GEOTECHNICAL INVESTIGATION

PROPOSED HAWK'S LANDING ESTATES
BERNALILLO COUNTY, NEW MEXICO

Submitted To:

Panorama Homes
P.O. Box 94897
Albuquerque, NM 87199-4897

Submitted By:

Florentino Engineering, LLC
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March 2015
Project No. 15-01394

FLORENTINO ENGINEERING, LLC

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March 9, 2015

Project No. 15-01394

Panorama Homes
P.O. Box 94897
Albuquerque, NM 87199-4897

Attn: John Lowe

RE: Hawk's Landing Estates
Bernalillo County, NM

As requested, Florentino Engineering LLC conducted a geotechnical investigation at the referenced site. The report contains our findings, and earthwork recommendations for building foundations and earthwork construction.

In addition, in order to verify compliance with the recommendations contained herein, we recommend that testing and observation services be provided by a qualified geotechnical engineer, during the construction of this project.

If you have questions concerning this report or need additional information, please contact our office at your convenience.

Respectfully submitted,

Florentino Engineering, LLC

Guillermo A. Florentino, PE
Principal

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1.0 INTRODUCTION

This report presents a geotechnical investigation for the proposed Hawk's Landing Estates subdivision, located in Bernalillo County, New Mexico.

2.0 PROJECT DESCRIPTION

The proposed development consists of the construction of thirty (30) single family residential lots in an approximately 10-acre parcel. The proposed residences will consist of wood framed structures with concrete slab on grade floors. In addition, the proposed development will include underground utilities, and paved access streets.

The maximum anticipated foundation loads are not to exceed 2 kips per foot for continuous footings, and 10 kips for isolated column loads.

3.0 SCOPE OF SERVICES

The scope of services consisted of a field investigation during which, six (6) test pits were observed. The test pits were 8 feet in maximum depth, and located throughout the site. The test pit locations are shown in the attached Site Plan. The excavations were logged, and soil samples were obtained at selected depths. The samples were analyzed in the laboratory to determine their classification and pertinent engineering characteristics. The results of these tests were the basis for the recommendations for:

- Building Foundations
- Retaining Walls
- Earthwork Construction

4.0 INVESTIGATION

4.1 FIELD INVESTIGATION

The field investigation included the observation of six (6) test pits to a maximum depth of 8 feet below the existing surface. The approximate test pit locations are shown in the enclosed Site Plan.

Continuous logs of the soil conditions were recorded, and samples were obtained during the field sampling program. Summaries of the subsurface conditions encountered are presented on the test pit logs. Field exploration and investigation procedures are further described in Appendix A.

4.2 LABORATORY TESTING

Samples obtained during the field investigation were taken to the laboratory and classified in accordance with ASTM D-2488, which is based on the Unified Soils Classification System. Representative samples were then selected for testing to determine physical and engineering properties. These tests included; moisture content, density, swell/collapse potential, grain size distribution, and plasticity index.

The results of the laboratory tests are summarized on the enclosed tables presented in Appendix A. The laboratory test results and field observations, were utilized to prepare the boring logs. Laboratory testing procedures are also further described in Appendix A.

The soil samples presently stored in our laboratory will be discarded after 30 days, unless our office receives a specific request to retain the samples for a longer period.

5.0 SITE AND SUBSURFACE CONDITIONS

5.1 SITE DESCRIPTION

The project site consists of an approximately 10-acre parcel, with relatively even topography, sloping to the southwest. The site is bound to the west by Tramway Boulevard, to the east by Tramway Lane, to the south by a drainage channel, and a residential development to the north.

5.2 SUBSURFACE CONDITIONS

The site soil profile consisted primarily of blends of sand, silt and clay with gravel, cobbles, and boulders distributed throughout the site. The soil plasticity ranged from low to non-plastic, with low to medium moisture and low density. The gravel, cobbles and boulders were semi-rounded, and with maximum observed 24-inch diameter. Larger boulders may be encountered during grading and excavation.

