No. 1, Vicinity Map, at the end of this report.

The purposes of this investigation were to 1) evaluate the subsurface soil conditions at the site, 2) assess the appropriate engineering characteristics of the subsurface soils, 3) to provide geotechnical recommendations for general site grading, and the design and construction of foundations, concrete floor slabs, and asphalt pavement sections, and 4) provide a review of geological hazards and/or features at the site. The scope of work completed throughout the course of this investigation included subsurface investigation, field and laboratory testing, engineering analysis, and the preparation of this report.

2.0 CONCLUSIONS

Based on the results of our investigation, the following is a brief summary of our findings and conclusions:

(1) It is our opinion that the subject site is suitable for the proposed construction provided the recommendations presented in this report are followed.

(2) The results of our investigation indicate that the subsurface soil conditions encountered consist of approximately 6 to 18 inches of topsoil, followed by dense to very dense Gravel (GP, GP-GM, GC) with cobbles interbedded at some locations with medium stiff to stiff Silt (ML), medium stiff to stiff Clay (CL, CL-ML), and medium dense Sand (SP, SP-SM, SM, SC) extending beyond the maximum depth explored of 10 feet. Groundwater was not encountered within the depths explored during our investigation.

(3) Laboratory test results indicate that the fine-grained soils (clay, silt) encountered exhibit a low to moderate compressibility under the anticipated structural loads and a low to moderate potential for hydro-collapse when subjected to an increase in moisture content and loading.

(4) It is recommended that the proposed homes be supported on a foundation system consisting of conventional strip and spread footings founded entirely on dense to very dense undisturbed native gravel or on properly placed and compacted structural fill extending to the gravel soils. Conventional footings constructed as described above may be proportioned for a maximum allowable net bearing capacity of 2,300 psf. More detailed information pertaining to construction of foundations and concrete floor slabs are provided in Sections 10.0 and 11.0 of this report.

(5) Proper drainage is important to the long term performance of foundations, concrete flatwork, and pavements at the site, as well as to aid in construction. Site drainage recommendations are provided in Section 12.0 of this report.

(6) The eastern half of the subject site lies within the seismically active Wasatch Fault zone. Evidence of faulting was observed and has been mapped in the foothills on the eastern portion of the site. Two ancient landslide deposits have been mapped on the site adjacent to the eastern boundary. One of these landslide deposits has shown recent evidence of instability. The potential hazard from rock fall, debris flows, and flash floods is moderate to high in the foothill area of the eastern portion of the site. Evidence of surface slumping was observed on the steep, north facing slope which forms the southern edge of the narrow river bottom valley on the northern portion of the site. The northern and western portions of the site which lie in the river bottom valley formed by the American Fork River are subject to a moderate flood hazard. Recommendations regarding geologic hazards at the site are presented in Section 8.0 of this report.

3.0 PROPOSED CONSTRUCTION

It is our understanding that the project as planned will consist of the construction of a residential development consisting of single-family units on an approximately 400 acre site. We understand that the proposed buildings will be of wood-frame construction and will be two to three story and may have basements. Foundation loads for the proposed buildings are estimated not to exceed 3 kips per linear foot for bearing walls, and 200 to 300 pounds per square foot for floor slabs. If structural loads are greater than

those discussed herein, our office should be notified so the necessary modifications may be made to our recommendations.

Based on our understanding of the site and the planned development, it is anticipated that cuts and fills throughout the majority of the site will be minimal (less than two to three feet), however, on the east side of the site, cuts and fills may be moderate (three to eight feet). In addition to the structures described above it is anticipated that the following developments will be made.

1. Utilities will be constructed to service the proposed buildings;
2. Exterior concrete in the form of sidewalks and miscellaneous flatwork; and
3. Asphalt pavement sections for low-volume interior roadways within the development.

4.0 SITE CONDITIONS

The subject site consists predominantly of open range land moderately to densely vegetated with natural grasses, sage brush and other shrubs, and some localized thick stands of trees. The topography of the site varies considerably from east to west across the site. The eastern portion of the site is situated along the foothills of the Wasatch Mountains to the east. The general topography at this locations is hilly and slopes down to the west toward State Road 146. West of the State Highway 146 the topography levels off to form a broad bench extending several hundred feet to the west. The bench is bordered on the north and west by a moderate to steep slope dropping in elevation roughly 150 to 250 feet down to the west terminating in a river bottoms which occupies the western portion of the site. The south side of the central and western

portions of the site are bound by existing residential developments. The remaining portions of the site are bound by undeveloped property.

5.0 FIELD INVESTIGATION

The subsurface soil conditions at the site were explored by excavating 40 exploratory test pits to depths of 4.5 to 10 feet below the existing site grades. Three of the test pits were terminated upon refusal in very dense gravel at depths less than nine feet. The test pits were excavated with the aid of a conventional rubber tire backhoe. The approximate locations of the test pits with respect to the proposed construction are shown on Figure No. 2, Site Plan and Location of Test Pits, included at the end of this report.

Field exploration operations were performed under the supervision of a qualified member of our geotechnical staff. During the course of our field exploration program, samples of the soils encountered were collected at two to four foot intervals throughout the soil profile. Soil sampling was completed utilizing hand sampling equipment. The soil samples collected were classified by visual examination in the field, and then packaged in air-tight sample bags for transportation to our Orem, Utah laboratory. The samples were later examined in our laboratory and classified in accordance with the Unified Soil Classification System (USCS). The stratification lines shown on the enclosed test pit logs represent the approximate boundary between soil units; the actual transition may be gradual. Due to the heterogeneity of natural soil deposits, care should be taken in interpolating between and beyond exploration points. Graphical representations of the soils encountered are shown on Figure Nos. 3 through 42, Test Pit Logs. A key to the symbols and terms on the test pit logs is presented on Figure No. 43, Key to Symbols.

6.0 LABORATORY TESTING

Representative soil samples were tested in the laboratory to assess pertinent engineering properties and to aid in classification. The following paragraphs describe the tests performed and summarize the test results. Due to the coarse granular nature of the majority of the soils and the limited extent of fine-grained soils encountered in our exploration, only a few representative undisturbed samples were possible. Laboratory testing included gradation tests, Atterberg limit determinations, one-dimensional consolidation tests, a moisture density relationship (proctor), and a California Bearing Ratio (CBR) test. Test results are summarized on the enclosed test pit logs and in Table Nos. 4, Summary of Laboratory Test Data, Table No. 5, Summary of California Bearing Ratio (CBR) Test Results, at the end of this report.

Eighteen sieve analysis tests were performed on soil samples collected in the test holes completed for this investigation. Sixteen of the tests were completed on granular soil samples and two on fine-grained soil samples. Results of the sieve analysis indicate that the on-site granular soils contain 3 to 38 percent fines (material passing the No. 200 standard sieve) and 0 to 80 percent gravel. Due to the presence of cobble-sized rock in the granular soils encountered at the site, these soils are probably coarser in-situ than shown on the laboratory test results. The fine-grained soils contain approximately 20 to 49 percent sand.

Three Atterberg limit determinations were performed on representative samples of the on-site soils encountered at the site to aid in classification and provide index parameters. The test results indicate that the on-site soils have low to moderate plasticities with liquid limits ranging between 30 and 35 percent, and plasticity indices ranging between 9 and 10 at the locations tested (Table No. 3).

Two swell-consolidation tests were performed to assess the compressibility and moisture sensitivity of the on-site fine-grained soils. Test results indicate that the soils are over-consolidated, and will exhibit a low to moderate compressibility under the anticipated loading conditions. These soils were also shown to be low to moderately hydro-collapsible (approximately two to six percent) at the locations tested.

One moisture density relationship (proctor) test and one California Bearing Ratio (CBR) test were completed to provide geotechnical parameters for asphaltic concrete pavement section design. Test results indicate a CBR-Value of 16.2 for the supportive subgrade soils. The CBR test was completed on a sample compacted to 88 percent of the maximum dry density as determined by ASTM D-1557.

