GEOTECHNICAL ENGINEERING REPORT
FITZGERALD / HOPPER PROPERTY

Property location:
3287 SOUTH 9200 WEST
MAGNA, UTAH

Prepared for:
UPSTART HOUSING
345 SOUTH MOFFATT COURT
SALT LAKE CITY, UTAH 84111

December 27, 2006

PREPARED BY:

WILDING ENGINEERING

14721 SOUTH HERITAGE CREST WAY
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APPENDIX

LIST OF TABLES AND FIGURES

1. INTRODUCTION

This report presents the field investigation for a proposed subdivision to be located at about 3287 South 9200 West, Magna, Utah, see site and vicinity maps in appendix. The subsurface field investigation was performed in accordance with Wilding Engineering Proposal dated October 12, 2006 and authorized by Paula Carl on October 18, 2006.

The field investigation consisted of six (6) test pits excavated to a depth ranging from about 14 to 19 feet below the ground surface. Detailed Test Pit Logs (TP-1 through TP-6) can be found in the Appendix. Recommendations in this report are based upon information gathered from the field investigation, site inspection, lab testing, and from reviewing geologic maps and reports of the area.

2. PURPOSE AND SCOPE

The purpose of this investigation was to determine the suitability of on site soils for the development of a residential subdivision with associated utilities and asphalt paved roadways. The investigation includes a review of surface water and ground water conditions and their affects. Engineering and construction recommendations are presented based on subsurface conditions encountered in the field along with the effects of both subsurface and surface waters.

3. SITE AND PROJECT INFORMATION

3.1. Proposed Project Description

Based on the site plan prepared by Wilding Engineering, the proposed 7.7 acre subdivision will be developed into twenty seven (27) residential lots with the associated utilities, asphalt paved drive areas. The lots will be developed with single family buildings consisting of typical wood framed walls with concrete slab-on-grade floors and below grade basements. Based on our experience and understanding of the proposed construction, maximum column and continuous wall loads are assumed to be about 50 kips and 3 klf, respectively. Asphalt concrete will be used to construct the road for the subdivision. A site plan is located in the Appendix of this report.

Recommendations presented in this report are based upon the current available information. If the assumed building loads or any information presented is incorrect or has changed, please inform Wilding Engineering in writing so that we may amend the recommendations presented in this report appropriately.

3.2 Existing Site Conditions

The site is located at 3287 South 9200 West in Magna, Utah, in the southeast quarter Section 30, Township 1 South, Range 2 West, Salt Lake Base and Meridian, Magna, Utah.

The property is currently developed with two single family residential buildings along with open fields used for grazing of horses. The property also consists of various sheds or structures used for storage and livestock purposes. Vegetation through out the property consists of various weeds, grasses and large trees. The current land use in the vicinity of the area is primarily residential with heavy industrial west of the site (Kennecott Utah Copper).

Based upon a survey conducted by Wilding Engineering, the topography the site ranges in elevation from 4403 to 4452 feet above mean sea level. The site generally slopes towards the northeast at about five percent (5%).

The property is bound by the residential on the north and east, vacant land on the south and 9200 West Street on the west. Access to the site is proposed from 9200 West Street (west), Weir Drive (south) and 9100 West Street (north).

4. GENERAL GEOLOGY AND HYDROLOGY

4.1. Surficial Geology

Based on the available geologic maps, the project site is underlain by Alluvium deposits, (Upper Holocene). The site is mapped with two USGS soil units; “Qa – Stream alluvium, alluvial fans, and locally, mudflows” and “Qpsf – Cheifly sand and gravel in beach deposits, bars, spits, and deltas.[1]

4.2. Geologic Hazards

4.2.1. Faulting

The site is located about six (6) miles west of the West Valley Fault Zone, which runs through the central portion of the Salt Lake Valley from Taylorsville to west of the Salt Lake International Airport. Salt Lake County Surface Rupture and Special Study Map indicates there is no fault study zone mapped through the project area.

