EARTHWORKS ENGINEERING GROUP, L.L.C.
7901 LORRAINE CT NE, ALBUQUERQUE, NM 87113
505-899-4886•505-899-4861(FAX)

GEOTECHNICAL INVESTIGATION

TIERRA MONTOSA APARTMENTS
751 GUSDORF ROAD, TAOS, NM

EEG Project No.: A16-547

Prepared for:

TIERRA REALTY TRUST

Prepared by

Lee Hopkins, Geologist

Reviewed by

Dave Liebelt, P.E.
Earthworks Engineering Group LLC

DAVID K. LIEBELT NEW MEXICO 14069 REGISTERED PROFESSIONAL ENGINEER

July 29, 2016

SUMMARY

The information presented in this section is a partial summary intended for reference use only. This information is intended for use only in conjunction with the complete geotechnical investigation report. Significant information contained in the complete geotechnical report may not be present here.

ON-SITE SOILS

The test holes encountered a surface layer of clay that was generally four to five feet thick. The clay was very stiff to hard and slightly moist. Beneath the clay, dense gravel and sand with silty to clayey fines was encountered.

GEOTECHNICAL ANALYSIS

The clays have a moderate swell potential with the ability to heave the building foundations and floor slabs if they are allowed to increase in moisture content. If left in place under the buildings, these clay soils will have the ability to cause repeated damages over the life of the structures due to shrink-swell behavior. In order to reduce the potential for movement and chronic distress of the buildings to acceptable levels, the following remedial earthwork is recommended:

REMEDIAL EARTHWORK

Building pads for the apartment homes must be constructed by excavating the upper four feet of existing soils. Soil removal must extend a minimum of two feet laterally beyond the outside edges of foundations or to the lateral extent of porches, patios, and exterior concrete flatwork. The building pads must then be brought to design grade with engineered fill. This office must perform inspections and testing during construction.

Excavated site clay soils are not suitable for reuse as engineered fill. Imported non-expansive sandy fill will be required. It may be possible to blend onsite clays with imported sands to produce a mixed material that is suitable for use as engineered fill. A preliminary blend ratio of 2 parts import to 1 part onsite clay should be considered for budgeting purposes; this office must consult further with the grading contractor concerning soil blends.

FOUNDATIONS

An IBC Seismic Site Soils Classification of **C** may be utilized for design purposes.

Frost depth at the site is estimated at thirty inches. However in lieu of embedding foundations to frost depth, the apartment buildings may be constructed with frost-protected foundations provided that the recommendations herein are followed particularly those concerning earthwork, grading, drainage, and landscaping. The base of all foundations including foam insulation underlayment should be embedded a minimum of twelve inches below grade. Foundations/thickened slabs should be a minimum of twenty-four inches wide. Foundations/thickened slabs constructed to these dimensions may be designed for an allowable bearing capacity of 2500 psf assuming they are supported by four feet of engineered fill.

Non-frost-protected foundations for auxiliary structures (dumpster enclosures, yard walls, etc.) should be embedded a minimum of thirty inches below grade. Non-frost-protected foundations bearing on native soils may be designed for an allowable bearing capacity of 1500 psf. Differential movement between the non-frost-protected foundations and the frost-protected building foundation should be anticipated.

CONCRETE SLABS-ON-GRADE

We anticipate the apartment buildings will have concrete slab-on-grade ground floors with foam insulation underlayment. Floor slabs must be supported by a four foot thick earthen building pad constructed of properly compacted granular engineered fill.

A subgrade modulus (k) of 100 pci may be utilized for design of conventionally reinforced structural slabs. The foam insulation manufacturer's specifications regarding deflection under differential load should also be consulted. We recommend designing for a maximum allowable angular distortion of the slab surface of 1/1000. Exterior porches and stoops should be insulated and reinforced in similar fashion.

Concrete slabs-on-grade and exterior flatwork should be isolated from all utility lines.

All exterior concrete (exposed to weather) should conform to an approved air entrained mix design having between 4.5% and 7.5% air. This also applies to interior slabs, if it is anticipated that they will be placed or left unprotected during winter months.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

This report presents the results of our geotechnical investigation and recommendations for design and construction of the proposed "Tierra Montosa" residential apartments at 751 Gusdorf Road in Taos, New Mexico.

The investigation was performed to determine the site subsurface conditions, and based on the conditions encountered, develop geotechnical recommendations for:

- Foundation Design
- Slabs-on-Grade
- Retaining Walls
- Site Grading
- Earthwork Construction
- Onsite Asphalt Pavements

The conclusions and recommendations presented are based on information provided by the client regarding the proposed construction, subsurface conditions disclosed by the test holes, laboratory testing, and the local standards of our profession at the time this report was prepared. It is assumed that all recommendations herein will be followed.

PROJECT DESCRIPTION

The project will consist of construction of a new apartment complex consisting of six buildings with associated driveways, parking lots, etc.

We anticipate the buildings will utilize frame construction. The buildings will be a maximum of two stories in height. No basements or below grade structures are anticipated.

For the purposes of this report, column and strip loads (dead + live) were estimated as not exceeding 20 kips and 2 kips per linear foot. If actual loads are significantly different than those assumed, this office should be contacted to verify the recommendations presented herein remain applicable.

If structure loads or configuration differ from those indicated in this report, this office should be notified.

SOIL CONDITIONS

To explore the site subsurface conditions eleven test holes were excavated on the property with a truck-mounted CME Model 75 drill rig using hollow stem auger drilling techniques. Standard penetration testing was performed with an automatic SPT hammer (140 lb. /30 inch free-fall).