5.3 GROUNDWATER

Groundwater was not encountered at the time of our investigation. Numerous factors contribute to fluctuations of groundwater levels, however, the evaluation of these factors and groundwater determination was beyond the scope of this investigation.

5.4 SEISMICITY AND LIQUEFACTION

Based on the observed soil classification groundwater depth, the potential for liquefaction can be considered negligible. In addition, based on the explored soil profile the site can be characterized as Seismic Site Class D, in accordance with IBC criteria.

6.0 GENERAL EVALUATION

The site soils may be considered with low expansive potential, however, due to the relative low density, the soils may become compressible under foundation loads in their present condition.

Conventional spread shallow foundation systems can be utilized, provided that the recommendations contained herein are adhered to. **The site soils if adequately processed to comply with the fill requirements contained herein, are suitable for re-use as structural fill.**

7.0 RECOMMENDATIONS

The following sections present a discussion of earthwork, foundations, and geotechnical related requirements for different aspects of the project. Specific design recommendations are presented at the end of each section. Specifications for earthwork acceptance and placement are provided herein.

7.1 GENERAL

Based on the results of the field and laboratory investigations, the proposed structures may be established on conventional foundation systems, placed upon properly blended and compacted structural fill. The building pad grading shall be designed to contain a minimum of 5 feet of compacted structural fill in cut and fill areas.

7.2 SITE GRADING AND EARTHWORK

Within the areas to be graded, existing vegetation and debris should be removed and hauled from the site. Any undocumented fill and loose, soft, and firm native soils should be excavated, processed, and stockpiled for later use as compacted structural fill. Surface preparation should extend a minimum of 5 feet beyond the exterior footings and a minimum of 2 feet beyond exterior flatwork and pavements.

After stripping, the exposed native soils should be scarified to bedrock in areas to receive structural fill for the support of footings, slabs-on-grade, exterior concrete flatwork, and asphaltic pavements.

A representative of this office should observe the bottom of the over-excavation prior to the continuance of grading to ascertain whether the recommended removals have been made and whether the exposed soils are suitable for the support of structural fill. Further requirements for earthwork suitability, placement, and compaction procedures are provided below:

1. All organic material, undocumented fill, debris and soft, firm, loose, or disturbed native soils should be removed from the proposed building and pavement areas.

2. Compacted fill placed for the support of footings, slabs-on-grade, post-tensioned slabs, exterior concrete flatwork, and pavements should be considered structural fill. Structural fill may consist of approved imported soils or processed on-site soils that meet the criteria provided herein.

3. The subgrade in all areas to receive fill, should be scarified to a minimum depth of **8 inches**, the soil moisture adjusted to within 3 percent of optimum. The soils shall be compacted with a vibratory roller to a minimum of 95 percent of the maximum laboratory dry density, as determined by ASTM D 1557.

4. Unless otherwise noted, all earthwork and structural fill should conform to the earthwork specifications outlined, and shall be approved by a Geotechnical Engineer.

5. Fill consisting of excavated on-site soils or imported soils approved by the Geotechnical Engineer shall be placed in controlled horizontal layers compatible with the type of compaction equipment used. Soils used as structural fill shall be clean material free of deleterious debris and/or organic material, and meet the following requirements:

Sieve Size	% Passing
3"	100
No.4	50 -100
No.200	20 – 50

Plasticity Index – 12 Max.

7. During the earthwork phase, experienced personnel should be present to observe fill materials for suitability and consistency. A documented testing program should be conducted and approved by a Geotechnical Engineer to determine that soil compaction and earthwork procedures are in accordance with these requirements.

8. There will be material losses due to clearing and grubbing operations. Also, there will be shrinkage losses when excavating and compacting the on-site soils. **Due to the large amount of cobbles and boulders, an estimated shrinkage factor in excess of 25 percent is applicable for the natural soils within 5 feet of the existing ground surface.** A subsidence factor of 0.1 feet should be used in all areas where the exposed uncemented native soils are scarified to a depth of six inches and re-compacted.

9. Based on observations made during our field explorations, the upper native soils can be excavated with conventional earthwork equipment. The Contractor should be aware of the potential for vibrational damage to adjacent or nearby structures when using heavy impact equipment during removal of moderately hard to hard cemented materials.