4.2.2. Liquefaction

Liquefaction is a common earthquake condition in which soils lose virtually all shear strength and act as viscous liquids during severe ground shaking. A physical change occurs to the soil transforming it “from solid ground capable of supporting a structure, to a quicksand-like liquid with a greatly reduced ability to bear the weight of a building.”[2] This site is mapped as having a “low” potential for liquefaction.[3] This suggests that the probability of liquefaction to occur at the project site is between five and ten percent (5% to 10%) in 100 year return period. Based on the Salt Lake County Ordinance, a liquefaction analysis is not required at the site.

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[1] Geologic Map of the Central Wasatch Front, Utah; U.S. Geological Survey, Fitzhugh D. Davis,May 1983.
[2] Liquefaction- A Guide To Land Use Planning, Craig V. Nelson, S.L. County Public Works- Planning Division.
[3]Geologic Hazards, Salt Lake County, Utah, L.R. Anderson, J.R. Keaton, J.E. Spitzley, and A.C, Allen in 1986 under U.S. Geological Survey Contract 14-08-0001-1991.

4.3 Ground Water

The site is mapped as having a depth to ground water greater than 30 feet.[4] Ground water was not encountered during excavation. However, it is possible for nearby streams or canals to fluctuate water levels through perched water conditions. For further ground water evaluation see section 5.2.2 of this report.

4.4 Surface Water

The storm drainage plan must include measures to properly convey surface water runoff from the paved surfaces and structures into a detention pond or near by drainage system. The site shall be graded to direct any surface flows away from buildings and structures. Natural drainage is generally from southwest to northeast.
This site is mapped by Federal Emergency Management Agency (FEMA) as Zone X, which is an area described as being located outside the 500-year flood event.[5] FEMA Map is included in the Appendix.

5. FIELD EXPLORATIONS

5.1 Subsurface Investigation

Subsurface conditions at the project site were evaluated with six (6) test pits designated as TP-1 through TP-6 excavated at approximate locations indicated on Site Map and Test Pit Locations in the Appendix.

Test Pits were excavated with a track mounted excavator to depths ranging from 14 to 19 feet below the ground surface. Stratigraphy and classification of the soils were logged under the direction of a geotechnical engineer.

Disturbed samples were taken at various depths and examined in the field and representative portions were stored in sealed plastic bags. The samples were transported to our laboratory for further examination and testing. The test pits were backfilled up to the ground surface with on-site soils. Sample types with depths as well as all lab test results are shown in detail in the Test Pit Logs found in the Appendix.

5.2 Subsurface Conditions

5.2.1 Soils

The soil profile generally consists of about 14 to 36 inches of topsoil, underlain by poorly graded gravel with silt and sand (GP-GM) with cobbles and an occasional boulder, followed by silty sand to sandy silt with clay to the maximum depth explored of about 19 feet.

The moisture content on select samples ranged from about two (2) to eight (8) percent of the dry weight. For a detailed description of the materials and conditions encountered at test pit locations, please refer to the Test Pit Logs in the Appendix.

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[4] Shallow Ground Water and Related Hazards in Utah, Utah Geological and Mineral Survey, Suzanne Hecker, Kimm M. Harty, and Gary E. Christensen, 1988

The subsurface profile description above is a generalized interpretation provided to highlight the major subsurface stratification features and material characteristics. The test pit logs included in the Appendix should be reviewed for more specific information. The stratifications shown on the test pit logs represent the conditions only at the test pit log locations. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual.

5.2.2 Ground Water

In test pits excavated to depths ranging from 14 to 19 feet, ground water was not encountered. It should be noted that it is possible for the ground water levels to fluctuate during the year depending on the season and climate. Additionally discontinuous zones of perched water may exist at various locations and depths beneath the ground surface. This could result in encountering ground water conditions during construction which may have been different than during our field investigation. If perched water is encountered during construction which differs from this report, Wilding Engineering must be notified to observe changing conditions and provide recommendations.

6 LABORATORY TESTING

Representative soil samples were tested to evaluate physical and engineering properties. Laboratory testing included: natural moisture content, grain size analysis and Atterberg Limits. Detailed lab results are presented in the appendix, as well as a on the Test Pit Logs a summary of lab results is also provided.

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[5] FEMA FIRM, City of Magna,Utah, Salt Lake County Recorders updated 2003.