The approximate test hole locations are presented on the attached Site Plan, Figure 1. Detailed logs of the test holes are presented on Figures 2 through 9. Soil Index test results are summarized on Table 4.

The test holes encountered a surface layer of clay that was generally four to five feet thick. The clay was very stiff to hard and slightly moist. Beneath the clay, dense gravel and sand with silty to clayey fines was encountered.

Groundwater was not encountered in the test holes to the maximum depth of exploration, approximately twenty-one feet.

Our assessment of the site subsurface conditions is based on the test holes which allow observation of a very small portion of the soils below the site. Significant variation in subsurface conditions may occur across the site that was not disclosed by the test holes.

GEOTECHNICAL ANALYSIS AND REMEDIAL EARTHWORK

GEOTECHNICAL ANALYSIS

Laboratory testing indicates the surface clay soils are currently dry but have a moderate plasticity. The clays have a moderate swell potential with the ability to heave the building foundations and floor slabs if they are allowed to increase in moisture content. If left in place under the buildings, these clay soils will have the ability to cause repeated damages over the life of the structures due to shrink-swell behavior. In order to reduce the potential for movement and chronic distress of the buildings to acceptable levels, the following remedial earthwork is recommended:

REMEDIAL EARTHWORK

Building pads for the apartment homes must be constructed by excavating the upper four feet of existing soils. Soil removal must extend a minimum of two feet laterally beyond the outside edges of foundations or to the lateral extent of porches, patios, and exterior concrete flatwork. The building pads must then be brought to design grade with engineered fill. This office must perform inspections and testing during earthwork construction.

Excavated site clay soils are not suitable for reuse as engineered fill. Imported non-expansive sandy fill will be required. It may be possible to blend onsite clays with imported sands to produce a mixed material that is suitable for use as engineered fill. A preliminary blend ratio of 2 parts import to 1 part onsite clay should be considered for budgeting purposes; this office must consult further with the grading contractor concerning soil blends. Material specifications for engineered fill are detailed in the General Earthwork Procedures section of this report.

FOUNDATION RECOMMENDATIONS

An IBC Seismic Site Soils Classification of **C** may be utilized for design purposes.

Frost depth at the site is estimated at thirty inches. However in lieu of embedding foundations to frost depth, the apartment buildings may be constructed with frost-protected foundations provided that the recommendations herein are followed particularly those concerning earthwork, grading, drainage, and landscaping. The base of all foundations including foam insulation underlayment should be embedded a minimum of twelve inches below grade. Foundations/thickened slabs should be a minimum of twenty-four inches wide. Foundations/thickened slabs constructed to these dimensions may be designed for an allowable bearing capacity of 2500 psf assuming they are supported by four feet of engineered fill. Foundations should be designed by a qualified structural engineer.

Non-frost-protected foundations for auxiliary structures (dumpster enclosures, yard walls, etc.) should be embedded a minimum of thirty inches below grade. Non-frost-protected foundations bearing on native soils may be designed for an allowable bearing capacity of 1500 psf. Differential movement between the non-frost-protected foundations and the frost-protected building foundation should be anticipated.

The allowable bearing capacity values presented herein may be increased by one-third for short term loading conditions due to wind and earthquakes. Foundation widths may need to be larger than the minimum widths stated herein based on actual structure design loads.

Lateral foundation loads will be resisted by a combination of passive soil pressure against the sides of foundations and friction along the base. A passive soil resistance of 300 pounds per cubic foot may be utilized for design. Frictional resistance may be determined by multiplying foundation dead load by a coefficient of friction of 0.40.

Foundations designed and constructed as described herein are not anticipated to experience differential movement of more than one inch. This estimate is implicit in the method used to calculate the allowable bearing capacities and also relies on the assumption the site soils will not be allowed to increase in moisture content and that all recommendations presented in this report will be fully implemented, particularly those regarding earthwork, drainage, grading, and landscaping. Additional movement on the order of ½ inch per foot of wetted soil and significant distress to the building may occur if the soils are allowed to increase in moisture content or if the recommendations presented herein are not followed.

CONCRETE SLABS-ON-GRADE

We anticipate the apartment buildings will have concrete slab-on-grade ground floors with foam insulation underlayment. Concrete floor slabs must be supported by a four foot thick earthen building pad constructed of properly compacted granular engineered fill as detailed in previous sections of this report. Concrete slabs-on-grade should be designed by a qualified structural engineer.

A subgrade modulus (k) of 100 pci may be utilized for design of conventionally reinforced structural slabs. The foam insulation manufacturer's specifications regarding deflection under differential load should also be consulted. We recommend designing for a maximum allowable angular distortion of the slab surface of 1/1000. Exterior porches and stoops should be insulated and reinforced in similar fashion.

If moisture-sensitive floorings are planned, the slab should be underlain by an impermeable moisture vapor barrier. Vapor barriers should have a minimum 15-mil thickness and should consist of extruded polyolefin plastic (no recycled content or woven materials permitted) that conforms in every way to an ASTM E 1745 Class A material. Vapor barriers should be installed in accordance with ASTM E 1643, including perimeter seal. Care should be taken during construction to minimize damage to the vapor barrier.

Concrete slabs-on-grade and exterior flatwork should be isolated from all utility lines.

Some movement should be expected to occur between the building and adjacent exterior concrete flatwork. Joints and cracks in concrete flatwork should be sealed as discussed in the Maintenance section of this report.

All exterior concrete (exposed to weather) should conform to an approved air entrained mix design having between 4.5% and 7.5% air. This also applies to interior slabs, if it is anticipated that they will be placed or left unprotected during winter months.

