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GEOTECHNICAL STUDY
HOLLAND PARK
APPROX. 9650 SOUTH 1300 WEST
SOUTH JORDAN, UTAH

Project No. 111055

October 4, 2011

Prepared For:

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1.0 INTRODUCTION

This report presents the results of a geotechnical study for a proposed residential subdivision to be located at approximately 9650 South 1300 West in South Jordan, Utah. The general location of the site is shown on Figure No. 1, *Vicinity Map*, at the end of this report.

The purposes of this study were to 1) evaluate the subsurface soil conditions at the site, 2) assess the engineering characteristics of the subsurface soils, and 3) provide geotechnical recommendations for general site grading and the design and construction of foundations, concrete floor slabs, miscellaneous concrete flatwork, and asphalt paved streets. The scope of work completed for this study included field reconnaissance, subsurface investigation, field and laboratory soil testing, engineering analysis, and the preparation of this report.

2.0 CONCLUSIONS

The following is a brief summary of our findings and conclusions:

a. At the test pit locations we encountered about 6 to 12 inches of clayey topsoil on the surface followed by layers of near surface Lean Clay (CL) underlain by layers of Silty Sand (SM) and Gravel (GP-GM), extending to the maximum depths explored of about 9½ to 10 feet below the existing surface.

b. Groundwater was encountered at a depth of about 9½ feet below the existing ground surface in Test Pit 5, but not encountered in the other test pits. Iron oxide staining, an indicator of past saturated conditions, was observed as shallow as about 2 feet below the surface in some of the test pits. Lowest floor slabs should be placed at least 3 feet above groundwater levels at the site.

c. The subsurface soils predominately consisted of clays which are typically considered non-liquefiable. A layer of saturated sand was encountered near the bottom of Test Pit 5. Though estimated to be in a medium dense state, this sand layer may be somewhat susceptible to liquefaction, but additional exploration would be required to quantify the liquefaction risks.

d. A pinhole texture, a typical visual indicator of potentially moisture sensitive soil, was observed in many of the subsurface soil layers. These soils can experience additional settlement (collapse) when wetted. Laboratory testing indicated moderate to high moisture sensitivity.

e. Because of the moisture sensitive nature of the subsurface soils we recommend that all footings bear entirely on undisturbed uniform native gravel soils, or entirely on a minimum 30 inches of structural fill placed on undisturbed native soils. A maximum bearing capacity of 1,500 psf may be used for design of the footings. More details regarding foundation design can be found in Section 10.0 of this report.

These findings and conclusions should not be relied upon without reading and consulting this entire report for a more detailed description of the geotechnical evaluation and recommendations contained herein.

3.0 PROPOSED CONSTRUCTION

We understand that single-family residences will be constructed at the site. We have based our recommendations in this report on the assumption that foundation loads for the proposed homes will not exceed 4 kips per linear foot for bearing walls, and 200 pounds per square foot for floor slabs. If structural loads will be greater our office should be notified so that we may review our recommendations and, if necessary, make modifications.

In addition to the construction described above, we anticipate that utilities will be installed to service the proposed residences; that exterior concrete flatwork will be placed in the form of curb, gutter, sidewalks, and driveways; and that asphalt concrete paved residential streets will be constructed.

4.0 GENERAL SITE DESCRIPTION

At the time of our subsurface investigation the site was predominately composed of pasture vegetated with grass, weeds, and a few trees. There was an unoccupied residence in the northeast corner of the site with a small barn southwest of the home. Some distress to the garage portion of the home, which consisted of cracks in the mortar and a separation of about ½ inch from the house, was observed. The ground surface appeared to slope downward to the east. We observed some water on the surface in the vicinity of TP-1 and a ditch running

from that area toward TP-4. The site was bounded on the north, south, and west by residences and on the east by 1300 West Street.

5.0 SUBSURFACE EXPLORATION

Subsurface soil conditions at the site were explored under the direction of a qualified member of our geotechnical staff. Using a rubber track mini-backhoe, 5 exploratory test pits were excavated to depths of approximately 9½ to 10 feet below the existing surface on September 23, 2011. The approximate locations of the test pits are shown on Figure No. 2, *Site Plan and Location of Test Pits*. Graphical representations and detailed descriptions of the soils encountered are shown on Figure Nos. 3 through 7, *Test Pit Log* at the end of this report. The stratification lines shown on the logs represent the approximate boundary between soil units; the actual transition may be gradual. Due to potential natural variations inherent in soil deposits, care should be taken in interpolating between and extrapolating beyond exploration points. A key to the symbols and terms on the logs is presented on Figure No. 8, *Legend*.

The subsurface soils exposed in the test pits were classified by visual examination using the guidelines of the Unified Soil Classification System (USCS). Disturbed bag samples and relatively undisturbed block samples were collected at various depths in each test pit. Samples will be retained in our laboratory for 30 days following the date of this report and then discarded unless a written request for additional holding time is received prior to the disposal date.

6.0 LABORATORY TESTING

Selected soil samples collected in the test pits were tested in the laboratory to assess pertinent engineering properties and to aid in refining field classifications, if needed. Tests performed included natural moisture content and dry density tests, one-dimensional consolidation tests, liquid and plastic limits determinations, a mechanical gradation analysis, and a California Bearing Ratio (CBR) test. The following table summarizes most of the laboratory test

results, which are also included on the attached test pit logs at the respective sample depths, and on Figure Nos. 8 through 11, *Consolidation-Swell Test.*

Table No. 1: Laboratory Test Results

TEST PIT NO.	DEPTH (ft.)	NATURAL MOISTURE (%)	NATURAL DRY DENSITY (pcf)	ATTERBERG LIMITS		GRAIN SIZE DISTRIBUTION (%)			SOIL TYPE
				LIQUID LIMIT	PLASTICITY INDEX	GRAVEL (+ #4)	SAND	SILT/ CLAY (- #200)	
TP-1	4	24	76	47	26	---	---	---	CL
TP-1	9	5	---	---	---	50	40	10	GP-GM
TP-2	7	24	71	47	26	---	---	---	CL
TP-3	3	16	81	35	17	---	---	---	CL
TP-4	9	25	68	47	20	---	---	---	CL
TP-5	1	10	---	35	15	---	---	---	CL

* NP = Non-Plastic

As part of the consolidation test procedure, water was added to the samples to assess moisture sensitivity when the samples were loaded to an equivalent pressure of 1,000 psf. This part of the consolidation test indicated moderate to high moisture sensitivity (1½% to 4½%) in the form of collapse (settlement).

7.0 SUBSURFACE CONDITIONS

7.1 Soil Types

On the surface of the site, we encountered topsoil which we observed to extend about 6 to 12 inches in depth at the test pit locations. Below the topsoil we encountered layers of Lean Clay (CL), occasionally underlain by layers of Silty Sand (SM) or Poorly Graded Gravel with silt and sand (GP-GM) extending to the bottom of the test pits. Pinholes, a typical visual indicator of potentially moisture sensitive (collapsible) soils, were observed in the subsurface clay soils. Based on the results of the consolidation testing, the clay soils have moderate to high moisture sensitivity, and moderate compressibility characteristics. Precautions should be taken to reduce the potential for subsurface soils to become wetted. Recommendations are given in Sections 10.0 and 13.0 of this report.