10. Rubble or debris resulting from excavating soils should be considered undocumented fill.

11. Over-excavation and utility trenches should be laid back to safe slopes or properly shored. Trenching and shoring operations should be conducted in accordance with the *OSHA Standards* as currently amended. Safety of construction personnel is the responsibility of the Contractor.

12. Soils in fill areas shall be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557, and at a moisture content within 3 percent of optimum.

7.3 FOUNDATION DESIGN

The proposed structures should receive adequate support from conventional spread footings founded on compacted structural fill. Specific design recommendations for spread footings are presented in the following subsection.

7.3.1 SPREAD FOOTINGS

Spread footings designed for the recommended allowable bearing pressures, and in accordance to the outlined recommendations, are expected to experience total settlements less than 1-inch for the maximum column load of 10 kips. Differential settlements are expected to be on the order of one-half the total settlement. It is expected that the majority of the anticipated settlement will occur during construction. Specific design recommendations are provided as follows:

1. Footings shall be established on a minimum of **3 feet** of structural fill. The soils shall be compacted to a minimum of 95% of the maximum density as determined by ASTM D-1557.
2. Footings shall be imbedded a minimum of 24 inches below the lowest adjacent grade. The excavation shall extend a minimum of 3 feet beyond the edge of the footing.
3. Foundations constructed in accordance to the above recommendations can be designed for an allowable soil bearing pressure of **2,000 psf**, and can be increased by one-third to include wind or seismic forces. Minimum footing widths shall be 1.5 feet for continuous and 2 feet for isolated.
4. Total estimated settlement of properly constructed foundations should be less than 1 inch, with a maximum differential settlement less than ¾ inch. Excessive moisture below the foundation may cause these values to be greater.
5. *Due to the potential for damaging differential settlements, individual spread footings should not bear on both bedrock and fill. If both are present at the footing base, as determined in the field by a representative of this office, the bedrock should be over-excavated by a depth of 12 inches and replaced with structural fill.*

7.4 SLABS-ON-GRADE

Building slabs shall be placed on a minimum of **3 feet** of structural fill. The soil should be compacted to at least 95 percent of the maximum laboratory dry density and within 3 percent of optimum moisture content as determined by ASTM D-1557. To prevent damage of moisture sensitive flooring or the possibility of Radon intrusion, a moisture barrier may be installed beneath the concrete slab.

Floor slabs may be designed utilizing a Modulus of Subgrade Reaction (k) of 140 PCI. Floor slabs shall be steel reinforced, and be designed by a qualified professional. In addition, to minimize concrete cracking, a 4-inch layer of crusher fines or similar granular material, should be placed under the slabs.

Concrete placement, curing operations, and control joint spacing should be in accordance with American Concrete Institute (ACI) guidelines. The concrete mix for exterior slabs shall be 4 to 7% air entrained to prevent freeze-thaw damage.

7.5 RETAINING WALLS

The following values for retaining wall design are recommended:

Allowable Bearing Capacity –	2,000 PSF
Active Soil Pressure –	29 pcf
Passive Soil Pressure –	345 pcf
At Rest Soil Pressure –	46 pcf
Coefficient of Friction –	0.40 (At soil-concrete interface)

Retaining wall footings shall be placed on compacted structural fill as previously indicated in the Foundation section. Backfill shall be placed in 10 inch loose layers and compacted to a minimum of 95% of ASTM D-1557. The retaining walls shall be provided with an adequate waterproofing, and an internal drainage system to prevent excessive hydrostatic pressures, and moisture seepage through the basement walls.

7.6 MOISTURE PROTECTION AND SURFACE DRAINAGE

Precautions should be taken during and after construction to minimize saturation of the foundation soils. Positive drainage should be established away from the exterior walls of structures..

1. The recommended minimum slope is 3 percent in areas landscaped with vegetation and irrigation and 1½ percent in pavement areas. The recommended slopes should extend laterally a distance of about 10 feet away from building structure.