This office should be allowed the opportunity to review project plans and material submittals prior to the start of construction.

RETAINING WALLS

Retaining walls constructed in association with this project are not anticipated to exceed four feet in height. The values presented below do not include surcharge loads or hydrostatic pressures. If taller walls, surcharge loads, or unusual conditions such as sloping backfill are anticipated, this office should be contacted for additional recommendations.

Retaining wall foundations should be designed as described in the Foundations section of this report.

Walls should be designed to resist an Active Earth Pressure calculated as an equivalent fluid pressure from a fluid having a unit weight of 40 pounds per cubic foot. If the wall is restrained against rotating the wall should be designed for an At-Rest Earth Pressure calculated as an equivalent fluid pressure from a fluid having a unit weight of 60 pounds per cubic foot.

Wall movement will be resisted by Passive Earth Pressure at the toe calculated as an equivalent fluid pressure from a fluid having a unit weight of 300 pounds per cubic foot. Friction along the base can be calculated as the normal force multiplied by a friction factor of 0.40.

The backside of retaining walls should be waterproofed to prevent moisture infiltration. A french drain or gravel-packed weep holes should be installed behind the wall to help prevent hydrostatic forces from developing. Water should drain rapidly.

Retaining wall backfill should be treated as engineered fill. Retaining walls should be backfilled with an approved granular material such as aggregate base course or pea gravel. Care should be taken during compaction of retaining wall backfill to avoid stressing and deflecting the walls.

ON-SITE PAVEMENTS

ASPHALT PAVEMENTS

We anticipate the site driveways and main parking areas will have asphalt pavement sections. The pavement section(s) presented below are based on NMSHTD design procedures. Based on the conditions encountered in the test holes, the site surface soils are classified as AASHTO A-6 and A-7-6 soils (clays). An estimated R-Value of 6 was utilized for design based on the predominant surface soils. The following additional design values were utilized:

Design Life	20-Years
Serviceability Index	1.5
Regional Factor	2.5
Asphalt Structural Coefficient	0.44
Aggregate Base Course Structural Coefficient	0.11

Table 1: Assumed Asphalt Pavement Design Coefficients

The following asphalt pavement section is recommended:

Pavement Section	SN	Daily ESALS
3.5 inches Asphalt over 6 inches Aggregate Base Course	2.2	≤1.5

Table 2: Recommended Asphalt Pavement Section

If greater numbers of vehicles per day can be anticipated, the pavement lifespan will be reduced. The projected daily ESALs should be reviewed by the property owner and project designers. If actual traffic loads are anticipated to differ from these assumptions, this office should be contacted for additional recommendations.

CONCRETE PAVEMENTS AND EXTERIOR FLATWORK

We anticipate site development will include relatively small areas of concrete flatwork and pavements such as sidewalks, patios, and dumpster islands. Concrete slabs and exterior flatwork should be isolated from all utility lines. All exterior concrete (exposed to weather) should conform to an approved air entrained mix design having between 4.5% and 7.5% air.

Sidewalks and other areas of concrete flatwork that will not experience vehicular traffic should be a minimum of four inches in thickness. Concrete pavements supporting vehicular traffic should be a minimum of six inches in thickness, conform to an approved minimum 4000 psi mix design and have adequate reinforcement as detailed by the structural engineer. Concrete pavements at dumpster pads and truck docks should be underlain by a minimum of eight inches of aggregate base course.

PAVEMENT SUBGRADE PREPARATION

Prior to constructing pavements, the ground surface should be prepared and compacted as detailed in the General Earthwork Procedures section of this report. The site should be graded to prevent saturation of pavement subgrade soils. The soils ability to support pavement will be significantly reduced should they become wetted.

Prior to placing Aggregate Base Course or Asphaltic Concrete a soil sterilant may be applied. The sterilant should be applied as per the manufacturer's recommendations.

BASE COURSE AND SURFACE COURSE PLACEMENT

Aggregate Base course and Sub-Base/Select Fill should be compacted to a minimum of 95% of maximum density as determined by ASTM D-1557 with testing and inspection by this office.

Asphaltic Concrete should exhibit a minimum Marshall stability of 1800 pounds and should be compacted to between 93% and 97% of maximum theoretical density with testing and inspection by this office.

MAINTENANCE

Some movement should be expected to occur between the building and adjacent exterior concrete flatwork/asphalt pavements. Crack cleaning and sealing should be performed to extend pavement life as further discussed in the Maintenance section of this report.

Periodic pavement maintenance will be required over the design life. Seal coating may also be desired after the pavement has been in service for several years to improve appearances and increase pavement life.

GENERAL EARTHWORK PROCEDURES

STRIPPING AND GRUBBING

Prior to performing earthwork, all borrow and fill areas should be stripped of vegetation and deleterious materials. All strippings should be hauled offsite or utilized in landscaped areas. All existing fill, remnant foundations, utilities, debris, septic systems, and disturbed soil should be removed from below the proposed structures.

NATURAL GROUND PREP

Following all cut earthwork and prior to placing any fill, the base of excavations exposing clay soils should be scarified to a depth of 8 inches and processed to moisture condition the material to between 0% and 4% above the optimum moisture content, then compacted to a minimum 95% of the maximum dry density as determined by ASTM Standard D698. The base of excavations exposing sand/gravel soils should be scarified to a depth of 8 inches and processed to moisture condition the material to the optimum moisture content (+/- 3%) and then compacted to a minimum of 95% of maximum dry density as determined by ASTM D-1557.