7 RECOMMENDATIONS AND CONCLUSIONS

7.1 Geotechnical Discussion

Wilding Engineering, Inc. has provided the following recommendations based on the information provided by the client and the soils encountered during our field investigation for the proposed development. The proposed site is suitable for the development of the proposed subdivision if the recommendations of this report are followed.

7.2 Site Work

7.2.1 Site Preparation

It is the contractor's responsibility to locate and protect all existing utility lines, whether shown on the drawings or not.

In general 14 to 42 inches of topsoil was encountered during our investigation. All topsoil or any soil containing organic materials should be removed from the site where structures or pavement are to be placed. Topsoil may be stockpiled on site for subsequent use in landscape areas. Any unsuitable material (loose, soft, saturated, or otherwise unstable soils where structures are to be placed), shall be replaced with structural fill according to the standards set forth in section 7.2.4 and 7.2.5 of this report. Free draining gravel or cobble shall be used in the entrance areas during construction to aid in soil strength and comply with storm water BMP's required by the site specific SWP3.

7.2.2 Excavation Consideration

All utilities encountered in excavating shall be carefully supported, maintained, and protected during construction in accordance with OSHA Regulations as stated in 29 CFR Part 1926. It is the responsibility of the contractor to have safe working conditions. Temporary construction excavations should be properly sloped or shored, in compliance with current federal, state, and local requirements.

Construction excavations up to 4 feet deep may be constructed with near-vertical side slopes. Excavations between 4 feet and 10 feet deep should have side slopes not steeper than 1 to 1, or a trench box or shoring may be used. Excavations are to be made to minimize subsequent filling. Coarse-grained material can easily become unstable and is anticipated in localized areas to experience toppling, cave-in or sliding. Boulders and cobbles larger than six inches shall not be used in trenches as backfill.

Wilding Engineering does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations. As stated in the OSHA regulations, "a competent person shall evaluate the soil exposed in the excavations as part of his/her safety procedures". In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

7.2.3 Structural Fill Material

Structural fill shall consist of well-graded granular material, with a maximum aggregate size of 2 inches, and a maximum of 15% passing the #200 sieve. The fill material which is finer than the number 40 sieve shall have a liquid limit (LL) less than 35 and a Plastic Index (PI) less than 25, see table 7.1 for gradation specification. This material shall be free from organics, garbage, frost, and other loose, compressible, or deleterious materials.

Table 7.2 Structural Fill Requirements

Grain Size	Percent Passing
2-inch	100
¾-inch	85 to 100
No. 4	15 to 45
No. 200	< 15
Plastic Index (PI)	< 25
Liquid Limit (LL)	< 35

Fine-grained materials (clays and silts) are not suitable for use as fill in areas that will be carrying a structural load such as roads, buildings, and utility trenches in roadways. However, they may be used as site grading fills in landscaped areas.

7.2.4 Fill Placement and Compaction

Fill under roads, driveways, and utilities should be placed in nine (9) inch lifts (loose) and shall be compacted to at least 95% of the modified proctor (maximum dry density as determined by the ASTM D 1557 method of compaction). Landscaped areas are to be compacted to at least 90% of the modified proctor. Each lift shall be tested for adequate compaction (see section 7.3.1 for fills placement and compaction under foundations).

7.2.5 Utility Trenches

Construction of the pipe bedding shall consist of preparing an acceptable pipe foundation, excavating the pipe groove in the prepared foundation and backfilling from the foundation to 12 inches above the top of the pipe. All piping shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded. In our experience individual municipalities will have local requirements regarding installation of utilities. However, in the absence of specified requirements the following is recommended:

The soils in the utility pipe zones consist of coarse grained soils. These soils are suitable as trench backfill pending they meet the specified structural fill requirements in Section 7.2.3.

Pipe foundation: shall consist of native soils if the soils are stable and undisturbed. Wherever the trench subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, the trench shall be excavated below the bottom of the pipe to such depth as may be necessary, and this additional excavation filled with compacted well-graded, granular soil (per 7.2.3), compacted to 95% of the modified proctor.

Pipe groove: shall be excavated in the pipe foundation to receive the bottom quadrant of the pipe so that the installed pipe will be true to line and grade. Bell holes shall be dug after the trench bottom has been graded. Bell holes shall be excavated so that only the barrel of the pipe bears on the pipe foundation.