Samples will be retained in our laboratory for 30 days following the date of this report at which time they will be disposed of unless a written request for additional holding time is received prior to the disposal date.

7.0 SUBSURFACE CONDITIONS

The results of our investigation indicate that the subsurface soil conditions encountered consist of approximately 6 to 18 inches of topsoil, followed by dense to very dense Gravel (GP, GP-GM, GC) with cobbles interbedded at some locations with medium stiff to stiff Silt (ML), medium stiff to stiff Clay (CL, CL-ML), and medium dense Sand (SP, SP-SM, SM, SC) extending beyond the maximum depth explored of 10 feet. Groundwater was not encountered within the depths explored during our investigation.

Topsoil encountered at the site was observed to be predominantly silt and sand with lesser amounts of clay and gravel and contained some roots and organics throughout. These soils were generally brown to dark-brown in color, moist, and in a medium stiff to stiff state.

The granular soil encountered consist predominantly of gravel and lesser amounts of sand. These soils are gray to brown in color, slightly moist to moist, and predominantly in a dense to very dense state with some localized medium dense zones predominantly in the sand areas. The gravel soils encountered throughout the central and west portions of site are cemented in the upper two to four feet of the soil profile and were observed to contain cobbles and some small boulders at some locations.

Fine-grained soils (clay, silt) were encountered in seven of the test pits as discrete layers generally less than four feet thick. These soils are gray to tan in color, slightly moist to moist, and in a medium stiff to stiff state. Laboratory test results indicate that these soils exhibit a low to moderate potential for hydro-collapsible when subjected to an increase in moisture and loading. A more detailed description of soil conditions encountered is included on the enclosed test pit logs.

8.0 GEOLOGICAL CONDITIONS

The area encompassed by the proposed Lone Peak Residential Development can be divided into three distinct geologic zones. These zones can be classified as a foothill zone, located to the east of S.R. 146, a deltaic and lacustrine deposit zone comprising the large, flat lying area to the west of S.R. 146, and a river bottom-flood plain zone comprising the northern and western most portions of the site. A geologic

reconnaissance of the site and review of geologic maps of the area were completed to address geologic conditions and to provide an assessment of the occurrence and extent of geologic hazards at the site. The following paragraphs present the results of our geologic reconnaissance and map review.

8.1 General Geology

The eastern portion of the subject site, to the east of S.R. 146, is located in the foothills of the Wasatch Range. The remainder of the site is comprised of a relatively flat lying deltaic and lacustrine gravel deposits and a narrow river bottom-flood plain valley formed by the American Fork River. The elevation ranges from approximately 4,900 feet above sea level in the river bottom area, on the western most portion of the site, to nearly 5,600 feet in the foothills along the eastern boundary of the site. The Wasatch Range, located directly east of the site, forms the easterly boundary of the Basin and Range physiographic province. The north trending Wasatch Fault zone lies at the base of the Wasatch Range and separates the Basin and Range physiographic province to the west from the Middle Rocky Mountain and Colorado Plateau physiographic provinces to the east. Seismic displacement within the Wasatch Fault zone has resulted in the uplift of the Wasatch Range and the down drop of Utah Valley. Known surface rupture areas within the Wasatch Fault zone are shown as dark, bold lines on the Geologic Hazards Map, Figure 44, taken from Machette (1992). The approximate boundaries of the subject site have been superimposed on this map to aid in the location of known geologic hazards relative to the project.

In addition to the Wasatch Fault zone, the area has also been influenced geologically by Lake Bonneville, an ancient fresh water lake which formerly covered the valleys of western Utah. The shoreline of the lake

reached a maximum elevation of approximately 5,200 feet above sea level. This shoreline, known as the Bonneville Level, and several others which formed as the lake level dropped, are visible along the foothills of the Wasatch Range as level terraces cut into the hillsides. The flat central portion of the site, to the west of S.R. 146, is predominantly an area of deltaic deposits and lacustrine gravels and sands deposited by the American Fork River as it emptied into Lake Bonneville at the mouth of American Fork Canyon, directly north of the site. As Lake Bonneville receded, the American Fork River cut into and eroded these deposits, forming the narrow river bottom valley in which the northern and western most portions of subject site lie.

The steep mountain slopes of the Wasatch Range to the east of the subject site are composed of Paleozoic sedimentary rocks consisting of sandstone, limestone, dolomite, quartzite, and shale. The native soils observed at the subject site and encountered in the subsurface investigation varied between the three geologic zones comprising the site. The foothill zone comprising much of the eastern portion of the site was observed to be mostly alluvial fan and older landslide deposits with minor fault scarp colluvial deposits. The alluvial fan deposits, labeled as **af1**, **af2**, **af4**, and **afb** on the Geologic Hazards Map, Figure 44, and the landslide deposits labeled as **clso** on Figure 44, are predominantly poorly sorted, angular to subrounded gravels and cobbles in a silty clay matrix with pockets of silty sand and silt. The alluvial fan deposits were eroded from the rocks of the Wasatch Range to the east by ephemeral streams and surface runoff and deposited at the mouths of small canyons and ravines along the eastern boundary of the site. The landslide deposits were formed during prehistoric mass wasting events where portions of the steep slopes of the Wasatch Range failed, causing large amounts of rock and soil to move down slope under the force of gravity.

A narrow strip of lacustrine gravels and deltaic deposits, labeled as **lbg** and **lbd** respectively on Figure 44, along with minor steam alluvium deposits labeled as **aly** and **alp**, are located along the eastern side of S.R. 146. These deposits are partially overlain by the alluvial fan and landslide deposits discussed above. The lacustrine gravels and deltaic deposits extend to the west of S.R. 146 across the flat lying, central area of the site. These deposits are predominantly poorly sorted, subrounded to rounded gravel and cobbles in a sandy matrix. Much of this gravel has been moderately cemented by post depositional calcite deposits, making the gravels very dense. Minor lacustrine sand deposits, labeled as **lbs** on Figure 44, were also observed in this area. These sands are generally coarse grained and poorly sorted with gravel. The narrow river bottom-flood plain zone along the northern and western portions of the site is covered with stream alluvium labeled as **aly** on Figure 44. These deposits are largely poorly sorted, subrounded to rounded gravels and cobbles, with a few boulders and occasional pockets of sand and silt.

8.2 Geologic Hazards

Several surface ruptures within the Wasatch Fault zone have been mapped with other known fault segments along the eastern boundary of the site, as shown on Figure 44. Three seismic trenches have been dug by others in this area to locate and study several of these fault segments. Machette has mapped the locations of these seismic trenches as **AF-1**, **AF-2**, and **AF-3** on Figure 44. Much of the surface rupture evidence observed and mapped on the site lies along the base of the steep slopes in the area, however, several fault segments have been mapped to the west of the steeper slopes in potential building areas. These include two mapped fault segments within 250 feet or less of each side of S.R. 146 and a concealed fault segment (dotted line) in the river bottom area in the northern most portion of the site, as shown on figure 44. No other

evidence of faulting was observed or has been mapped on the remainder of the site to the west of S.R. 146. The Wasatch Fault zone is considered to be seismically active and the potential for a large magnitude earthquake occurring on any portion of the fault within the next 50 to 100 years has been estimated to be high. The maximum potential earthquake magnitude along the Wasatch fault has been estimated to be 7.4. The peak horizontal acceleration due to ground-shaking during an earthquake, for periods less than 500 years, is 0.2g.

Two ancient landslide deposits were observed and have been mapped along the eastern boundary of the site. These deposits, labeled as **clso** and mapped as a medium gray shade with many small, black triangles, are shown on Figure 44. Although these landslide deposits are considered to be ancient, they do have the potential to again become unstable and continue moving down slope, especially during periods of above normal precipitation when soils can become over saturated and loose their frictional strength. This is evidenced by a small landslide event which occurred along the southern edge of the northern ancient landslide deposit at the site in 1983, during such a period of above normal precipitation in the area. This small landslide is labeled as **clsy (1983)** on Figure 44. Because of the steep slopes and nature of the soils along the entire eastern boundary of the site, the potential hazard from future landslides, which could affect the site, is moderate to high. The steep slope which forms the southern edge of the river bottom valley on the northern portion of the site is also subject to potential landslides and other slope surface failures. No large scale slope failures were observed or have been mapped along this slope, however, several smaller slope surface slumps were observed. These slumps are evidence that this slope has the potential to become unstable and that the potential hazard from future slope failures is moderate to high.