7.2 Groundwater Conditions

Groundwater was encountered in Test Pit 5 at about 9½ feet below the ground surface, but not encountered in the other test pits. Groundwater levels will fluctuate in response to the season, precipitation and snow melt, irrigation, and other on and off-site influences. Precisely quantifying these fluctuations would require long term monitoring.

8.0 SITE GRADING

8.1 General Site Grading

Unsuitable soils and vegetation should be removed from below foundation, floor slab, exterior concrete flatwork, and pavement areas. Unsuitable soils consist of topsoil, organic soils, undocumented fill, soft, loose, or disturbed native soils, and any other inapt materials. We encountered topsoil on the surface of the site which we observed to extend about 6 to 12 inches below the ground surface. The topsoil (including soil with roots larger than about ¼ inch in diameter) and any disturbed soils from past farming activities should be completely removed, even if found to extend deeper, along with any other unsuitable soils that may be encountered.

Fill placed over large areas, even if only a few feet in depth, can cause consolidation in the underlying native soils resulting in settlement of the fill. If more than 3 feet of grading fill will be placed above the existing surface (to raise site grades), Earthtec should be notified so that we may assess potential settlement and make additional recommendations if needed. Such recommendations may include placing the fill several weeks prior to construction to allow settlement to occur.

8.2 Temporary Excavations

For temporary excavations less than 5 feet in depth into the native soils or into structural fill, slopes should not be made steeper than ½H:1V (Horizontal:Vertical). Temporary excavations extending up to 10 feet in depth should not be made steeper than 1H:1V. If unstable conditions or groundwater seepage are encountered in excavations, flatter slopes,

shoring, or bracing may be required. Groundwater may be encountered in deeper excavations at the site, particularly on the east side.

8.3 Fill Material

Near surface native clay soils are generally not considered suitable for use as structural fill but may be stockpiled for use as fill in landscape areas. We recommend that a professional engineer or geologist verify that the structural fill to be used on this project meets our requirements, given below.

Regular structural fill should consist of imported material meeting the following requirements:

Maximum particle size:	4 inches
Percent retained on the 3/4 inch sieve (coarse gravel):	30 maximum
Percent passing the No. 200 sieve (fines):	15 maximum
Liquid Limit of fines:	35 maximum
Plasticity Index of fines:	15 maximum

In some situations, particles larger than 4 inches and/or more than 30 percent coarse gravel may be acceptable, however, compaction and compaction testing may be more difficult. As a result more strict quality control measures than normally used may be required. Such measures may include using thinner lifts, and increased or full time observation of fill placement.

Utility trenches below the building and pavements should be backfilled with structural fill. In other areas, utility trenches may be backfilled with the native soil. Native clay soils (as observed in the test pits) may be time consuming to compact due to more difficulty controlling the moisture content needed to obtain optimum compaction. All backfill soil should meet the following requirements:

Maximum particle size:	4 inches
Liquid Limit of fines:	35 maximum
Plasticity Index of fines:	15 maximum

Fill in submerged areas should consist of free draining granular material (sand and/or gravel) meeting the following requirements:

Maximum particle size:	3 inches
Percent passing the No. 10 sieve:	25 maximum
Percent passing the No. 40 sieve:	15 maximum
Percent passing the No. 200 sieve (fines):	5 maximum

Three inch minus washed rock (sometimes called river rock or drain rock) and pea gravel meet these requirements and may be used as free draining fill. If free draining fill will be placed adjacent to soil containing a significant amount of sand or silt, precautions should be taken to prevent the migration of fine soil into the free draining fill. Such precautions should include either placing a filter fabric between the free draining fill and the adjacent material, or using a well graded, free draining fill material approved by the geotechnical engineer.

8.4 Fill Placement and Compaction

The thickness of each lift should be appropriate for the compaction equipment that is used. We recommend a maximum lift thickness of 4 inches for hand operated equipment, 6 inches for most "trench compactors", and 8 inches for larger rollers, unless it can be demonstrated by in-place density tests that the required compaction can be obtained throughout a thicker lift. The full thickness of each lift of structural fill placed should be compacted to at least the following percentages of the maximum dry density, as determined by ASTM D-1557:

In landscape areas not supporting structural loads:	90%
Less than 5 feet of fill below foundations, flatwork and pavements:	95%
Five or more feet of fill below foundations, flatwork and pavements:	98%

Generally, placing and compacting fill at a moisture content within 2% of the optimum moisture content, as determined by ASTM D-1557, will facilitate compaction. Typically, the further the moisture content is from optimum the more difficult it will be to achieve the required compaction.

Fill should be tested frequently during placement and early testing is recommended to demonstrate that placement and compaction methods are achieving the required compaction. It is the contractor's responsibility to ensure that fill materials and compaction efforts are consistent so that tested areas are representative of the entire fill.

8.5 Stabilization

Near surface layers of clay were encountered in the test pits. These soils may rut and pump during grading and construction. The likelihood of rutting and/or pumping, and the depth of disturbance, is proportional to the moisture content in the soil, the load applied to the ground surface, and the frequency of the load. Consequently, rutting and pumping can be minimized by avoiding concentrated traffic, minimizing the load applied to the ground surface by using lighter equipment and/or partial loads, by working in dry times of the year, or by providing a working surface for equipment.

During grading the soil in any obvious soft spots should be removed and replaced with granular material. If rutting or pumping occurs traffic should be stopped in the area of concern. The soil in rutted areas should be removed and replaced with granular material. In areas where pumping occurs the soil should either be allowed to sit until pore pressures dissipate (several hours to several days) and the soil firms up, or be removed and replaced with granular material. Typically, we recommend removal to a minimum depth of 18 inches. Removal and replacement to a greater depth may be required.

For granular material, we recommend using angular well-graded gravel, such as pit run, or crushed rock with a maximum particle size of four inches. We suggest that the initial lift be

approximately 12 inches thick and be compacted with a static roller-type compactor. A finer granular material such as sand, gravelly sand, sandy gravel or road base may also be used. The more angular and coarse the material, the thinner the lift that will be required. We recommend that the fines content (percent passing the no. 200 sieve) be less than 15%, the liquid limit be less than 35, and the plasticity index be less than 15.

Using a geosynthetic fabric, such as Mirafi 500X or equivalent, may also reduce the amount of material required and avoid mixing of the granular material and the subgrade. If a fabric is used, following removal of disturbed soils and water, the fabric should be placed over the bottom and up the sides of the excavation a minimum of 18 inches. The fabric should be placed in accordance with the manufacturer's recommendations, including proper overlaps. The granular material should then be placed over the fabric in compacted lifts. Again, we suggest that the initial lift be approximately 12 inches thick and be compacted with a static roller-type compactor.

9.0 SEISMIC CONSIDERATIONS

9.1 Faulting

Based upon published data, no known faults traverse the site. No surficial evidence of faulting was observed during our field investigation. The nearest mapped[1] fault trace is the Wasatch Fault located about 6 miles east of the site.