ENGINEERED FILL SPECIFICATIONS

Excavated site clay soils are not suitable for reuse as engineered fill. Imported non-expansive sandy fill will be required. It may be possible to blend onsite clays with imported sands to produce a mixed material that is suitable for use as engineered fill. A preliminary blend ratio of 2 parts import to 1 part onsite clay should be considered for budgeting purposes; this office must consult further with the grading contractor concerning soil blends.

Sieve analysis and Atterberg Limits tests will be required prior to acceptance of proposed fill materials. Engineered fill soil should have a Plasticity Index of ten or less and should not contain any frozen, organic, or decomposable material. Cobbles, boulders and rock fragments should not be placed within engineered fills. Engineered fill should meet the following gradation:

U.S. SIEVE SIZE	%-PASSING
3-INCH	100
NO. 4	70-100
NO. 200	20-45

Table 3: Fill Specifications

FILL PLACEMENT AND COMPACTION

Engineered fill should be stockpiled on site, moisture conditioned, and blended to a homogeneous mixture prior to use. The contractor will be required to rake or disc the fill to provide uniform moisture content throughout the fill. The soils engineer may require testing of the soil moisture content to assess the uniformity, prior to allowing fill placement and compaction.

Engineered fill should be moisture conditioned, placed in horizontal lifts a maximum of 8-inches in loose thickness, and mechanically compacted. Lift thickness may need to be reduced based on the soil type and size of the compaction equipment utilized. Engineered fill should be compacted to a minimum of 95% of maximum dry density as determined by ASTM D-1557 at the approximate optimum moisture content (+/- 3%).

UTILITIES

Care should be taken when installing utilities that the prepared building pad is not overly disturbed. Trenches should be no wider than is necessary for proper installation of utilities. Utility line trenches should not be located parallel and below/immediately adjacent to foundations.

If water or sewer line leaks occur, differential movement of the structure may result. Prior to backfilling utility line trenches, all water and sewer lines should be pressure checked for leaks. Any leaks found should be repaired.

Per the APWA Manual of Standard Specifications 2007 Edition, Section 33-05-20-3.3, the maximum particle size allowable within the pipe zone is ¾-inches for plastic pipes. If the onsite soils cannot be milled or screened to these specifications then we recommend that buried utilities be surrounded by approximately one cubic foot of nominal 3/8-inch "pea gravel" in the pipe zone.

The excavation spoils may be reused as trench backfill provided that the minimum pipe bedding and cover requirements are fulfilled as described above. Cobbles, boulders and rock fragments should not be placed within pipe bedding or pipe backfills.

To reduce the possibility of breaking utility lines, compaction of pipe backfill should be performed with light, hand-operated equipment. In order to achieve compaction, it will be necessary to place backfill in thinner lifts than would normally be necessary. The fill soils in trenches should be compacted to a minimum of 95% of maximum dry density as determined by ASTM D-1557, except where applying this compactive effort may damage pipes or insulation, in which case the backfill should be compacted to a minimum 90%. Trenches for site utilities outside the building pad may be backfilled with excavated clays; clay backfills should be compacted to a minimum 95% of the maximum dry density as determined by ASTM Standard D698 at 0% to 4% above the optimum moisture content.

FOUNDATION EXCAVATIONS

Caving and raveling of excavation sidewalls should be expected. Prior to pouring concrete, foundation excavations should be cleaned of any slough, loose soil, or debris. Footing excavations should be scarified and moisture conditioned to optimum moisture content (+/- 3%). Foundation excavations should be compacted to a minimum of 95% of maximum dry density as determined by ASTM D-1557.

OBSERVATION AND TESTING

Compaction testing must be performed by this office during earthwork construction to verify the compaction requirements outlined in this report have been met.

Proctor testing (ASTM D-698 and/or D-1557) will be necessary to determine the maximum dry density and optimum moisture content of the natural soils at the base of excavations. The surface of natural soils should be tested for compaction prior to placing engineered fill.

Engineered/Structural fill material should be approved by this office prior to use. Following acceptance of the fill material, Proctor testing (ASTM D-698 and/or D-1557) will be necessary to determine the maximum dry density and optimum moisture content. Compaction testing should be performed on engineered fill at a minimum of every other lift until finished grade is reached. Testing of utility line trenches for compaction should be performed at a minimum of every foot of compacted backfill thickness.

The base of footing excavations and finished pad grade should be tested prior to placing reinforcement and pouring concrete. Compaction testing cannot be performed if reinforcement has been installed and will need to be removed to perform testing.

EARTHWORK CERTIFICATION

An earthwork certification letter may be requested **prior to** placing concrete.

Earthwork certification will only be provided if all recommendations presented herein are followed. It is up to the client to read and understand the recommendations prior to starting construction. Earthworks Engineering Group will answer all questions the client may have concerning these recommendations.

Earthwork certification will be valid for five days following the last inspection by this office. Foundations should be poured during this time period. The site must be re-inspected if foundations are not poured during this time period or if site conditions change for any reason following the previous inspection.

DRAINAGE, GRADING, AND LANDSCAPING

We recommend that earthen building pads be raised a minimum of twelve inches above surrounding grade to promote positive drainage away from the buildings on all sides. Site grading should comply with the 2009 IBC Section 1804.3. A grading and drainage plan should be designed by a qualified civil engineer.

To reduce the risk of moisture induced soil movement, the site should be graded to rapidly drain away from structures. We suggest a minimum five percent gradient within at least the first ten feet away from structures in areas not protected by sidewalks and pavement. Paved surfaces within ten feet of the structure should maintain a two percent gradient away from the structure. Planters and sidewalks should not "dam" water adjacent to structures.