A small debris flow deposit has been mapped in the southeastern portion of the site near the mouth of one of the several ravines which have been cut into the steep slopes of the Wasatch Range. The debris flow deposit is labeled as **cd1** on Figure 44 and is evidence that the potential hazard from debris flows and flash floods, at the mouths of these ravines along the entire foothill zone of the site, is moderate to high. High precipitation in a short period of time or heavy runoff from snow melt can cause large amounts of mud, water, and debris to flow down these ravines at a high rate of speed. Although these types of mass wasting events are rare, any structures at or near the mouths of these ravines could be damaged during such events in the future.

The potential hazard from rock fall in the foothill zone of the site is moderate to high. This is due to the steep slopes and rocky terrain to the east where large pieces of rock can be dislodged in earthquake events or by mechanical weathering processes, and roll down slope onto the site. Any structures built near the base of these steep slopes are at particularly high risk from this geologic hazard.

The northern and western portions of the subject site located in the narrow river bottom valley lie within the flood plain of the American Fork River. During periods of above normal precipitation and/or heavy spring runoff from snow melt in the mountains to the east, the American Fork River and several irrigation canals and ditches which also flow through the area, have the potential to overflow their banks and flood the surrounding low lying area. Although a flood control detention basin observed in the river bottom valley should mitigate much of the flooding risk to the portions of the site downstream of the basin, the potential

hazard remains moderate. A small portion of the site lies upstream of the detention basin and, therefore, is at greater risk.

No ground water was observed during the subsurface investigation on any portion of the site, however, the water table in the river bottom area could fluctuate greatly due to the porous soils and the nearby surface water sources. The potential hazard from earthquake induced soil liquefaction on the site is very low due to the lack of high ground water and the rocky soil conditions over most of the site. No other potential geologic hazards which could affect the subject site were noted.

8.3 Conclusions and Recommendations

Based on our site reconnaissance and previous geologic maps of the subject area, the potential for surface ruptures in the foothill zone of the site, due to earthquake events within the Wasatch Fault zone, is high. It is recommended that any structures built on the site have at least a 50 foot separation from any visible or mapped fault traces. Additional seismic trenching may be required to find the exact locations of some mapped fault lines if structures are to be built in their immediate vicinity.

Based on the high potential for future slope instability and the mapped earthquake fault segments in the area, it is recommended that no development take place on the steep mountain slopes along the eastern boundary of the site. The northern ancient landslide deposit on the site has shown evidence of recent (1983) instability and, therefore, any development on this landslide deposit or adjacent to the toe of the deposit should be avoided. The western half of the southern ancient landslide deposit on the site appears to be unaffected by

faulting or geologically recent slope failures. The risk to development on the western half of this landslide deposit appears to be minimal.

Surface runoff on the site should be controlled to prevent soils from becoming saturated or eroded, especially on or adjacent to any slopes and within the ancient landslide and alluvial fan deposits in the foothill zone on the eastern portion of the site were the slopes are steeper and the soil conditions are more clayey. It is recommended that vegetation requiring little or no irrigation be used for landscaping purposes in these areas.

In order to help mitigate the moderate to high threat from rock fall, debris flows, and flash floods adjacent to the steep mountain slopes on the eastern portion of the site, as much separation as possible should be given to any proposed structures and the base of the steep slopes. It is recommended that no structures be built directly down slope from the mouths of any of the ravines which drain these slopes. Block walls, earthen dikes, or trenches could also be used to help divert these hazards away from proposed building locations.

Several measures could be taken to reduce the moderate flooding threat to portions of the site which lie in the river bottom area. If possible, the river channel could be dredged and made deeper and/or earthen dikes could be built along the river banks to accommodate a larger volume of water. Building locations could also be elevated using structural fill material and structures in these portions of the site could be constructed without basements.

9.0 SLOPE STABILITY CONSIDERATIONS

9.1 Natural Slopes

As a part of our investigation a slope stability analysis was completed to assess the stability of natural slopes throughout the site. The majority of the site is relatively flat with some local variations in topography, however, some moderate slopes on the east side of the development, specifically along the range front, do exist. In addition, a moderate to steep slope exists near the central to western portion of the site separating the elevated central and east portion of the site from the river bottoms portion. This slope varies in angle from approximately 1.5:1 (horizontal:vertical) to approximately 3:1 and is 150 to 200 feet tall. As described above, some shallow sloughing was observed on the north face of this slope. Native hillside slopes on the east side of the site are generally less than 3:1.

Our stability analysis addressed both static and dynamic loading conditions. Slopes were modeled utilizing the two dimensional limit equilibrium computer program PCSTABLE6 and graphical pre-processor STED. Strength parameters in the on-site soils were estimated based on our experience and field observations. A seismic coefficient of 0.11g was used in our analysis of dynamic loading; this represents 75 percent of the estimated peak horizontal ground acceleration at the site. Soil strength parameters used in our analysis are included in the following table.

Table No. 1: Strength Parameters

Soil Type (USCS)	Cohesion (psf)	Friction Angle (degrees)
Clay/Silt	400	21
Gravel	200	33

The results of our stability analysis indicate that native slopes at this site under in-situ soil conditions, and dynamic loading are stable at an angle of 2:1 (horizontal:vertical) or less. A minimum factor of safety of 1.5 and 1.0 for static and dynamic loading, respectively, was achieved in our models.

We recommend that homes constructed near the crest of the existing moderate to steep slope which separates the central portion of the site from the river bottoms as described above should be set back a minimum of 50 feet. If the native slope is steeper than 2:1, the set back should be increased to 75 feet. This will aid in reducing potential impacts to the homes if shallow surface sloughing occurs on this slope.

9.2 Cut Slopes

It is anticipated that some cutting and filling will occur during site grading to facilitate construction at the site. It is recommended that temporary cut slopes at the site not be made steeper than 1:1. If groundwater seepage or instability is observed flatter slopes should be used. This should satisfy overall stability of temporary cuts at the site. Temporary cuts should not be left standing for long periods of time without

retainage. If steeper temporary slopes are required at the site during construction, bracing or reinforcing should be provided.

Permanent cut slopes at the site should not be made steeper than 1:2 (horizontal:vertical). If steeper permanent slopes are required, additional engineering should be completed to provide design recommendations for retaining walls, reinforced earth slopes, or other alternatives. Earthtec will provide these recommendations upon request.

Precautions should be taken to reduce the potential for surface water to run down the face of cut slopes at the site. If water is allowed to do so, erosion will take place and degrade the slope. We recommend that a drainage ditch be constructed near the top of cut slopes at the site. The ditch should be designed to divert runoff away from the slope face. Vegetation planted on cut slope faces will reduce the potential for shallow sloughs.

10.0 SITE GRADING

10.1 General Site Grading

Prior to construction, it is recommended that unsuitable soils and vegetation be removed from below areas which will ultimately support structural loads, including below foundations, floor slabs, pavements, and exterior concrete flatwork. Unsuitable soils consist of topsoil, organic soils, undocumented fill, disturbed native soils, and any other deleterious materials. Topsoil was observed to extend to depths of approximately

6 inches to 18 inches at the locations explored. If unsuitable soils are found to extend deeper, they should be completely removed. Soils excavated at the site which meet the recommendations presented in this report (Section 8.3 Structural Fill and Compaction) may be used as structural fill. Excavated materials which do not meet these recommendations may be stockpiled for use in landscape areas.

Following general site grading as described above, the native soils exposed below the proposed structures including foundations, concrete flatwork, and pavements should be proof-rolled to form a firm non-yielding surface preparatory to receiving structural fill or foundations.

10.2 Excavations

During our investigation, dense to very dense conditions were encountered throughout portions of the site. Excavations in this material may require the use of heavy duty excavation equipment. The contractor should be aware of this and provide the appropriate equipment.