9.2 Liquefaction Potential

The site is located within an area which has been mapped by the Utah Geological Survey[2] as having moderate liquefaction potential. Liquefaction is a phenomenon where a soil loses intergranular strength due to an increase in soil pore water pressures during a dynamic event such as an earthquake. The potential for liquefaction is based on several factors, including 1) the grain size distribution of the soil, 2) the plasticity of the fine fraction of the soil (material

[1] Hecker, S., 1993, Quaternary Faults and Folds, Utah, Utah Geologic Survey, Bulletin 127.

[2] Liquefaction Potential Map, Utah Geological Survey, Public Information Series 28. 1994.

passing the No. 200 sieve), 3) relative density of the soil, 4) earthquake strength (magnitude) and duration, and 5) overburden pressures. In addition, the soils must be saturated for liquefaction to occur. As a part of this investigation, the potential for liquefaction to occur in the soils we encountered was assessed.

Loose, saturated sands are most susceptible to liquefaction, but soft, sensitive silt soils also have the potential to experience failure and movement during a seismic event. Subsurface soils were predominately composed of clay. A layer of saturated sand was encountered at a depth of about 9½ feet below the ground surface in TP-5 and estimated to be in a medium dense state. Clay soils are typically considered non-liquefiable, but it is possible that the sand soils could liquefy. Additional exploration would be required to quantify potential movements.

9.3 IRC Seismic Design Category

The Seismic Design Categories in the International Residential Code (IRC) are based upon the short period design accelerations determined using the seismic provisions of the International Building Code (IBC) and the soil properties in the upper 100 feet of the soil profile. These properties are determined from SPT blow counts, undrained shear strength values, and/or shear velocity measurements. The code states, "When the soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used unless the building official or geotechnical data determines that Site Class E or F soil is likely to be present at the site." Based on the results of our field exploration, we recommend using Site Class D.

The site is located at approximately 40.576 degrees north latitude and about -111.931 degrees west longitude. For Site Class D, Fa is 1.0 and S_{DS} is 0.834. The Seismic Design Category is D_2.

10.0 FOUNDATIONS

10.1 General

The foundation recommendations presented in this report are based on the soil conditions encountered in the test pits, the results of laboratory testing of samples of the native soils, the site grading recommendations presented in this report, and the foundation loading conditions presented in Section 3.0, *Proposed Construction*, of this report. If loading conditions are significantly different, we should be notified in order to re-evaluate our design parameters and estimates (higher loads may cause more settlement), and to provide additional recommendations if necessary.

Given the moderate to high potential for collapse to occur if the soils become wet, we recommend that foundations be constructed entirely on firm, undisturbed, uniform native gravel soils, or entirely on a minimum 30 inches of structural fill placed on undisturbed native soils. In general, it appears the collapse potential of the soils is less at depths greater than 5 feet below the ground surface. Observation of the footing excavations should be performed to evaluate if the full 30 inches of structural fill is needed. For design of conventional strip and spread footings, the following parameters are recommended:

1. Conventional isolated and continuous footings should provide adequate support for the proposed residences and may be designed using a maximum allowable bearing capacity of 1,500 pounds per square foot. The bearing pressure may be increased by 33 percent for transient loadings.

2. Continuous and spot footings should be uniformly loaded and should have a minimum width of 20 and 30 inches, respectively.

3. Exterior footings should be placed below frost depth which is determined by local building codes. Generally 30 inches of cover is adequate for this site. Interior footings, not subject to frost, should extend at least 18 inches below the lowest adjacent grade.

4. Foundation walls on continuous footings should be well reinforced. We suggest a minimum amount of steel equivalent to that required for a simply supported span of 12 feet.

5. The bottom of footing excavations should be compacted with at least 4 passes of an approved non-vibratory roller prior to erection of forms or placement of structural fill to densify soils that may have been loosened during excavation and to identify soft spots. If soft areas are encountered, they should be stabilized as recommended in Section 8.5.

6. Footing excavations should be observed by the geotechnical engineer prior to placement of the footings to evaluate whether suitable bearing soils have been exposed and whether excavation bottoms are free of loose or disturbed soils.

Structural fill used below foundations should extend laterally a minimum of 6 inches for every 12 vertical inches of structural fill placed. For example, if 30 inches of structural fill are required to bring the excavation to footing grade, the structural fill should extend laterally a minimum of 15 inches beyond the edge of the footings on both sides.

10.2 Estimated Settlement

If the proposed foundations are properly designed and constructed using the parameters provided above, total settlement for non-earthquake conditions is estimated to not exceed one inch. Differential settlement is anticipated to be one-half of the total settlement over a 25-foot length of foundation. Additional settlement could occur during an earthquake due to ground shaking, if more than 3 feet of grading fill is placed above the existing ground surface, or if foundation soils are allowed to become wetted.

11.0 SUBSURFACE DRAINAGE

According to Section R405 of the 2006 International Residential Code, "Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade." An exception is allowed when the foundation is installed on well drained ground consisting of Group 1 soils, which include those defined by the Unified Soil Classification System as GW, GP, SW, SP, GM, and SM. The native soils encountered in the test pits varied, most (CL) were not Group 1 soils. Because of the iron oxide staining and the groundwater observed in one of the test pits, we recommend that foundation drains or possibly land drains be constructed.

12.0 FLOOR SLABS

Floor slabs should be designed and constructed to be at least 3 feet above the groundwater level. We recommend that foundation drains be installed (or land drains as discussed above) if floor slabs will be placed deeper than 3 feet below the existing ground surface.

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 firm native soils or 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.

13.0 MOISTURE CONTROL AND SURFACE DRAINAGE

Allowing the subsurface clay soils to become wetted after construction could lead to additional settlement or other movements. To reduce the potential for surface runoff water

from landscaping and roof drains to collect near foundation walls and saturate foundation soils, we recommend the following precautions be taken:

1. 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.**

2. The ground surface should be graded to drain away from each residence in all directions. We recommend a minimum fall of 8 inches in the first 10 feet.

3. Roof runoff should be collected in rain gutters with down spouts designed to discharge well outside of the backfill limits, or at least 10 feet from foundations, whichever is greater.

4. Sprinkler nozzles should be aimed away, and all sprinkler components kept at least 5 feet, from foundation walls. Also, sprinklers should not be placed at the top or on the face of slopes. Sprinkler systems should be designed with proper drainage and well maintained. Over-watering should be avoided.

5. Any additional precautions which may become evident during construction.

14.0 PAVEMENT RECOMMENDATIONS

We understand that residential streets will be constructed as part of the development. The native near surface soils encountered in the test pits were composed of clay. We collected a sample of these soils from TP-5 for California Bearing Ratio (CBR) testing. Test results were not available at the time this report was completed, but will be provided in an addendum report. Also, the clay soils are potentially moisture sensitive, and over-excavation will likely be needed to minimize the potential settlement of pavements.