2. Downspouts from roof drains should discharge on to an impervious surface or a minimum distance of 10 feet from the exterior building wall or fill slope. The impervious surface should start at the exterior building wall and slope away from the structure a minimum distance of 10 feet. Splash blocks may be used as the impervious surface described above. **In no case should downspouts from roof drains discharge into planter areas immediately adjacent to the building unless there is a positive drainage away from the structures and the 10-feet minimum discharge criteria are followed.**

3. Landscape trees and plants requiring regular watering should be planted at least 10 feet away from footings. Landscaping within 10 feet of the footings should be desert landscaping such as decorative rock or plants that do not need to be watered and have a shallow root system.

4. All utility trenches within the pad and extending 5 feet beyond the structure footings should be backfilled with structural fill consisting of on-site or similar soils. The backfill should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.

5. Special care should be taken during installation of subfloor sewer and water lines to reduce the possibility of future leakage and subsoil saturation, which could result in foundation and slab settlement and/or failure.

7.7 TRENCHES AND EXCAVATIONS

Trenches greater than 4 feet in depth shall be sloped or braced in accordance to OSHA Construction and Safety Standards. The excavated material shall be placed a minimum of 2 feet from the edge of the excavation, and should not be allowed to fall into the excavations.

Temporary construction excavations less than 8 feet in depth shall be sloped no steeper than 2:1 (Horizontal to Vertical). Equipment and stockpiles shall be placed at a minimum distance of 5 feet from the edge of the excavation.

7.8 FOUNDATION REVIEW AND OBSERVATION

This report has been prepared to aid in the evaluation of this site and to assist in the design of the structure. This office should be provided the opportunity to review the final grading plans, design drawings and specifications in order to determine whether the assumptions and recommendations presented in this report are valid and have been implemented. Review of the final grading plan, design drawings and specifications should be noted in writing and become a supplement to this report.

Variations in soil conditions may be encountered during construction of this project. In order to permit correlation between the field conditions encountered in this investigation and the actual conditions encountered during construction, and to confirm recommendations presented herein, this office should be retained to perform sufficient review during construction of this project. Observation and testing should be performed during construction to confirm that suitable fill soils are placed upon competent materials and properly compacted, and that foundation elements are placed upon the recommended soils, and their required depth.

8.0 CLOSURE

The recommendations given in this report are based on results of field and laboratory investigations, combined with interpolation of subsurface conditions between boring locations. The nature and extent of variations between the borings may not become evident until construction. If variations are then exposed, it will be necessary to re-evaluate the recommendations of this report. **This report does not address the effects of flooding, environmental issues, seismic events, and/or seasonal ground water variations.**

If changes in the nature, design, or location of the facility are planned, the recommendations contained in this report shall not be considered valid unless the changes are reviewed and the recommendations of this report modified or verified in writing.

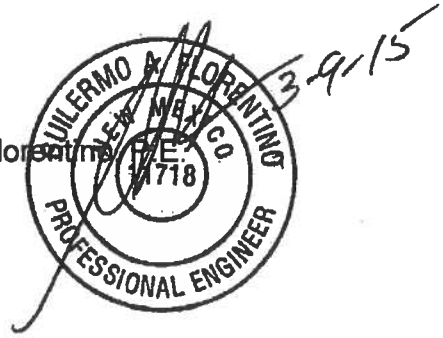
In addition, it is assumed that continuous observation and testing, during grading operations, will be conducted by a qualified geotechnical engineer or its representative.

This report is not intended for bidding purposes. Any person using this report for bidding or construction purposes should perform such independent investigation as he deems necessary to satisfy himself as to the surface and subsurface conditions to be encountered, and the procedures to be used in the performance of work on this project. If conditions are encountered during construction that appear to be different than indicated by this report, this office should be notified.

If you have any questions or need additional information, please contact our office at your convenience.

Respectfully submitted;

Florentino Engineering, LLC.