Temporary construction excavations into the native soils or structural fill less than five feet in depth should not be made steeper than 0.5:1.0 (horizontal:vertical). Excavations extending up to ten feet in depth should not be made steeper than 1:1. If unstable conditions or groundwater seepage is encountered flatter slopes or shoring or bracing may be required. Excavations deeper than ten feet are not anticipated for the site. All

excavations advanced deeper than three feet should be protected with all applicable OSHA[1] Health and Safety Standards.

10.3 Structural Fill and Compaction

Structural fill should consist of imported or on-site, well-graded, granular soil with a maximum particle size of 3 inches, less than 30 percent retained on the 3/4 inch sieve, and containing 15 to 25 percent fines (materials passing the No. 200 sieve). The liquid limit of the fines should not exceed 35 percent and the plasticity index should be below 15.

Structural fill should be placed in maximum 8-inch, loose lifts and compacted on a horizontal plane. Moisture should be maintained by proper mixing at a moisture content within 2 percent of the optimum moisture as determined by ASTM[2] D 1557. Structural fills placed below foundations, flatwork and pavements should be compacted to at least 95 percent of maximum density as determined by ASTM D 1557. Fills placed in landscape areas not supporting structural loads should be compacted to at least 90 percent of the maximum density to reduce settlement.

[1] "*Occupational Safety and Health Administration*".

[2] "*American Standard for Testing and Materials*"

10.4 Utility Trench Backfill

Utility trenches may be backfilled with the native soils or structural fill. Native soils may be used if properly processed and placed at a moisture content within two percent of optimum as determined by ASTM D-1557. If the native soils are used, more time and effort may be required by the contractor to provide proper compaction. The use of structural fill for backfill in utility trenches will likely reduce the time and effort required to meet the necessary compaction requirements as outlined herein. All utility backfill soil should be processed to remove rock material larger than 4 inches in nominal size, organic material, and other deleterious material. The liquid limit of the fines should not exceed 35 percent and the plasticity index should be below 15. Backfill soils should be placed in lift heights suitable to the compaction equipment used (12 inches maximum). The lifts should be compacted to at least 95 percent of the maximum density as determined by ASTM D 1557 below structures including foundations, pavements, and concrete flatwork, and 90 percent in landscape areas.

11.0 SEISMIC CONSIDERATIONS

Based on published data no active faults are known to traverse the site and no faulting was indicated during our field investigation. The nearest known fault trace is associated with the Wasatch Fault located to the east of the subject property. No special seismic considerations are recommended other than the proposed structures should be designed in accordance with the "Zone 3" requirements of the Uniform Building Code. We recommend a seismic zone factor of 0.30 with a soil profile type of "S_C".

12.0 FOUNDATIONS

12.1 General

The foundation recommendations presented in this report are based on the foundation loading conditions presented in section 3.0, PROPOSED CONSTRUCTION, of this report (p. 3) and the soil conditions encountered at the site. If loading conditions are significantly different, we should be notified in order to re-evaluate our design parameters and estimates, and to provide additional recommendations if necessary.

Based on the results of our investigation, soil conditions encountered at the anticipated foundation elevations throughout the site consist predominantly of dense to very dense gravel. However, at some locations, layers of silt and clay were encountered. Laboratory test results show that these silt and clay layers are hydro-collapsible. It is important that foundations not be brought to bear on the silt and clay soils at the site. If silt or clay soils are encountered at foundation elevations we recommend that either structural fill be placed and compacted below footings extending to native dense gravel soils or footings may be extended to bear on native dense gravel soils. Structural fill soils need not be more than 24 inches thick if gravel soils are not encountered.

For design of conventional strip and spread footings founded as described above, the following parameters are recommended:

Minimum embedment for frost protection:	30 inches
Minimum strip footing width:	20 inches
Maximum allowable net bearing pressure:	2,300 psf
Bearing pressure increase for transient loading:	33 percent

Foundations should not be installed on disturbed soils. If foundation soils become disturbed during construction they should be recompacted to the requirements for structural fill presented in this report.

We recommend that structural fills placed below foundations extend laterally a minimum of 6 inches for every 12 vertical inches of structural fill placed. For example, if 24 inches of structural fill is required to bring the excavation to footing grade, the structural fill should extend laterally a minimum of 12 inches beyond footings on both sides.

12.3 Estimated Settlement

If the proposed foundation is properly designed and constructed as described above, total estimated settlements should not exceed one inch under normal (static) conditions. Differential settlements are anticipated to be one-half of the total settlements over a 25-foot length of foundation. Total settlements my increase if the native soils underlying the structural fill become wetted.

12.4 Lateral Pressures

Resistance to lateral loads (including those due to wind or seismic loads) on foundations may be achieved by frictional resistance between the foundations and underlying soils, and by passive earth pressures of backfills placed against the sides of foundations. Below grade walls act as soil retaining structures and should be designed to resist pressures induced by the backfill soils.

The lateral pressures imposed on a retaining structure are dependant on the rigidity of the structure and its ability to resist rotation. Structures that are not allowed to rotate or move laterally, such as subgrade basement walls, develop an at-rest lateral earth pressure condition. Lateral pressures applied to structure may be computed by multiplying the vertical depth of backfill material by the appropriate equivalent fluid density. Any surcharge loads in excess of the soil weight applied to the backfill should be multiplied by the appropriate lateral pressure coefficient and added to the soil pressure. The lateral pressures presented herein are based on horizontal drained granular backfill and static conditions. For computing lateral forces we recommend the following equivalent fluid densities.

Table No. 2: Lateral Earth Pressures

Condition	Equivalent Fluid Pressure (pcf)	Lateral Pressure Coefficient
At-Rest	49	0.47
Passive	340	3.26

The friction acting along the base of foundations founded on granular structural fill may be computed by using a coefficient of friction of 0.60 with the normal dead load. These values may be increased by one-third for transient wind and seismic loads.

The values presented above are ultimate, therefore, an appropriate factor of safety should be applied to these values for design purposes. The appropriate factor of safety will depend on the design condition and should be determined by the project structural engineer.

13.0 FLOOR SLABS

To facilitate construction, act as a capillary break, and aid in distributing floor loads we recommend that all at-grade slabs and exterior flatwork be underlain by four inches of free-draining granular material such as "pea" gravel or three-quarters to one-inch minus clean gravel supported on dense native granular soils or on properly placed and compacted structural fill.

To help control normal shrinkage and stress cracking the floor slabs should have the following features:

(1) Adequate reinforcement for the anticipated floor loads with the reinforcement continuous through interior floor joints;

(2) Frequent crack control joints; and

(3) Non-rigid attachment of the slabs to foundation and bearing walls.

Special precautions should be taken during placement and curing of all concrete slabs and flatwork. Excessive slump (high water-cement ratios) of the concrete and/or improper finishing and curing procedures used during hot or cold weather conditions may lead to excessive shrinkage, cracking, spalling, or curling of slabs. We recommend all concrete placement and curing operations be performed in accordance with American Concrete Institute (ACI) codes and practices.

14.0 SURFACE DRAINAGE

Precautions should be taken during and after construction to reduce the potential for saturation of foundation soils. Over wetting the soils prior to or during construction may result in softening and pumping, causing

equipment mobility problems and difficulty in achieving compaction and will likely lead to some volume change in the native soils. We recommend that the following precautions be taken at this site:

(1) The ground surface should be graded to drain away from the structures in all directions. We recommend a minimum fall of 6 inches in the first 10 feet.

(2) Roof runoff should be collected in rain gutters with downspouts designed to discharge well outside of the backfill limits and at least 10 feet from structures.

(3) Sprinkler heads, if planned, should be aimed away and kept at least 5 feet from foundation walls.

(4) Adequate compaction of foundation backfill should be provided i.e. a minimum of 90% of ASTM D 1557. Water consolidation methods should not be used.

(5) Other precautions which may become evident during design and construction should be taken.