We anticipate the traffic volume will be about 200 vehicles a day or less, consisting of mostly cars and pickup trucks, with an occasional delivery truck and a weekly garbage truck. Based on these values and the typical parameters and procedures outlined in the *UDOT Pavement Design Manual (1998)*, until the CBR test results are available, we recommend the preliminary asphalt pavement section presented in the table below.

Table No. 2: Preliminary Pavement Section Design

ASPHALT THICKNESS (in)	COMPACTED ROADBASE THICKNESS (in)	COMPACTED SUBBASE THICKNESS (in)
3	6	18*

* Stabilization may be required

If the pavement will be required to support construction traffic, more than an occasional semi-tractor or fire truck, or more traffic than listed above, our office should be notified so that we can re-evaluate the pavement section recommendations. All subbase, base material, and asphalt should conform to local or UDOT requirements regarding gradation, oil content, and any other requirements pertaining to the project. We recommend that all roadbase and subbase be properly processed, moisture conditioned, and compacted to a minimum of 95% of the maximum dry density as determined by ASTM-D 1557. All asphalt should be compacted to current local or UDOT requirements, as appropriate.

15.0 GENERAL CONDITIONS

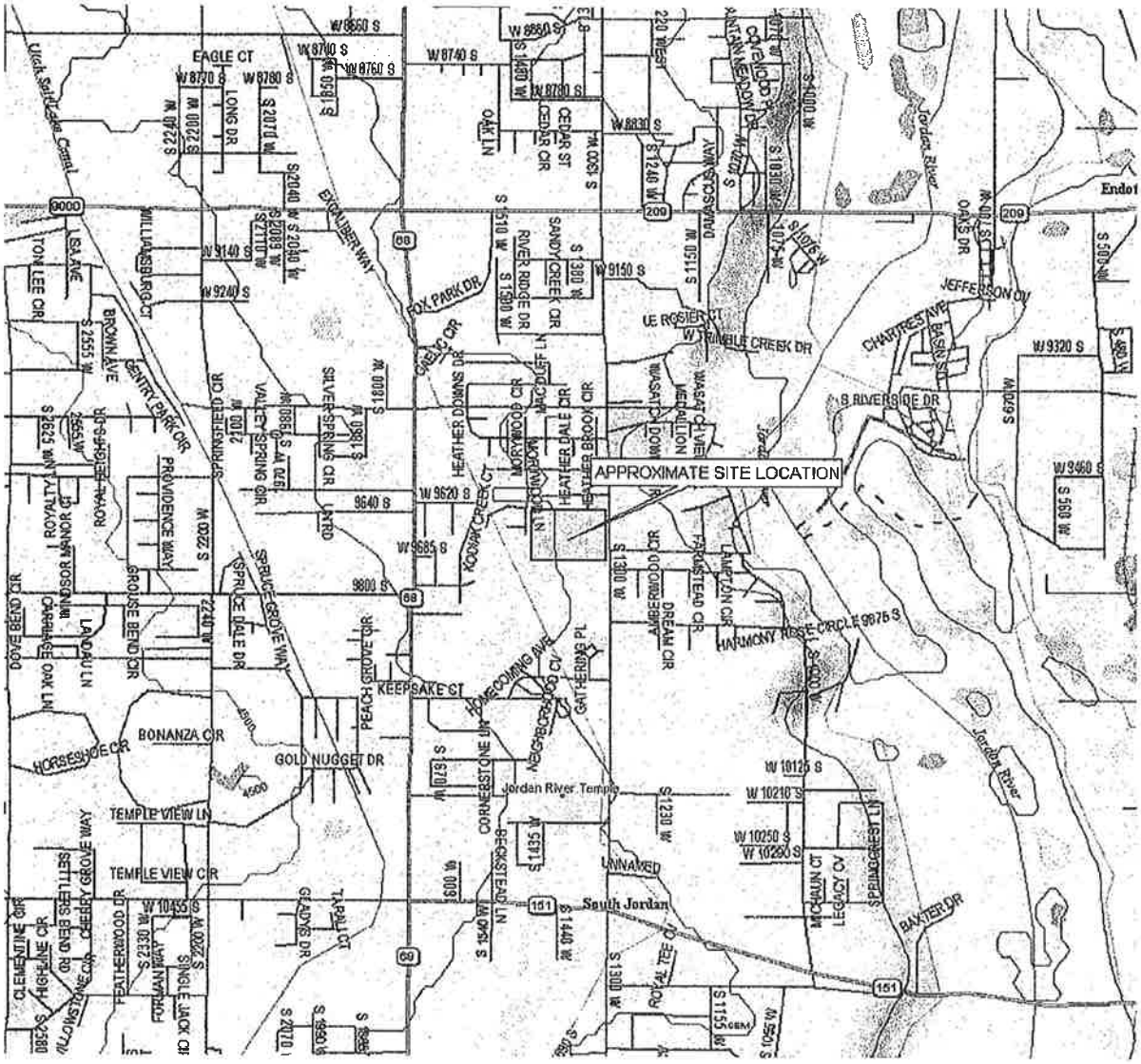
The exploratory data presented in this report was collected to provide geotechnical design recommendations for this project. The test pits may not be indicative of subsurface conditions outside the study area or between points explored and thus have a limited value in depicting subsurface conditions for contractor bidding. Variations from the conditions portrayed in the test pits may occur and which may be 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.

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.

For consistency, Earthec should perform materials testing and special inspections for this project. The recommendations presented herein are based on the assumption that an adequate program of tests and observations will be followed during construction to verify compliance with our recommendations. We also assume that we will review the project plans and specifications to verify that our conclusions and recommendations are incorporated and remain appropriate (based on the actual design).