Guillermo A. Florentino, P.E.
Principal

APPENDIX A
FIELD AND LABORATORY INVESTIGATIONS

FIELD INVESTIGATION

The subsurface soil conditions were explored by excavating six (6) test pits to a maximum depth of 8 feet below the surface. The approximate locations of the explorations are shown on the site plan. Continuous logs of the subsurface conditions, as encountered in the explorations were recorded at the time of exploration by our field personnel.

The subsurface conditions encountered were visually classified in accordance with ASTM D2488, which is based on the Unified Soil Classification System (UCS). Summaries of the subsurface conditions encountered are presented on the boring logs.

A representative portion of each sample was retained and carefully sealed in waterproof plastic containers for transport to the laboratory.

LABORATORY TESTING

Laboratory tests were conducted on representative soil samples for the purpose of classification, and determination of their physical properties and engineering characteristics. The tests performed consisted of the following:

- Moisture content (ASTM D-4959)
- Sieve Analysis (ASTM D-422)
- Plasticity Index (ASTM D-4318)
- Density and Moisture (ASTM D-2937)
- Swell/Collapse Potential

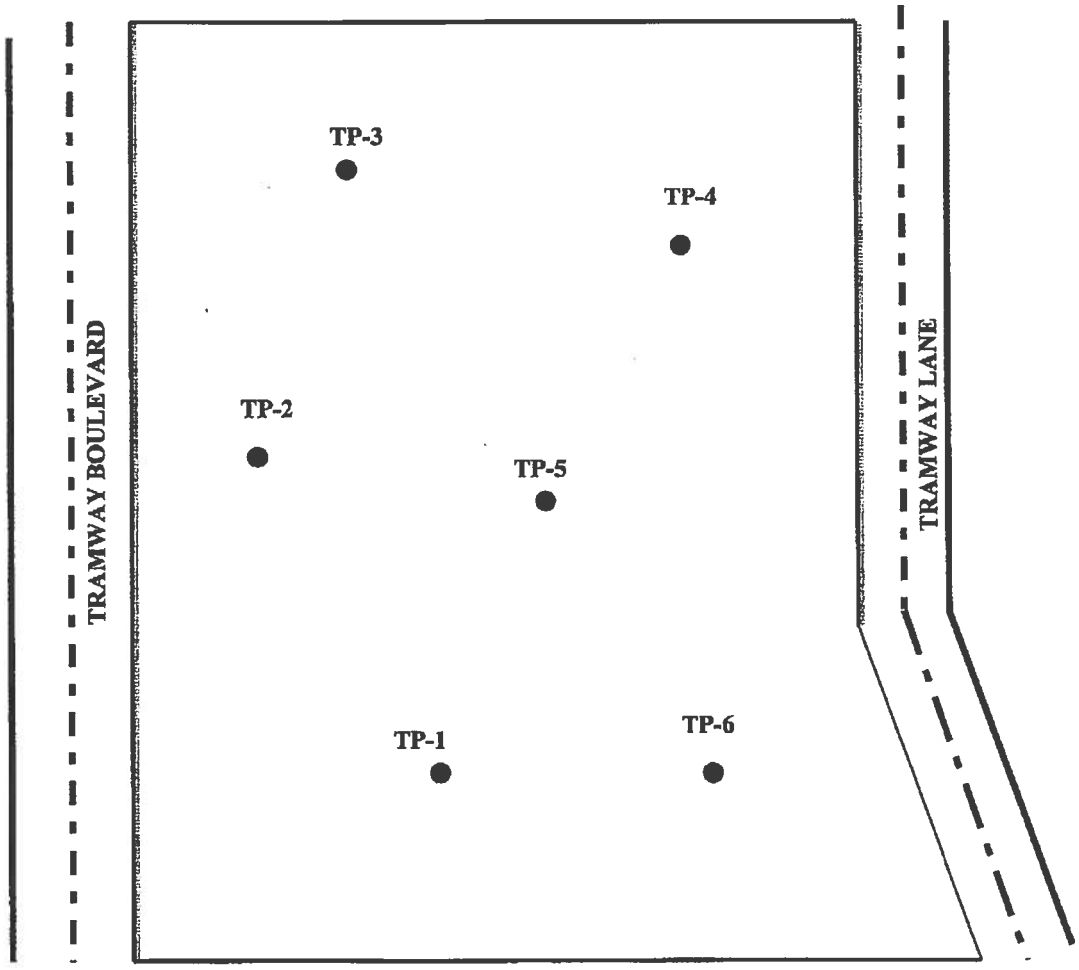
A summary of the various laboratory tests results are presented in the Test Summary Table.