15.0 ASPHALT PAVEMENT SECTION DESIGN

We understand that an asphaltic concrete paved low-volume interior roads will be constructed throughout the development. We have prepared a pavement section design based on visual classification of the on-site soils, assumed traffic volumes based on our experience with similar projects, a California Bearing Ratio (CBR) of 16.2 for the supporting native soils, and the site grading recommendations presented in this report. The proposed low-volume interior roads should consist of the minimum asphalt pavement section presented in Table No. 3, Pavement Section Design.

Table No. 3: Pavement Section Design

Asphalt Thickness (in)	Compacted Roadbase Thickness (in)
3.0	6.0

All base material and asphalt should conform to local requirements regarding gradation, oil content, and any other requirements pertaining to the project. We recommend that all roadbase be properly processed, moisture conditioned, and compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D 1557. All asphalt should be compacted to a minimum of 95 percent of the laboratory Marshal mix design density. Prior to placing the pavement sections the subgrade should be proof-rolled to form a firm surface. If soft spots are encountered during proof-rolling, the soft areas should be removed and replaced with compacted structural fill.

16.0 GENERAL CONDITIONS

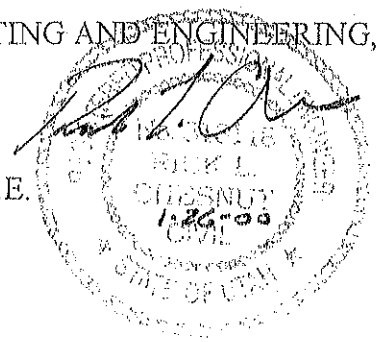
The exploratory data presented in this report were collected to provide geotechnical design recommendations for this project. The test pits may not be indicative of subsurface conditions outside the study area or between points explored and thus have a limited value in depicting subsurface conditions for contractor bidding. Variations from the conditions portrayed in the test pits often occur which are sometimes sufficient to require modifications in the design. If during construction, conditions are different than presented in this report, please advise us so that the appropriate modifications can be made. An experienced geotechnical

engineer or technician should observe fill placement and conduct testing as required to confirm the use of proper structural fill materials and placement procedures.

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

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 TESTING AND ENGINEERING, P.C.



Rick L. Chesnut, P.E.
Project Engineer

RC/kar

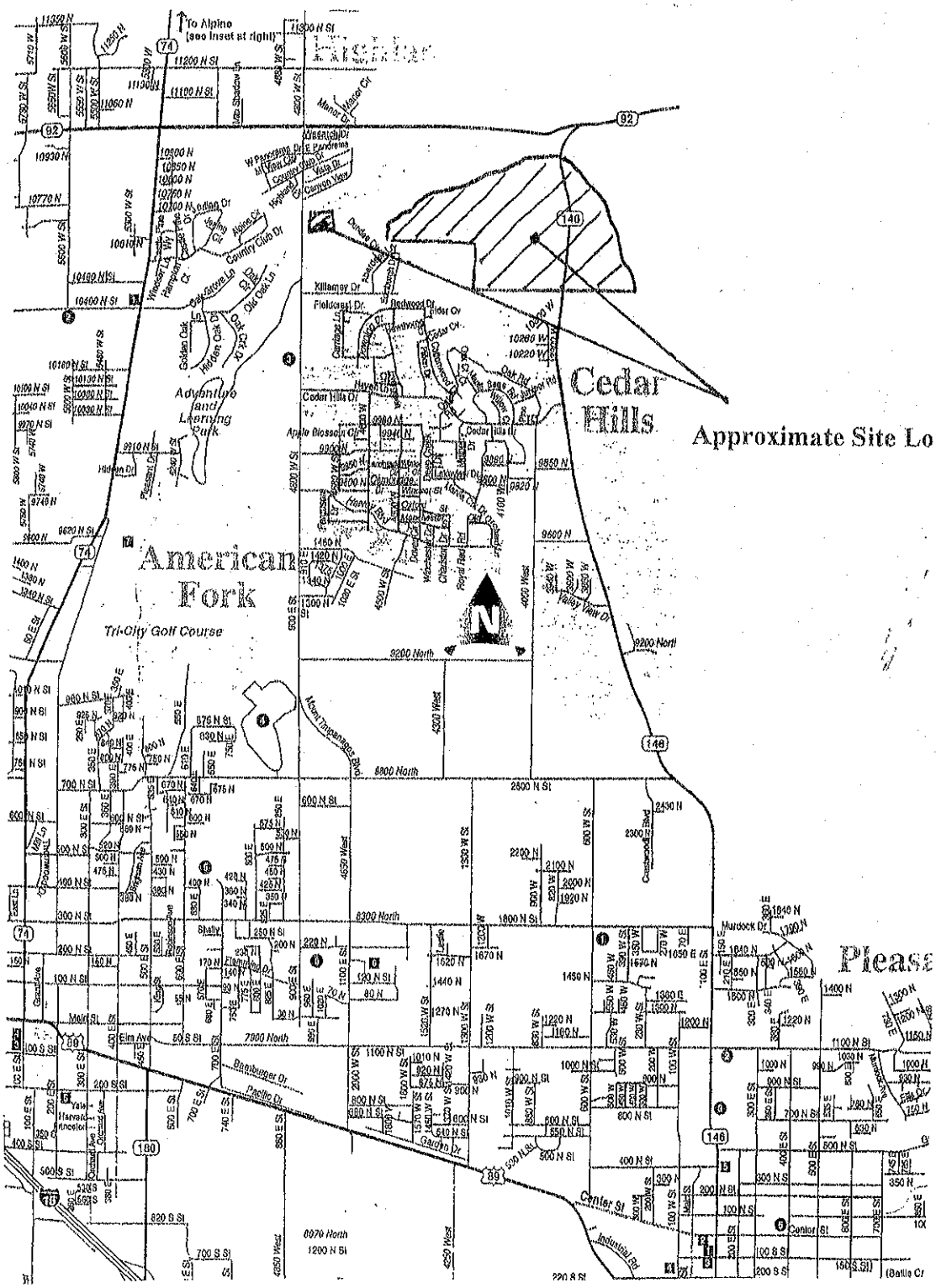
Mark Larsen
Project Geologist

Reviewed by:

Steven L. Smith, P.E.
Principal Engineer

VICINITY MAP

EARTHTEC TESTING & ENGINEERING, P.C.