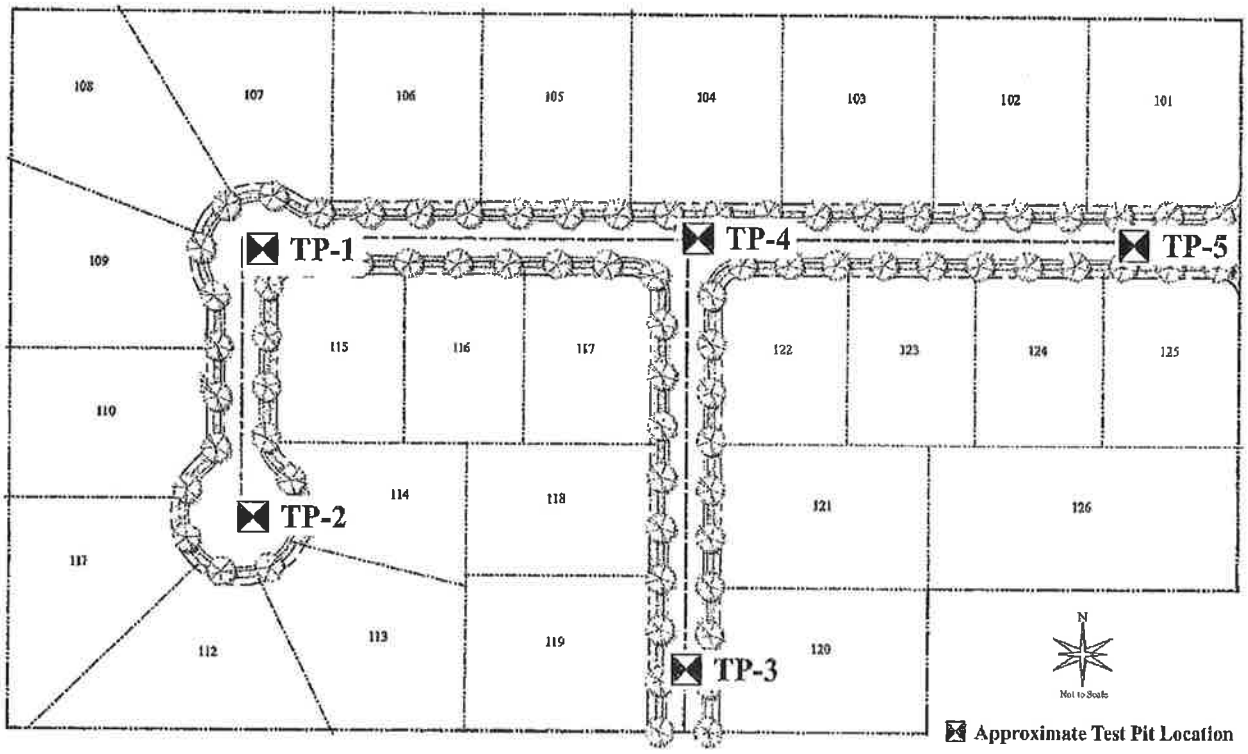
We appreciate the opportunity of providing our services on this project. If we can answer questions or be of further service, please call.

VICINITY MAP
HOLLAND PARK



PROJECT NO.: 111055	Earthtec Engineering Inc.	FIGURE NO.: 1

SITE PLAN & LOCATION OF TEST PITS
HOLLAND PARK



PROJECT NO.: 111055	Earthtec Engineering Inc.	FIGURE NO.: 2

TEST PIT LOG
NO.: TP-1

PROJECT: Holland Park
CLIENT: The Boyer Company
LOCATION: Refer to Figure 2.
OPERATOR: Blaine Hone Ex.
EQUIPMENT: CAT 303.5C
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 111055
DATE: 09/23/11
ELEVATION: NM
LOGGED BY: J.E.
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL: Clay, roots, organics, moist, brown.									
1		CL	LEAN CLAY, medium stiff (estimated), moist, brown, white mottling, iron oxide stains.									
2												
3												
4		CL	LEAN CLAY, medium stiff (estimated), moist, gray-brown, iron oxide stains.									
				■	24	76	47	26				C
5												
6												
7												
8		GP-GM	POORLY GRADED GRAVEL with sand and silt, clay layers, medium dense (estimated), moist, gray, heavy iron oxide stains.									
9				╳	5				50	40	10	
10			Bottom at approximately 9.5 feet.									
11												
12												

Notes: No groundwater encountered.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 111055

Earthtec Engineering Inc.

FIGURE NO.: 3

LOG OF TESTPIT 111055 LOGS.GPJ EARTHTEC.GDT 10/4/11

TEST PIT LOG
NO.: TP-2

PROJECT: Holland Park
CLIENT: The Boyer Company
LOCATION: Refer to Figure 2.
OPERATOR: Blaine Hone Ex.
EQUIPMENT: CAT 303.5C
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 111055
DATE: 09/23/11
ELEVATION: NM
LOGGED BY: J.E.
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL: Clay, roots, organics, moist, brown.									
1		CL	LEAN CLAY, moderate pinholes, roots holes, stiff (estimated), slightly moist, light gray-brown-white.									
2												
3		CL	LEAN CLAY, minor pinholes in upper foot, hard (estimated), slightly moist, gray-brown, iron oxide stains.									
4												
5												
6												
7												
8					24	71	47	26				C
9		SM	SILTY SAND, medium dense (estimated), slightly moist, light gray, heavy iron oxide stains.									
10												
11			Bottom at approximately 10 feet.									
12												

Notes: No groundwater encountered.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 111055

Earthtec Engineering Inc.

FIGURE NO.: 4

LOG OF TESTPIT 111055 LOGS.GPJ EARTHTEC.GDT 10/4/11

TEST PIT LOG
NO.: TP-3

PROJECT: Holland Park
CLIENT: The Boyer Company
LOCATION: Refer to Figure 2.
OPERATOR: Blaine Hone Ex.
EQUIPMENT: CAT 303.5C
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 111055
DATE: 09/23/11
ELEVATION: NM
LOGGED BY: J.E.
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0												
1			TOPSOIL: Clay, roots, organics, moist, brown.									
2		CL	LEAN CLAY, moderate to major pinholes, stiff (estimated), slightly moist, dark brown, iron oxide stains.									
3					16	81	35	17				C
4												
5												
6		CL	LEAN CLAY, stiff (estimated), moist, gray, iron oxide stains.									
7												
8												
9												
10												
11			Bottom at approximately 10 feet.									
12												

Notes: No groundwater encountered.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 111055

Earthtec Engineering Inc.

FIGURE NO.: 5

LOG OF TESTPIT 111055 LOGS.GPJ EARTHTEC.GDT 10/4/11

TEST PIT LOG
NO.: TP-4

PROJECT: Holland Park
CLIENT: The Boyer Company
LOCATION: Refer to Figure 2.
OPERATOR: Blaine Hone Ex.
EQUIPMENT: CAT 303.5C
DEPTH TO WATER; INITIAL ▽ :

PROJECT NO.: 111055
DATE: 09/23/11
ELEVATION: NM
LOGGED BY: J.E.
AT COMPLETION ▼ :

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL: Clay, roots, organics, moist, brown.									
1		CL	LEAN CLAY, minor pinholes, root holes, stiff (estimated), slightly moist, light brown.									
2												
3												
4												
5												
6												
7		CL	LEAN CLAY, minor pinholes, medium stiff (estimated), moist, gray, iron oxide stains.									
8												
9												
10					25	68	47	20				C
11			Bottom at approximately 10 feet.									
12												

Notes: No groundwater encountered.

Tests Key
CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 111055

Earthtec Engineering Inc.

FIGURE NO.: 6

LOG OF TESTPIT 111055 LOGS.GPJ EARTHTEC.GDT 10/4/11

TEST PIT LOG
NO.: TP-5

PROJECT:	Holland Park	**PROJECT NO.:**	111055
CLIENT:	The Boyer Company	**DATE:**	09/23/11
LOCATION:	Refer to Figure 2.	**ELEVATION:**	NM
OPERATOR:	Blaine Hone Ex.	**LOGGED BY:**	J.E.
EQUIPMENT:	CAT 303.5C		

DEPTH TO WATER; INITIAL ▽ : 9.5 ft. **AT COMPLETION ▼ :**

Depth (Ft.)	Graphic Log	USCS	Description	Samples	TEST RESULTS: Water Cont. (%)	Dry Dens. (pcf)	LL	PI	Gravel (%)	Sand (%)	Fines (%)	Other Tests
0			TOPSOIL: Clay, roots, organics, moist, brown.									
1			LEAN CLAY, minor to moderate pinholes, root holes, stiff (estimated), slightly moist, brown, white spots.									
2		CL		X	10		35	15				CBR
3												
4			LEAN CLAY, medium stiff (estimated), moist, gray, iron oxide stains.									
5												
6		CL										
7												
8												
9			▽									
10		SM	SILTY SAND, medium dense (estimated), moist to wet, red (iron oxide stained).	X								
			Bottom at approximately 10 feet.									
11												
12												

Notes:

Tests Key

CBR = California Bearing Ratio
C = Consolidation
R = Resistivity
DS = Direct Shear
SS = Soluble Sulfates
UC = Unconfined Compressive Strength

PROJECT NO.: 111055

Earthtec Engineering Inc.