TEST SUMMARY TABLE

TEST PIT	DEPTH (FT.)	CLASS.	LL	PI	SIEVE ANALYSIS (% PASS.)										MOIST. (%)	DRY DENSITY (PCF)	COLLAPSE 60 PSF (%)
					#200	#100	#40	#10	#4	3/8"	3/4"	1"	2"	4"			
TP-1	0 - 3	SW-SM	NV	NP	7.5	11	24	60	83	97	100				3.2		
TP-2	2 - 8	SM	23	3	36	45	52	73	93	99	100				3.4	110.8	5.2
TP-3	1 - 6	SM	NV	NP	22	28	40	67	88	96	100				4.9		
TP-4	2 - 4	SC-SM	32	8	41	47	58	82	94	97	100				8.2	101.6	
TP-5	2 - 4	SC-SM	29	8	76	85	93	98	100						7.9		
TP-5	5 - 8	SM	NV	NP	14	21	29	64	76	91	98	100			2.6		
TP-6	4 - 8	SM	NV	NP	14	21	29	64	76	91	98	100			5.4		6.4

SITE PLAN

HAWK'S LANDING ESTATES
BERNALILLO CO., NM



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N.T.S.

● Indicates Approximate Test Pit Location

TEST PIT LOG

Project No. 15-01392

HAWK'S LANDING ESTATES

TEST PIT NO: 1

BERNALILLO CO., NM

DATE: 2/14/2015

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 inches	Soil Pattern	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Remarks
1	X			SW-SM	Light brown well graded silty sand; non-plastic, low moisture medium density	Moisture - 3.2% PI - NP
2						
3					Low density	
4					Cobbles	
5						
6	X					
7					Cobbles	
8					Test Pit Ends @ 8 feet Groundwater Notr Encountered	
9						
10						

Legend: Ring Sample; Bulk Sample; No Recovery; Water Table

TEST PIT LOG

Project No. 15-01392

HAWK'S LANDING ESTATES

TEST PIT NO: 2

BERNALILLO CO., NM

DATE: 2/14/2015

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 inches	Soil Pattern	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Remarks
0 – 8				SM	Light brown silty sand; non-plastic, low moisture medium density	Moisture - 3.4% PI - 3
2					Cobbles	
3					Low density	
4					Cobbles	
6					Cobbles	
8					Test Pit Ends @ 8 feet Groundwater Notr Encountered	
10						

Legend: Ring Sample; Bulk Sample; No Recovery; Water Table

TEST PIT LOG

Project No. 15-01392

HAWK'S LANDING ESTATES

TEST PIT NO: 3

BERNALILLO CO., NM

DATE: 2/14/2015

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 Inches	Soil Pattern	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Remarks
0				SM	Light brown silty sand; non-plastic, low moisture medium density	Moisture - 4.9% PI - NP
1	X					
2					Cobbles	
3						
4					Cobbles	
5	X					
6						
7					Cobbles	
8					Test Pit Ends @ 8 feet Groundwater Notr Encountered	
9						
10						

Legend: Ring Sample; Bulk Sample; No Recovery; Water Table

TEST PIT LOG

Project No. 15-01392

TEST PIT NO: 4

HAWK'S LANDING ESTATES

BERNALILLO CO., NM

DATE: 2/14/2015

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 inches	Soil Pattern	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Remarks
0 – 5	Ring Sample			SC-SM	Light brown silty clayey sand; low plasticity, medium moisture medium density Low Moisture Cobbles	Moisture - 4.9% PI - 8
5 – 8	Ring Sample			SM	Light brown silty sand, non-plastic, low moisture low density Cobbles	
8					Test Pit Ends @ 8 feet Groundwater Notr Encountered	