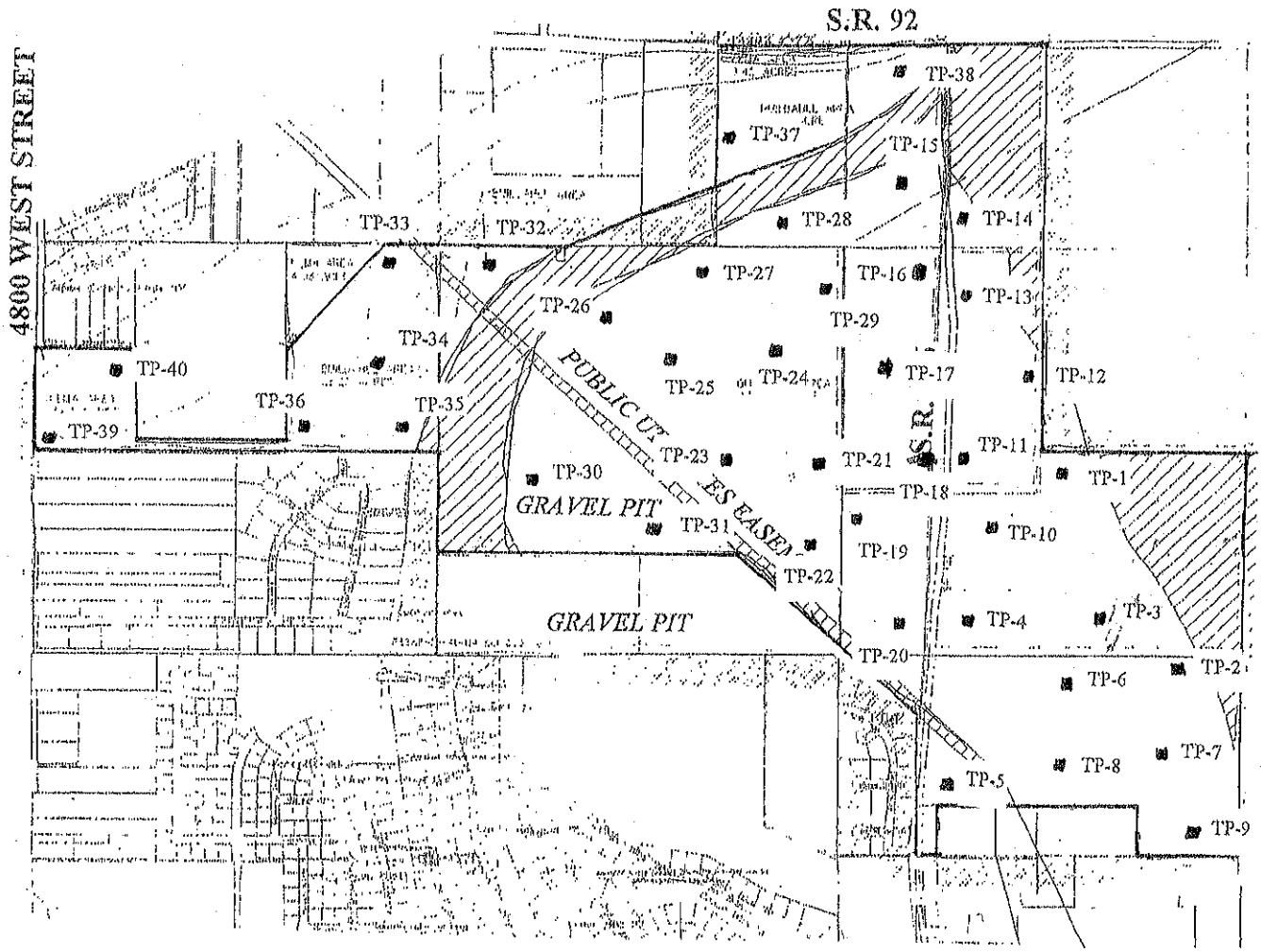


Job No. 99E-400

Figure No. 1

SITE PLAN AND LOCATIONS OF TEST PITS

EARTHTEC TESTING & ENGINEERING, P.C.



Job No. 99E-400

Figure No. 2

TEST PIT LOG

PIT NO.: TP-1

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GC	CLAYEY GRAVEL: With silt, sand, cobbles, trace of boulders, dense, slightly moist to moist, gray-tan to gray-brown.									
4												
6									57	23	20	
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-2

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GC	CLAYEY GRAVEL: With silt, sand, cobbles, trace of boulders, dense, slightly moist to moist, gray-tan.									
4												
6												
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-3

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GP-GM	GRAVEL: Poorly graded, with clay, sand, cobbles, trace of boulders, dense, slightly moist to moist, gray-tan.						65	19	16	
4												
6												
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-4

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GC	CLAYEY GRAVEL: With silt, sand, cobbles, trace of boulders, dense, slightly moist to moist, gray-tan.									
4		ML	SILT: With sand, gravel, trace of clay, medium stiff to stiff, moderate pinholes, moist, tan.									
6												
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-5

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, moist, gray.									
4		ML	SILT: With sand, gravel, trace of clay, medium stiff to stiff, moderate pinholes, moist, gray.		70.7	10.2	NP	NP	0	49	51	C
6		GP	GRAVEL: Poorly graded, with sand, dense, slightly moist, gray.									
8		SM	SILTY SAND: With silt, trace of gravel, medium dense, moist, gray-tan.						0	83	17	
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-6

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GC	CLAYEY GRAVEL: With silt, sand, cobbles, trace of boulders, dense, slightly moist to moist, gray-tan.									
4												
6												
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-7

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GC	CLAYEY GRAVEL: With silt, sand, cobbles, trace of boulders, dense, slightly moist to moist, gray-brown.									
4												
6		SC	CLAYEY SAND: With gravel, some cobbles, clay layers, major pinholes, medium dense, slightly moist, gray-tan.				25	35	23	39	38	
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-8

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GC	CLAYEY GRAVEL: With silt, sand, cobbles, trace of boulders, dense, slightly moist to moist, gray-tan.									
4												
6												
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-9

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2			CLAYEY GRAVEL: With silt, sand, cobbles, trace of boulders, very dense, slightly moist to moist, gray-tan, caliche deposits.									
4												
6		GC										
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-10

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GC	CLAYEY GRAVEL: With silt, sand, cobbles, trace of boulders, dense, slightly moist to moist, gray-tan.									
4												
6												
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-11

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2			CLAYEY GRAVEL: With silt, sand, cobbles, trace of boulders, dense, slightly moist to moist, gray-tan.									
4							21	30	56	19	25	
6		GC										
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-12

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GC	CLAYEY GRAVEL: With silt, sand, cobbles, trace of boulders, dense, slightly moist to moist, gray-tan.									
4												
6												
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-13

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		CL	CLAY: With silt, trace of sand, trace of gravel, major pinholes, stiff, slightly moist, light-brown.									
4					73.1	12.5	21	30	2	20	78	C
6		GP	GRAVEL: Poorly graded, with sand, trace of clay, cobbles, very dense, moist, gray.									
8												
10												
12												

Notes: Refusal at 7 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-14

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		CL	CLAY: With silt, trace of sand, trace of gravel, major pinholes, stiff, slightly moist, light-brown.									
4		GP	GRAVEL: Poorly graded, with sand, trace of clay, cobbles, very dense, moist, gray, cemented in upper five feet.									
6												
8												
10												
12												

Notes: Refusal at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-15

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GP	GRAVEL: Poorly graded, with sand, trace of silt, cobbles, very dense, moist, gray, cemented in upper two feet.									
4												
6												
8									77	20	3	
10												
12												

Notes: Refusal at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-16

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GP	GRAVEL: Poorly graded, with sand, trace of silt, cobbles, very dense, slightly moist to moist, gray-tan, cemented in upper two feet.									
4												
6												
8												
10												
12												

Notes: Refusal at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-17

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, very dense, slightly moist to moist, gray-tan, cemented in upper two feet.									
4												
6												
8												
10												
12												

Notes: Refusal at 5 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-18

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, very dense, trace of silt, slightly moist to moist, gray-tan, cemented in upper three feet.									
4												
6												
8												
10												
12												

Notes: Refusal at 7 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-19

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with clay, gravel, organics, soft to medium stiff, dark-brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, very dense, trace of silt, slightly moist to moist, gray-tan, cemented in upper three feet.						54	30	6	
4												
6												
8												
10												
12												

Notes: Refusal at 7 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-20

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
2		GP	GRAVEL: Poorly graded, with sand, cobbles, very dense, trace of silt, slightly moist to moist, gray-tan, cemented in upper three feet.									
4		SM	SILTY SAND: With gravel, medium dense, moist, light-brown.									
		CL-ML	SILTY CLAY: With sand, major pinholes, medium stiff, moist, light-brown.									
6		SP	SAND: poorly graded, with thin silty clay layers, medium dense, moist, gray.									
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-21

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, very dense, trace of silt, slightly moist to moist, gray-tan, cemented in upper three feet.						61	33	6	CBR
4												
6												
8												
10												
12												

Notes: Bottom at 8 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-22

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan, cemented.									
4												
6												
8												
10												
12												

Notes: Bottom at 8 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-23

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2			GRAVEL: Poorly graded, with sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan, cemented.									
4		GP										
6												
8												
10												
12												

Notes: Bottom at 8 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-24

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan, cemented.									
4												
6												
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-25

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan, cemented.						59	31	10	
4												
6												
8												
10												
12												

Notes: Bottom at 8.5 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-26

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, very dense, trace of silt, slightly moist to moist, gray-tan, cemented.									
4												
6												
8												
10												
12												

Notes: Refusal at 4.5 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-27

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2		GP-GM	GRAVEL: Poorly graded, with silt, sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan, cemented.									
4												
6												
8												
10												
12												