FIGURE NO.: 7

LOG OF TESTPIT 111055 LOGS.GPJ EARTHTEC.GDT 10/4/11

LEGEND

PROJECT: Holland Park **DATE:** 09/23/11
CLIENT: The Boyer Company **LOGGED BY:** J.E.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR SOIL DIVISIONS			USCS SYMBOL	TYPICAL SOIL DESCRIPTIONS
COARSE GRAINED SOILS (More than 50% retaining on No. 200 Sieve)	GRAVELS (More than 50% of coarse fraction retained on No. 4 Sieve)	CLEAN GRAVELS (Less than 5% fines)	GW	Well Graded Gravel, May Contain Sand, Very Little Fines
			GP	Poorly Graded Gravel, May Contain Sand, Very Little Fines
		GRAVELS WITH FINES (More than 12% fines)	GM	Silty Gravel, May Contain Sand
			GC	Clayey Gravel, May Contain Sand
	SANDS (50% or more of coarse fraction passes No. 4 Sieve)	CLEAN SANDS (Less than 5% fines)	SW	Well Graded Sand, May Contain Gravel, Very Little Fines
			SP	Poorly Graded Sand, May Contain Gravel, Very Little Fines
		SANDS WITH FINES (More than 12% fines)	SM	Silty Sand, May Contain Gravel
			SC	Clayey Sand, May Contain Gravel
FINE GRAINED SOILS (More than 50% passing No. 200 Sieve)	SILTS AND CLAYS (Liquid Limit less than 50)		CL	Lean Clay, Inorganic, May Contain Gravel and/or Sand
			ML	Silt, Inorganic, May Contain Gravel and/or Sand
			OL	Organic Silt or Clay, May Contain Gravel and/or Sand
	SILTS AND CLAYS (Liquid Limit Greater than 50)		CH	Fat Clay, Inorganic, May Contain Gravel and/or Sand
			MH	Elastic Silt, Inorganic, May Contain Gravel and/or Sand
			OH	Organic Clay or Silt, May Contain Gravel and/or Sand
HIGHLY ORGANIC SOILS			PT	Peat, Primarily Organic Matter

SAMPLER DESCRIPTIONS

- SPLIT SPOON SAMPLER (1 3/8 inch inside diameter)
- MODIFIED CALIFORNIA SAMPLER (2 inch outside diameter)
- SHELBY TUBE (3 inch outside diameter)
- BLOCK SAMPLE
- BAG/BULK SAMPLE

WATER SYMBOLS

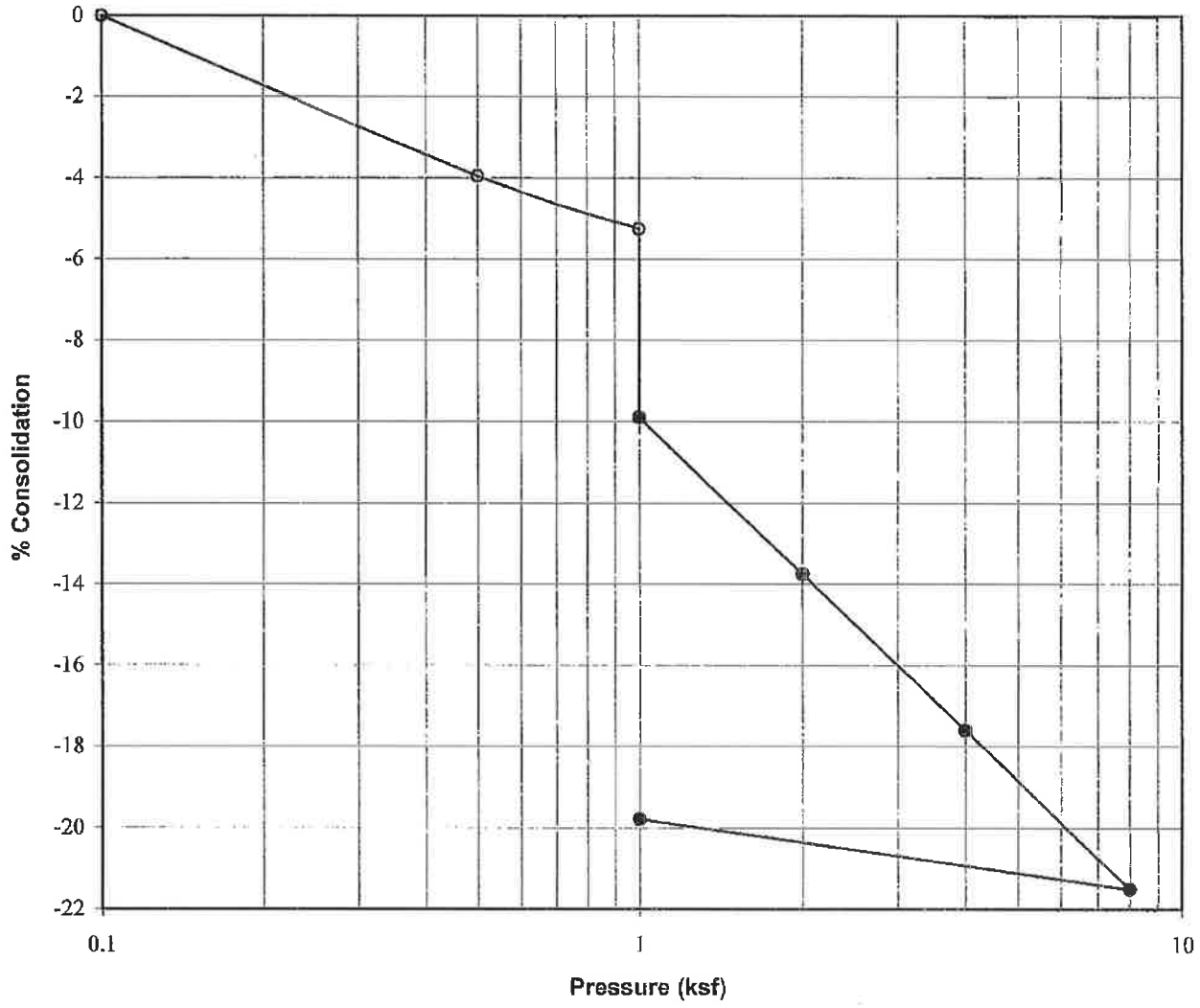
- ▽ Water level encountered during field exploration
- ▼ Water level encountered at completion of field exploration

NOTES:
1. The logs are subject to the limitations, conclusions, and recommendations in this report.
2. Results of tests conducted on samples recovered are reported on the logs and any applicable graphs.
3. Strata lines on the logs represent approximate boundaries only. Actual transitions may be gradual.
4. In general, USCS symbols shown on the logs are based on visual methods only: actual designations (based on laboratory tests) may vary.