Roof gutters and downspouts should be utilized on the building(s). Down spouts should discharge down slope and well away from building(s), a minimum of ten feet. Surface water should run off rapidly.

Landscaping adjacent to structures should be designed and constructed to minimize the potential for wetting of soils supporting the proposed facilities. We suggest utilizing a xeriscape design. Watering should be carefully controlled to prevent over watering. All lawns, plantings, drip irrigation, and sprinkler lines should be located a minimum of five feet away from foundations.

If onsite leach fields or stormwater ponding areas are required, they should be located downhill from and as far away from structures as possible, a minimum of fifteen feet.

Permanent, non-retained slopes should be graded to a maximum slope of 3:1 horizontal to vertical for gross slope stability.

All earth slopes will require protection from erosion.

This office should review site grading and drainage plans to evaluate conformance with the recommendations presented herein.

SHORING

All trenches greater than five feet in depth must be sloped, shored or braced, or otherwise supported according to OSHA Construction and Safety Standards. Site soils should be considered OSHA Class "B" soils in the upper four feet and Class "C" soils below. Temporary construction excavations less than eight feet deep should be sloped no steeper than 1½:1 (horizontal: vertical). If deeper excavations are required, this office should be contacted for supplemental recommendations.

Limited raveling of slopes will occur particularly as the exposed soils dry out. Material excavated from the trench or spoil must be placed away from the edge of the excavation. The spoil should be retained in an effective manner such that no loose material can fall into the excavation. Heavy equipment and material stockpiles should be located a minimum of five feet from the top of slope.

The above information is intended to provide only general guidelines. This office is not responsible for excavation safety. Temporary construction excavations should be evaluated by the contractor's competent person. Design of safe excavations should conform to the regulations set forth in 29 CFR 1926 Subpart P by the contractor or their designated engineer of record.

MAINTENANCE

Performance of structures depends not only on proper design and construction, but also on an ongoing foundation maintenance program. A properly designed foundation may still experience distress from incorrectly controlled water sources, improper drainage, and landscaping. The owner should perform a yearly inspection to observe for necessary maintenance and repair.

Positive drainage should be provided away from the structure over the life of the building. A minimum slope of five percent within the first ten feet of the structure should be maintained. Flowerbeds and landscaping that requires irrigation should not be installed adjacent to structures. Walkways and borders that dam water adjacent to foundations should be eliminated.

Depressions and excavations should be backfilled with compacted, non-swelling, relatively-impervious soils such as clayey sands.

Gutters and downspouts should be installed to control roof drainage. Downspouts should discharge a minimum of ten feet away from structures. Area drains may be installed around structures to improve drainage. Discharge pipes should slope a minimum of 1/8th inch vertical per foot of horizontal pipe. Drainage sewers and discharge channels should be kept free of debris.

Water bills should be monitored for unexplained increases in usage. Higher than normal water usage may indicate a leaking utility line. If a leaking line is suspected, utility lines should be pressure checked for leaks.

Expansion joints within exterior concrete flatwork should be filled with a flexible joint sealer to minimize water infiltration.

Some minor cracking of new concrete foundations, concrete flatwork, and interior dry wall is normal. This is a result of concrete shrinkage as it cures, "settling in" of the new structure, drying of timbers used in construction, etc. Normally the majority of this movement should cease within the first year following construction. However, depending on the structure and site conditions, movement may continue at a slow rate for several years. If cracks tend to open and close, increase significantly within a short period of time, or resume after a period of relative inactivity, it is recommended that this office be contacted to review the situation.

CLOSURE

The recommendations presented in this report are based upon the subsurface conditions disclosed by the test holes. Soil and groundwater conditions may vary between test holes and with time. This office may change the recommendations presented herein based on the conditions encountered during construction.

Prior to performing earthwork, a meeting between the client, this office, and the earthwork contractor should be arranged to discuss the earthwork and foundation recommendations and testing requirements of this project. The purpose of this meeting is to assure that recommendations and requirements are implemented and to minimize delays and expenses during construction.

In order to verify the recommendations presented herein are followed this office must perform field inspections and earthwork Proctor and compaction testing. If this office is not utilized to perform these services, the client agrees to assume all risk for post-construction movement and distress.

This report reflects our interpretation of the site subsurface conditions. We strongly recommend that prior to bidding all contractors perform their own subsurface investigation to form their own opinion of the site soil, rock and groundwater conditions. Should contractors elect to use this report for construction, bidding or estimating purposes, they do so at their own risk.

As this report makes recommendations concerning prudent landscaping and site maintenance, the property owner/ building manager should be given access to this report and the recommendations herein.

The staff of Earthworks Engineering Group, LLC is available for supplemental consultation as necessary at (505) 899-4886.