Legend: Ring Sample; Bulk Sample; No Recovery; Water Table

TEST PIT LOG

Project No. 15-01392

HAWK'S LANDING ESTATES

TEST PIT NO: 5

BERNALILLO CO., NM

DATE: 2/14/2015

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 inches	Soil Pattern	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Remarks
0				SC-SM	Light brown silty clayey sand; low plasticity, medium moisture medium density	Moisture - 7.9% PI - 8
1	X					
2					Cobbles Low Moisture	
3						
4					Boulders	
				SM	Light brown silty sand non-plastic, low moisture low density	Moisture - 2.6% PI- NP
5						
6	X				Cobbles	
7						
8					Boulders	
					Test Pit Ends @ 8 feet Groundwater Notr Encountered	
9						
10						

Legend: Ring Sample; Bulk Sample; No Recovery; Water Table

TEST PIT LOG

Project No. 15-01392

HAWK'S LANDING ESTATES

TEST PIT NO: 6

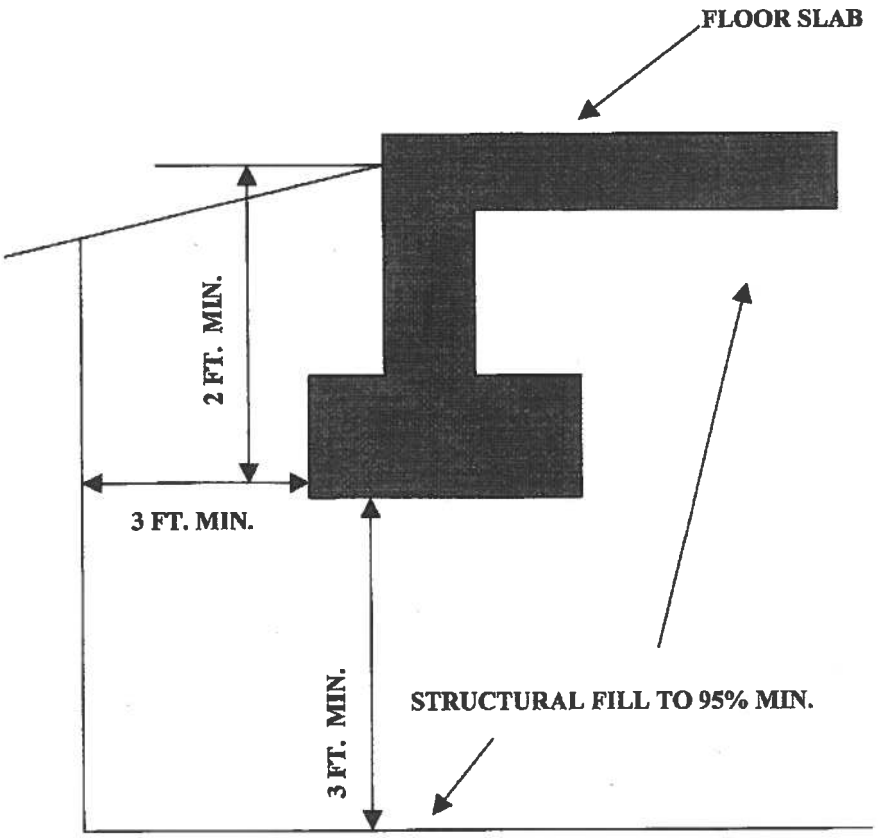
BERNALILLO CO., NM

DATE: 2/14/2015

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 inches	Soil Pattern	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Remarks
0				SM	Light brown silty clayey sand; low plasticity, medium moisture low density	Moisture - 5.4% PI - NP
1	X					
2					Cobbles Low Moisture	
3						
4						
5	X					
6					Cobbles	
7						
8					Test Pit Ends @ 8 feet Groundwater Notr Encountered	
9						
10						

Legend: Ring Sample; Bulk Sample; No Recovery; Water Table

OVEREXCAVATION DETAIL



NTS