PROJECT NO.: 111055 | Earthtec Engineering Inc. | **FIGURE NO.:** 8

LEGEND 111055 LOGS.GPJ EARTHTEC.GDT 10/4/11

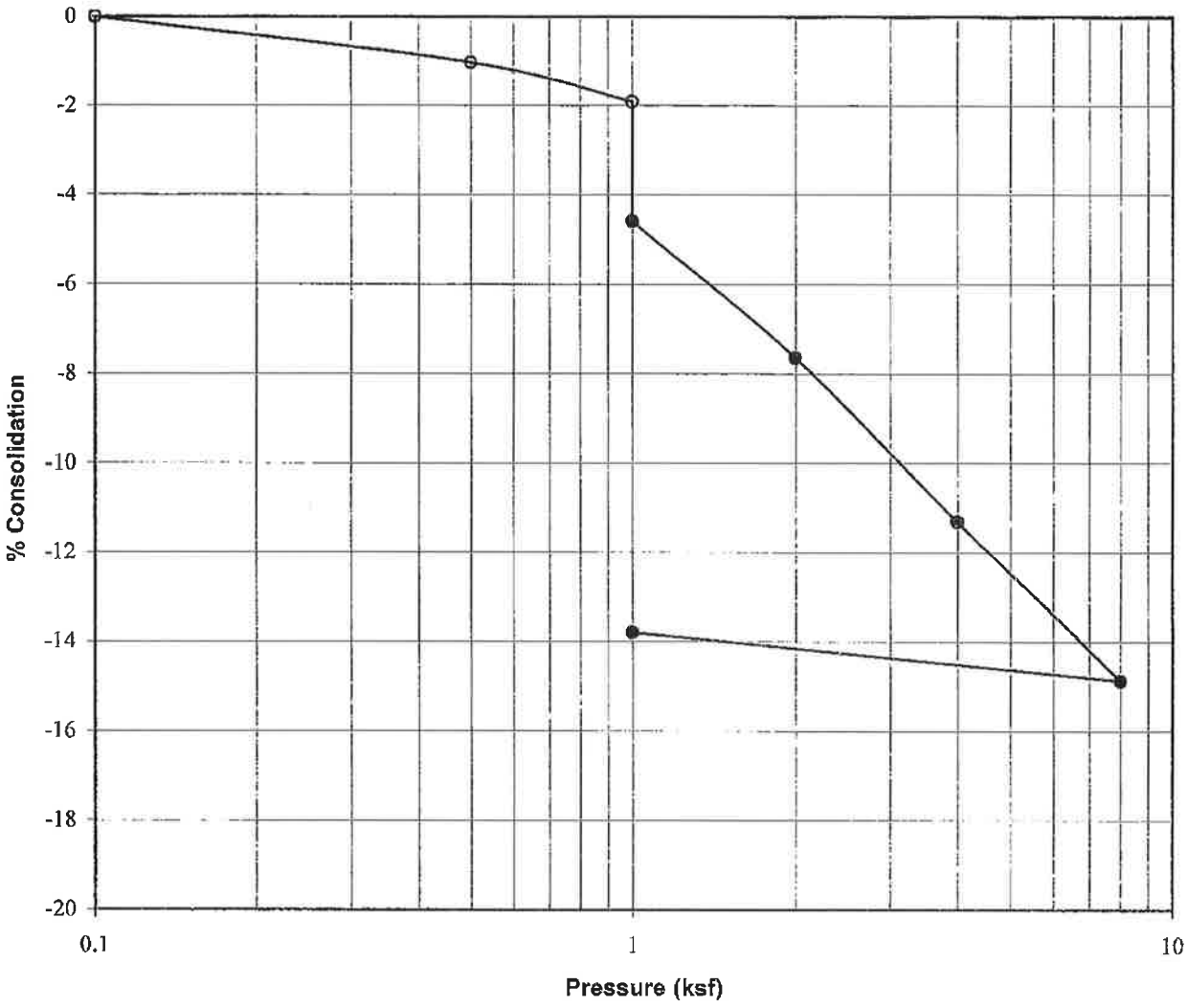
CONSOLIDATION - SWELL TEST



Project:	Holland Park
Location:	TP-1
Sample Depth:	4
Description:	Block
Soil Type:	LEAN CLAY (CL)
Natural Moisture, %:	24
Dry Density, pcf:	76
Liquid Limit:	47
Plasticity Index:	26
Water Added at:	1 ksf
Percent Collapse:	4.6