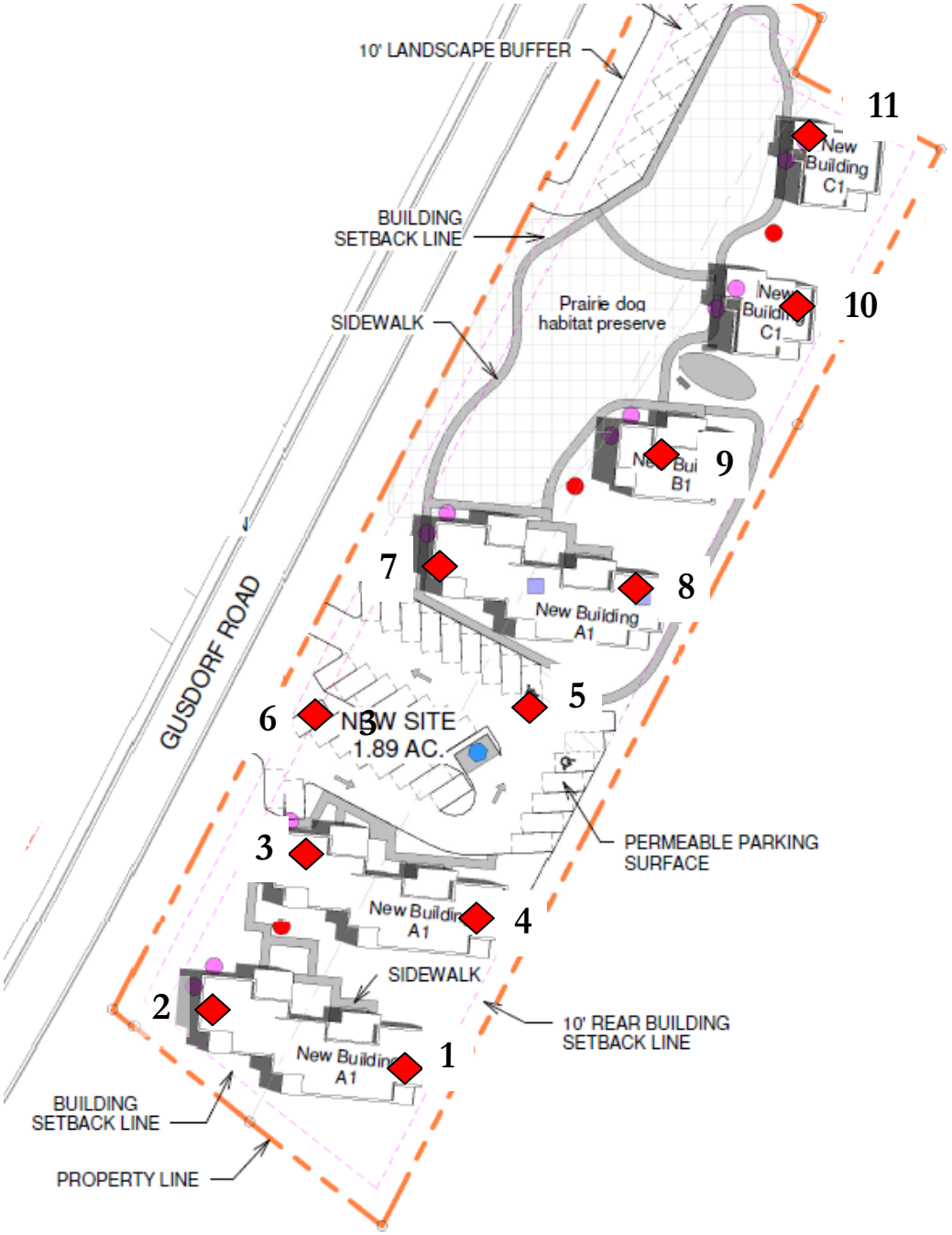
Test Hole	Depth (feet)	Density, Dry (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Percent Passing - U.S. Sieve Numbers										
						1-1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	N0. 100	No. 200	2 µm
1	0		8.8	39	12		100	99	99	98	97	95	91	87	78.5	
	2		7.5					100	98	97	94	91	88	84	75.0	
	5		2.1			100	89	71	60	52	44	36	28	22	16.3	
2	0		5.7				100	99	98	97	95	92	87	80	67.5	
	2		9.2	39	11			100	99	97	94	89	82	75	63.7	
	5		3.6			100	84	65	59	53	48	43	37	31	24.4	
	10		1.3			100	61	53	43	36	31	26	21	17	12.5	
	15		4.3			100	75	61	51	44	38	33	28	23	18.0	
	20		3.9			100	77	64	58	51	45	39	31	23	18.2	
3	0		8.3								100	98	95	91	82.7	
	2		7.0			100	89	80	70	60	51	43	35	28	21.4	
	5		3.0			100	73	53	41	35	31	27	23	20	15.6	
	10		4.9			100	77	68	55	48	42	37	31	27	22.7	
	15		2.3			100	85	61	53	46	40	35	29	22	17.2	
4	0		8.3							100	99	98	96	93	86.3	
	2		4.1			100	94	78	65	57	49	41	33	25	19.0	
	5		2.7			100	82	77	70	65	59	50	39	30	21.7	
5	1		7.9						100	99	98	96	92	87	75.3	
	2.5		9.4					100	99	97	93	88	33	74	62.3	
6	1		9.5				100	99	99	98	98	96	94	90	80.5	
	2.5		16.2	47	18		100	99	99	98	96	92	83	74	62.4	
7	0		6.5			100	99	99	99	99	99	97	95	92	83.5	
	2		9.3	44	17				100	99	99	98	95	91	82.7	
	3		9.3							100	99	97	94	90	82.1	
	5		3.2			100	73	59	51	43	39	35	30	24	19.1	