Notes: Refusal at 8 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-28

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2		GP-GM	GRAVEL: Poorly graded, with silt, sand, cobbles, very dense, trace of silt, slightly moist to moist, gray-tan, cemented.									
4												
6												
8									63	30	7	
10												
12												

Notes: Refusal at 8 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-29

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan, cemented.									
4												
6												
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-30

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan, cemented in upper three feet.									
4												
6												
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-31

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan, cemented in upper three feet.									
4												
6												
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-32

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with snad, gravel, trace of clay, organics, medium stiff to stiff, moist, brown.									
2			GRAVEL: Poorly graded, with sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan, cemented in upper three feet.									
4		GP										
6												
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-33

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		SM	TOPSOIL: Sand, with gravel, organics, medium dense, moist, brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan, cemented in upper three feet.						67	28	5	
4												
6												
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-34

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
0		SM	TOPSOIL: Sand, with gravel, organics, medium dense, moist, brown.									
2		GP-GM	GRAVEL: Poorly graded, with silt, sand, cobbles, dense, slightly moist, gray-tan.									
4												
6		GP	GRAVEL: Poorly graded, with cobbles, sand, dense, slightly moist, gray.									
8												
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-35

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
0		SM	TOPSOIL: Sand, with gravel, organics, medium dense, moist, brown.									
2		ML	SILT: With some clay, sand, stiff, slightly moist, tan.									
4		GP-GM	GRAVEL: Poorly graded, with silt, sand, cobbles, dense, trace of silt, slightly moist to moist, gray-tan.									
6												
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-36

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		SM	TOPSOIL: Sand, with gravel, organics, medium dense, moist, brown.									
2			GRAVEL: Poorly graded, with silt, sand, cobbles, very dense, slightly moist, gray-tan, cemented.									
4		GP-GM							60	33	7	
6												
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-37

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		SM	TOPSOIL: Sand, with gravel, organics, medium dense, moist, brown.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, moist, gray-brown.						75	22	3	
4												
6												
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-38

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, moist, gray-brown.						80	17	3	
4												
6												
8												
10												
12												

Notes: Bottom at 9 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-39

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS							
					Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
		ML	TOPSOIL: Silt, with roots, organics, stiff, moist, tan.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, moist, gray-brown.									
4												
6		ML	SILT: Stiff, moist, tan, with some pinholes.									
8		GP-GM	GRAVEL: Poorly graded, with silt, cobbles, dense, slightly moist, gray-tan.						63	25	12	
10												
12												

Notes: Bottom at 10 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

TEST PIT LOG

PIT NO.: TP-40

PROJECT: Cedar Hills 400 Acre Development
CLIENT: Landco Development , Inc.
LOCATION: Refer to Figure 2
OPERATOR: Hall Excavating
EQUIPMENT: Backhoe

PROJECT NO.: 99E-400
DATE: 12/29/99
ELEVATION:
LOGGED BY: ML

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Dry Dens. pcf	Water Cont. %	PL	LL	Gravel %	Sand %	Fines %	Other Tests
0		ML	TOPSOIL: Silt, with roots, organics, stiff, moist, tan.									
2		GP	GRAVEL: Poorly graded, with sand, cobbles, dense, moist, gray-brown.									
4												
6												
8												
10												
12												

Notes: Bottom at 8 feet.
No groundwater encountered.

Tests Key:
P = Percolation
C = Consolidation
G = Gradation
DS = Direct Shear
T = Torevane
UC = Unconf. Compress. Strength

KEY TO SYMBOLS

Symbol Description

Strata symbols


Topsoil


Clayey gravel


Poorly graded gravel with silt


Silt


Poorly graded gravel


Silty sand


Clayey sand


Low plasticity clay


Silty low plasticity clay


Poorly graded sand

Soil Samplers


Disturbed bag/grab sample


Undisturbed thin wall Shelby tube

Notes:

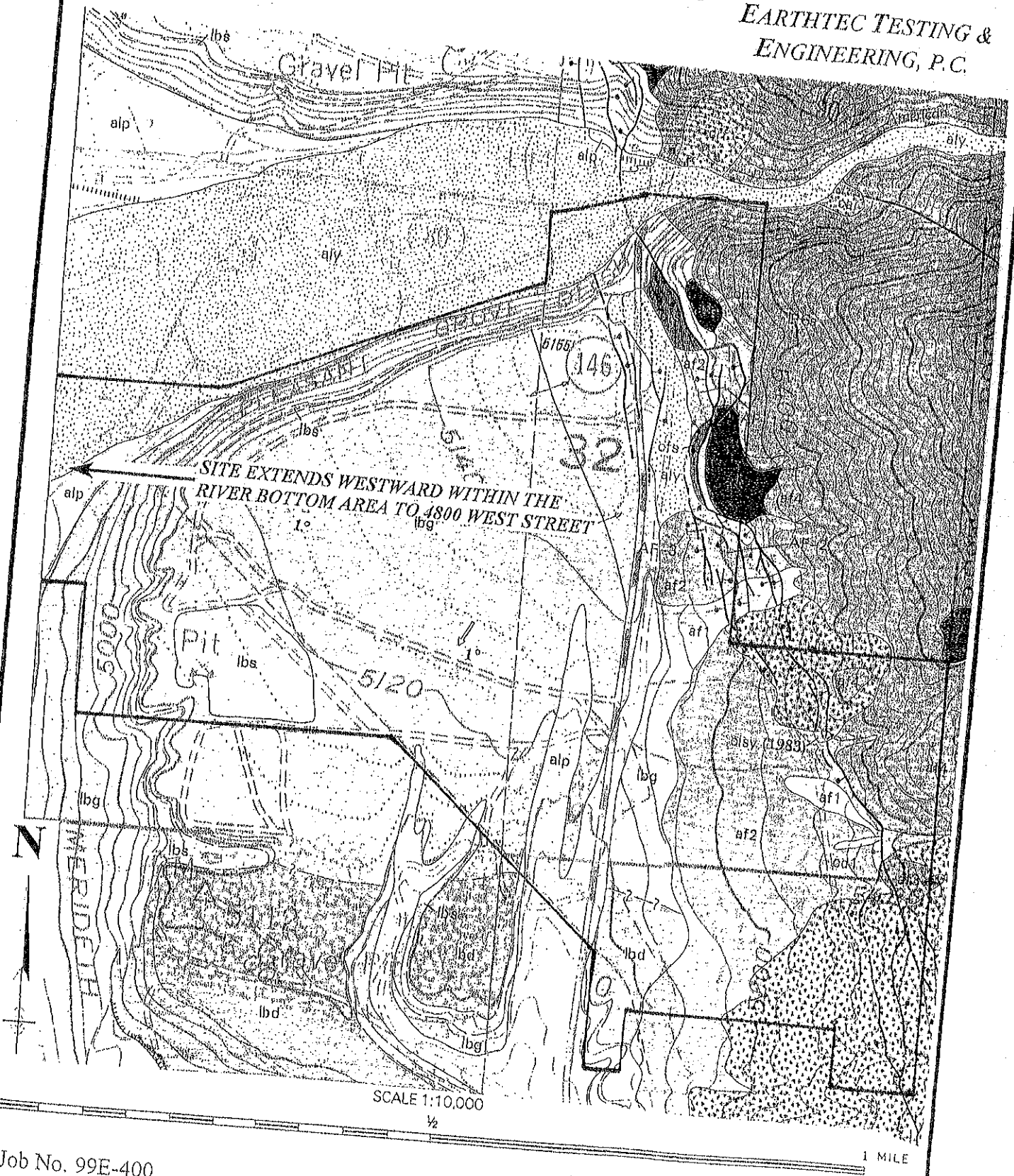
1. This log is subject to the limitations, conclusions, and recommendations in this report.