PROJECT NO.: 111055	Earthtec Engineering Inc.	**FIGURE NO.:** 9

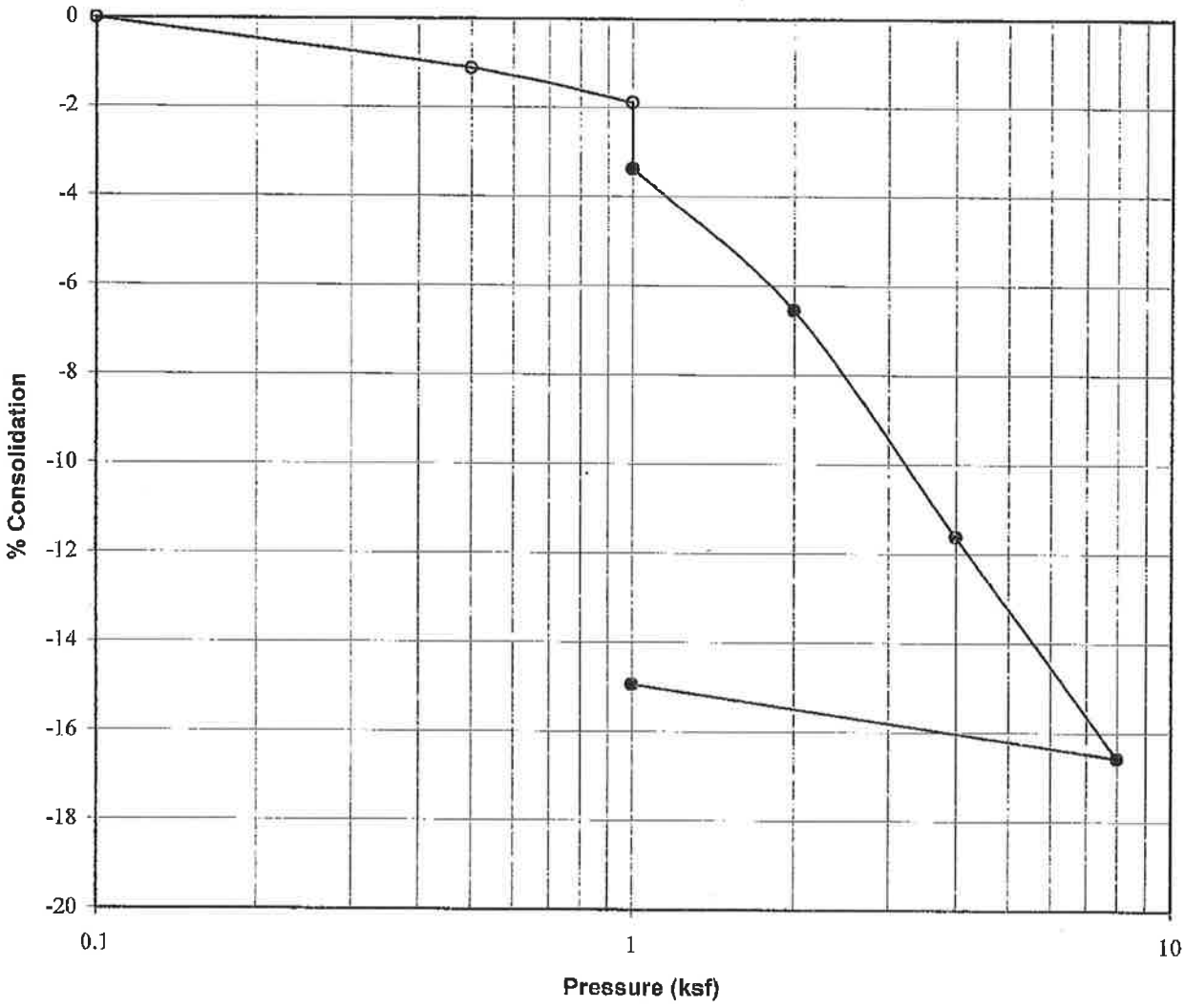
CONSOLIDATION - SWELL TEST



Project:	Holland Park
Location:	TP-2
Sample Depth:	7
Description:	Block
Soil Type:	LEAN CLAY (CL)
Natural Moisture, %:	24
Dry Density, pcf:	71
Liquid Limit:	47
Plasticity Index:	26
Water Added at:	1 ksf
Percent Collapse:	2.7

PROJECT NO.: 111055	Earthtec Engineering Inc.	**FIGURE NO.:** 10

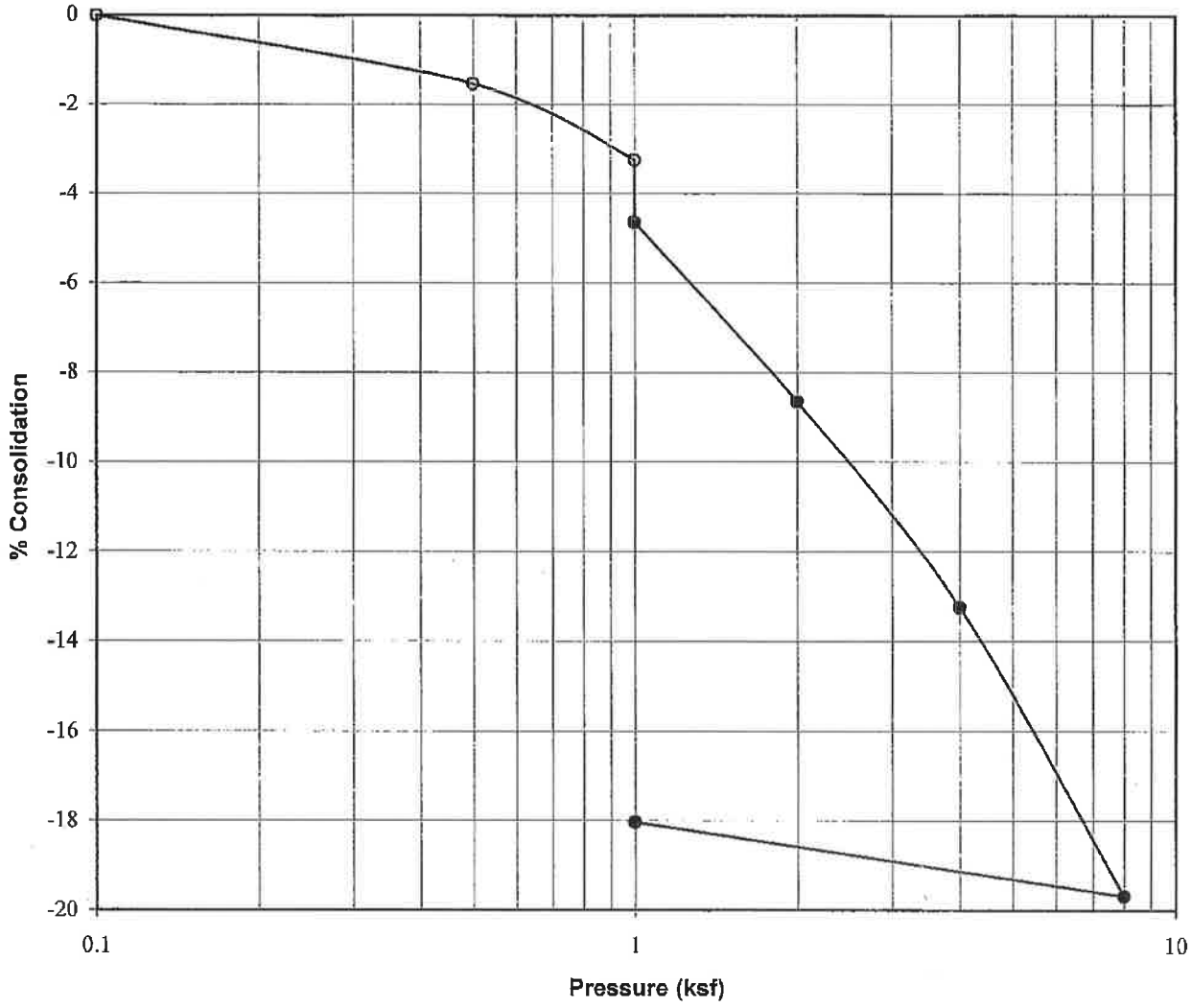
CONSOLIDATION - SWELL TEST



Project:	Holland Park
Location:	TP-3
Sample Depth:	3
Description:	Block
Soil Type:	LEAN CLAY (CL)
Natural Moisture, %:	16
Dry Density, pcf:	81
Liquid Limit:	35
Plasticity Index:	17
Water Added at:	1 ksf
Percent Collapse:	1.5

PROJECT NO.: 111055	Earthtec Engineering Inc.	**FIGURE NO.:** 11

CONSOLIDATION - SWELL TEST



Project:	Holland Park
Location:	TP-4
Sample Depth:	9
Description:	Block
Soil Type:	LEAN CLAY (CL)
Natural Moisture, %:	25
Dry Density, pcf:	68
Liquid Limit:	47
Plasticity Index:	20
Water Added at:	1 ksf
Percent Collapse:	1.4

PROJECT NO.: 111055	Earthtec Engineering Inc.	**FIGURE NO.:** 12