Test Hole	Depth (feet)	Density, Dry (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Percent Passing - U.S. Sieve Numbers										
						1-1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	N0. 100	No. 200	2 µm
8	0		7.9					100	99	99	98	97	95	91	83.8	
	2		8.4	43	14				100	99	98	97	93	87	76.8	
	5		8.4			100	98	93	88	82	75	66	56	46	35.2	
	9		2.4			100	48	32	23	21	18	17	16	15	13.0	
9	0		7.5							100	99	98	97	93	85.0	
	2		4.2			100	77	66	62	58	55	52	46	41	34.0	
	5		2.2			100	87	74	60	54	43	37	29	22	16.0	
	10		2.3			100	91	78	66	56	48	39	30	22	15.8	
	15		2.8			100	89	66	48	40	34	28	22	17	13.0	
10	0		6.4						100	99	97	95	90	83	65.6	
	2		7.6	41	17			100	97	94	89	83	77	70	60.1	
	5		4.4				100	82	77	71	66	58	48	40	32.3	
11	0		8.6						100	99	98	97	94	88	78.8	
	2		8.9					100	97	93	85	79	73	67	57.6	
	5		2.3			100	82	59	45	37	31	26	21	16	11.5	

751 Gusdorf Road, Taos, NM

Site Plan

*Not To Scale



◆ Test Hole Locations

LOG OF TEST HOLE NO.: 1

Project:	751 Gusdorf Rd. Taos, NM
Date Drilled:	7.11.2016
Drilling Method:	3.25" I D Hollow Stem Auger
Surface Elevation:	Not Available
Depth to Groundwater:	Not Encountered
Bottom of Hole:	7.0 ft

Depth (feet)	N-Value (blows/ft)	Sample Type	Unified Class.	Description	Dry Density (pcf)	Moisture Content (%)
		B	CL	CLAY, hard, slightly moist, pale brown		8.8
2	37	S		- pale brown to brown		7.5
5	38	S	GC	GRAVEL, with clayey fines, dense, slightly moist, grey and orange-brown lenses - auger refusal on cobbles		2.1
				Bottom of Test Hole at 7 Feet		
10						
15						
20						
25						

Project No.:A16-547 **Earthworks Engineering Group, LLC** **FIGURE 2.**

LOG OF TEST HOLE NO.: 2

Project:	751 Gusdorf Rd. Taos, NM
Date Drilled:	7.11.2016
Drilling Method:	3.25" I D Hollow Stem Auger
Surface Elevation:	Not Available
Depth to Groundwater:	Not Encountered
Bottom of Hole:	20.5 ft

Depth (feet)	N-Value (blows/ft)	Sample Type	Unified Class.	Description	Dry Density (pcf)	Moisture Content (%)
		B	CL	CLAY, very stiff, slightly moist, pale brown		5.7
2	15	S		- pale brown to brown		9.2
5	86	S	GC	GRAVEL, with clayey fines, dense, slightly moist, grey and pale-brown lenses		3.6
10	85	S	GP	GRAVEL, with sand lenses, dense, slightly moist, grey		1.3
15	56	S		- lenses of grey gravel and orange-brown sand		4.3
20	150	S				3.9
				Bottom of Hole at 20.5 Feet		
25						

LOG OF TEST HOLE NO.: 3

Project:	751 Gusdorf Rd. Taos, NM
Date Drilled:	7.11.2016
Drilling Method:	3.25" I D Hollow Stem Auger
Surface Elevation:	Not Available
Depth to Groundwater:	Not Encountered
Bottom of Hole:	21 ft

Depth (feet)	N-Value (blows/ft)	Sample Type	Unified Class.	Description	Dry Density (pcf)	Moisture Content (%)
		B	CL	CLAY, hard, slightly moist, pale brown		8.3
2	85	S		- with some caliche and gravel		7.0
5	120	S	GC	GRAVEL, with clayey fines, dense, medium moist, grey and orange-brown lenses		3.0
10	37	S	GP-GM	GRAVEL, with silty-clayey fines and sand lenses, dense, medium moist, grey to dark orangish brown		4.9
15	85	S		- grey gravel and orange-brown sand, slightly moist		2.3
20	80	S		- no recovery		
				Bottom of Hole at 21.0 Feet		
25						

Project No.:A16-547 **Earthworks Engineering Group, LLC** **FIGURE 4.**

LOG OF TEST HOLE NO.: 4

Project:	751 Gusdorf Rd. Taos, NM
Date Drilled:	7.12.2016
Drilling Method:	3.25" I D Hollow Stem Auger
Surface Elevation:	Not Available
Depth to Groundwater:	Not Encountered
Bottom of Hole:	Test Hole 4: 8 ft Test Hole 5: 5 ft

Depth (feet)	N-Value (blows/ft)	Sample Type	Unified Class.	Description	Dry Density (pcf)	Moisture Content (%)
		B	CL	CLAY, very stiff, slightly moist, pale-brown		8.3
2	89	S	GC	GRAVEL, with clayey fines, dense, grey to pale green, medium moist		4.1
5	73	S	GP-GM	GRAVEL, slightly silty, dense, slightly moist, grey - Auger refusal on cobbles		2.7
				Bottom of Test Hole at 8.0 Feet		
10						

LOG OF TEST HOLE NO.: 5

		B	CL	CLAY, slightly sandy, very stiff, dry, pale brown		7.9
2		B				
			GC	GRAVEL at 4 ft		9.4
5				**Bottom of Test Hole at 5 Feet**		
10						

LOG OF TEST HOLE NO.: 6

Project:	751 Gusdorf Rd. Taos, NM
Date Drilled:	7.12.2016
Drilling Method:	3.25" I D Hollow Stem Auger
Surface Elevation:	Not Available
Depth to Groundwater:	Not Encountered
Bottom of Hole:	Test Hole 6: 5 ft Test Hole 7: 7 ft