2. Results of tests conducted on samples recovered are reported on the logs.

FIGURE NO.: 43

GEOLOGIC HAZARDS MAP

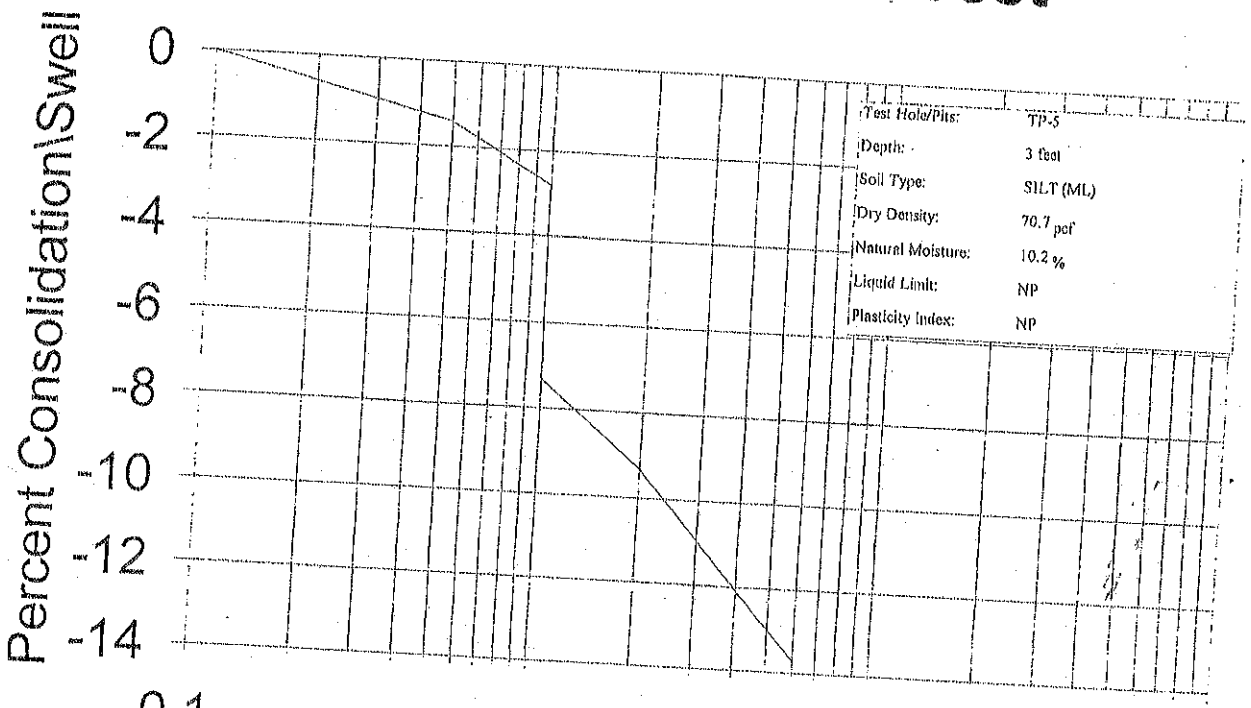
EARTHTEC TESTING & ENGINEERING, P.C.



Job No. 99E-400

Figure No. 44

Swell - Consolidation Test



Job No. 99E-400

Figure No. 4S

Swell - Consolidation Test

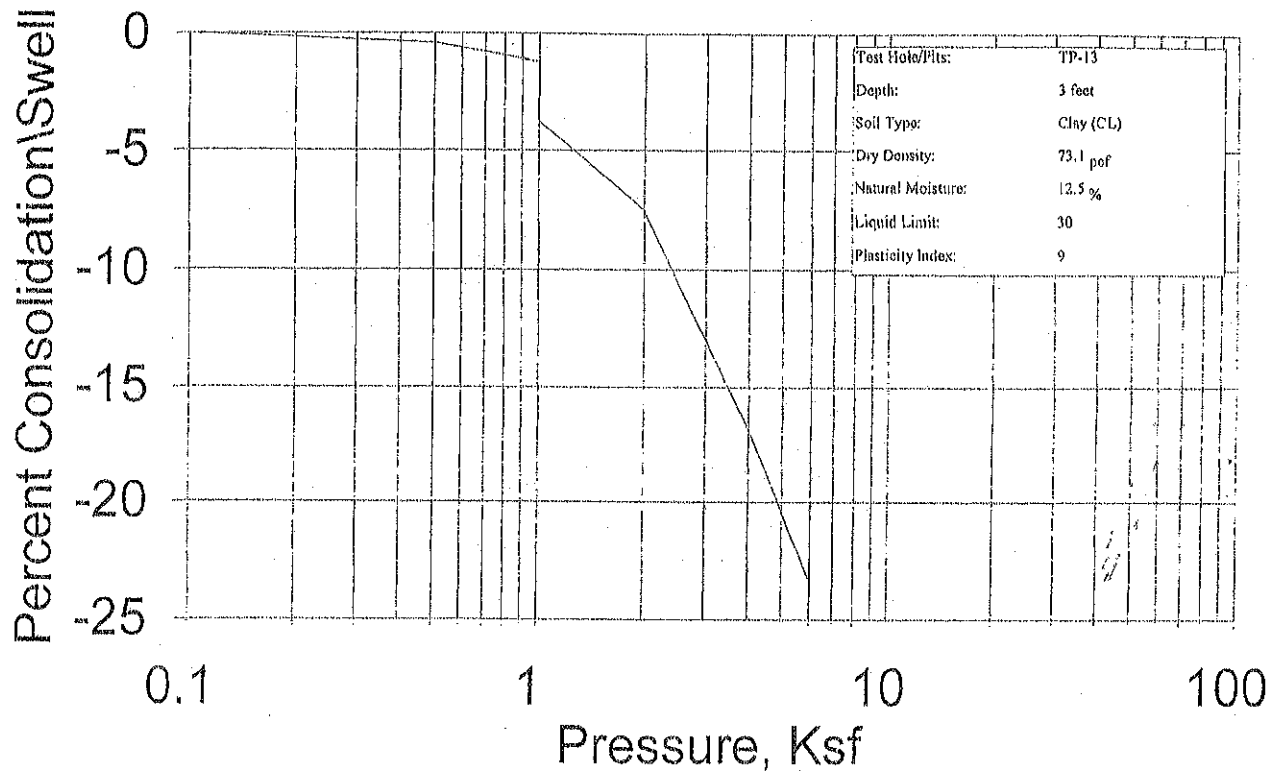


TABLE 4

Summary of Laboratory Test Data

TEST LOCATION	DEPTH (ft.)	IN-SITU DRY DENSITY (pcf)	IN-SITU MOISTURE CONTENT (%)	ATTERBERG LIMITS		GRADATION			CLASSIFICATION USCS
				LIQUID LIMIT	PLASTICITY INDEX	GRAVEL (%)	SAND (%)	SILT/ CLAY (%)	
TP-1	6	—	—	—	—	57	23	20	GM
TP-3	3	—	—	—	—	65	19	16	GP-GM
TP-5	3	70.7	10.2	NP	NP	0	49	51	ML
	9	—	—	—	—	0	83	17	SM
TP-7	6	—	—	35	10	23	39	38	SC
TP-9	6	—	—	—	—	59	17	24	GM
TP-11	3	—	—	30	9	56	19	25	GC
TP-13	3	73.1	12.5	30	9	2	20	78	CL
TP-15	8	—	—	—	—	77	20	3	GP
TP-19	5	—	—	—	—	64	30	6	GP
TP-21	1	—	—	—	—	61	33	6	GP
TP-25	2	—	—	—	—	59	31	10	GP-GM
TP-28	7	—	—	—	—	63	30	7	GP-GM
TP-33	PILE	—	—	—	—	67	28	5	GP
TP-36	5	—	—	—	—	60	33	7	GP-GM
TP-37	PILE	—	—	—	—	75	22	3	GP
TP-38	PILE	—	—	—	—	80	17	3	GP
TP-39	PILE	—	—	—	—	63	25	12	GP-GM

TABLE 5

Summary of California Bearing Ratio (CBR) Test Data

TEST HOLE NO.	DEPTH (ft.)	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	CBR	CLASSIFICATION USCS
TP-21	1	136.5	7.0	16.2	GP