Depth (feet)	N-Value (blows/ft)	Sample Type	Unified Class.	Description	Dry Density (pcf)	Moisture Content (%)
		B	CL	CLAY, slightly sandy, very stiff, dry, pale brown		9.5
2						
		B		- medium moist		16.2
				- Gravel at 5 Feet		
5				**Bottom of Test Hole at 5.0 Feet**		
10						

LOG OF TEST HOLE NO.: 7

		B	CL	CLAY, slightly sandy, very stiff, dry,brown		6.5
2						
	24	S				9.3
			ML	SILT at 3 feet, very stiff, slightly moist, pale pink-brown		9.3
5						
	51	S	GM	GRAVEL, silty-clayey, dense, medium moist, grey-brown		3.2
				- Auger refusal at 7 feet		
				Bottom of Test Hole at 7.0 Feet		
10						

LOG OF TEST HOLE NO.: 8

Project:	751 Gusdorf Rd. Taos, NM
Date Drilled:	7.12.2016
Drilling Method:	3.25" I D Hollow Stem Auger
Surface Elevation:	Not Available
Depth to Groundwater:	Not Encountered
Bottom of Hole:	9 ft

Depth (feet)	N-Value (blows/ft)	Sample Type	Unified Class.	Description	Dry Density (pcf)	Moisture Content (%)
		B	CL	CLAY, very stiff, slightly moist, brown		7.9
2	22	S	CL	CLAY with silt seams, very stiff, slightly moist, pale-brown		8.4
5	34	S	CL	CLAY, with gravel stringers, hard, slightly moist, orange-brown		8.4
		B	GC	GRAVEL, with clayey-sand fines, slightly moist, brown - Auger refusal at 9 feet		2.4
10				**Bottom of Hole at 9.0 Feet**		
15						
20						
25						

Project No.:A16-547 **Earthworks Engineering Group, LLC** **FIGURE 7.**

LOG OF TEST HOLE NO.: 9

Project:	751 Gusdorf Rd. Taos, NM
Date Drilled:	7.12.2016
Drilling Method:	3.25" I D Hollow Stem Auger
Surface Elevation:	Not Available
Depth to Groundwater:	Not Encountered
Bottom of Hole:	20 ft

Depth (feet)	N-Value (blows/ft)	Sample Type	Unified Class.	Description	Dry Density (pcf)	Moisture Content (%)
		B	CL	CLAY, very stiff, slightly moist, red-brown		7.5
2	44	S	ML	SILT with gravel stringers, hard/dense, dry, pale-brown		4.2
5	61	S	GC	GRAVEL, with clayey-sand fines, slightly moist, brown		2.2
10	38	S	GP-GM	GRAVEL, with sand lenses, dense, slightly moist, grey-orange-brown		2.3
15	47	S				2.8
20	200	S		- very dense, no sample recovery		
				Bottom of Hole at 20.0 Feet		
25						

LOG OF TEST HOLE NO.: 10

Project:	751 Gusdorf Rd. Taos, NM
Date Drilled:	7.12.2016
Drilling Method:	3.25" I D Hollow Stem Auger
Surface Elevation:	Not Available
Depth to Groundwater:	Not Encountered
Bottom of Hole:	Test Hole 10: 9 ft Test Hole 11: 8 ft

Depth (feet)	N-Value (blows/ft)	Sample Type	Unified Class.	Description	Dry Density (pcf)	Moisture Content (%)
		B	CL	CLAY, slightly sandy, stiff, dry, brown		6.4
2	17	S		- very stiff		7.6
5	20	S	CL	CLAY, with gravel lenses, very stiff/medium dense, dry, brown		4.4
			GM	- GRAVEL, auger refusal at 9 feet		
10				**Bottom of Test Hole at 9.0 Feet**		

LOG OF TEST HOLE NO.: 11

		B	CL	CLAY, slightly sandy, very stiff, dry,brown		8.6
2	36	S		- pale brown caliche - brown		8.9
5	46	S	GM	GRAVEL, silty-clayey, dense, medium moist, grey-orange-brown		2.3
				- Auger refusal at 8 feet		
10				**Bottom of Test Hole at 8.0 Feet**		

EARTHWORK CERTIFICATION CHECKLIST

Client: Tierra Realty Trust EEG Project No. (GT): A16-547

Project: 751 Gusdorf Road, Taos, NM EEG Project No: (MT):

It is the responsibility of the owner and the contractor to fully read and understand the complete geotechnical investigation report and recommendations made therein. The following checklist is a summary of steps necessary in order to receive earthwork certification by Earthworks Engineering Group, LLC.

SCHEDULING

Call a minimum of 2 days prior to starting earthwork, to arrange for the pickup and testing of proctor sample(s). Call a minimum of 1 day prior to starting earthwork, to schedule natural ground prep inspection and initial compaction testing. Call 24 hours in advance to schedule testing once earthwork has commenced.

EARTHWORK COMPACTION TESTING		**Pass?**
1. Have Proctor Test Results for onsite and/or import soils:_____		☐
2. Test Base of Excavations/Natural Ground Preparation:_____		☐
3. Test During Placement of Engineered Fill (Test @ 1 Ft Min. Intervals):_____		☐
4. Test Bottom of Footing Excavations Prior to Steel Placement:_____	*EXTERIOR FTGS* *INTERIOR FTGS*	☐ ☐
5. Test Plumbing Trench Backfill (Test @ 1 Ft. Min. Intervals):_____		☐
6. Test Finished Pad Grade (After Footing Excavation & Trench Backfill):_____		☐
7. **BEFORE PLACING CONCRETE, GET CERTIFICATION LETTER:**_____		☐

Earthworks Engineering Group, LLC

Figure 10