Pipe bedding: (from pipe foundation to 12 inches above top of pipe) shall be deposited and compacted in layers not to exceed 9 inches in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. All bedding materials shall be placed in the trench in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compact masses.

Backfill for utility trenches located beneath roads shall be compacted to 95% of the modified proctor. In non-load bearing areas (landscape), trenches shall be compacted to 90% of the modified proctor (ASTM D 1557).

7.2.6 Native Soil As Fill

The native soils generally consist of non-plastic silty sands to gravel to silty gravel with cobbles and an occasional boulder. If clayey soils are encountered they are generally not acceptable as fill, because of the difficulty in achieving compaction due to their moisture sensitivity. If onsite native soils meet the structural fill requirements in section 7.2.3 of this report they can be used as structural fill, otherwise, we recommend that a well-graded granular material be imported. Any tested fill material that do not achieve either the required dry density or moisture content requirements shall be recorded, the location noted, and reported to the contractor and owner. A retest of that area shall be performed after the contractor has completed all necessary remedial measures including moisture conditioning (wetting to drying) and reworking the fill.

7.2.7 Surface Drainage

A grading and drainage plan prepared by Wilding Engineering and shall be adhered to for the site drainage. Generally, each building site shall be graded in such a manner that surface water will flow away from the buildings foundations**.** Natural drainage is generally from southwest to northeast. Surface water should be prevented from entering trenches during construction. An embankment may be used to divert any storm water from construction areas and directed into the proposed retention basin.

7.3 Foundations

7.3.1 Installation and Bearing Material

Footings must be placed on undisturbed native soils or entirely on structural fill which is bearing on native soils and is compacted to 95% of the modified proctor (maximum dry density as determined with ASTM D1557 method of test). Any existing topsoil shall be removed from the areas where footings are to be located. All load bearing soils which are disturbed or considered soft areas are unsuitable for support for foundations and should be removed down to firm soils and replaced with properly placed compacted structural fill within ±2% of the optimum moisture content.

If perched water is encountered during excavation and installation refer to foundation drainage section 7.3.6. Foundations shall have minimum dimensions of 18-inches for continuous wall footings and 24-inches for isolated column footings.

Footing excavations shall be inspected by the Geotechnical Engineer prior to placement of structural fill, concrete or reinforcement steel to verify their suitability for placement of the footings.

7.3.2 Bearing Pressure

The ASCE and USACE recommend residential wall loads of 1.0 to 1.5 klf as a minimum value for settlement calculations. We have chosen to use 3.00 klf. Assuming an 18" footing, this correlates to a 2000 psf contact pressure. The International Building Code table 1804.2 indicates an allowable foundation pressure of 2000 psf for sands. Confirmation of this recommendation was made using Hansen's modifications to Terzahgi's original bearing capacity equation and assumed values for internal friction angle (φ) of 32 and a cohesion (c) of 0 psf. For the purpose of the calculation we assumed a footing depth of 8 feet. The calculation yielded a factor of safety above the typically accepted value of 3. Therefore, footings bearing on undisturbed soils or on properly placed and compacted granular structural fill extending down to undisturbed native soils may be designed with a maximum allowable bearing capacity of 2000 psf. The recommended allowable bearing pressure refers to the total dead load and can be increased by 1/3 to included the sum of all loads including wind and seismic.

7.3.3 Settlement

Several factors are generally considered in settlement. They are immediate settlement, consolidation settlement and secondary settlement. Immediate settlement occurs very quickly, as the building is constructed. Since this factor is generally small and adjustments are made during construction to compensate, this factor is usually neglected. Secondary settlement occurs over a very long period of time.

The anticipated settlement due to consolidation is not anticipated to exceed 1-inch, which is the recommended maximum settlement for this type of structure. Differential settlement is expected to approach about 50 to 75 percent of the total settlement under static conditions. Settlement does not control bearing capacity and our recommendation remains 2000 psf.

7.3.4 Frost Depth

All exterior footings are to be at least 30 inches below the ground surface to protect against possible frost heave. This may require fill to be placed around buildings. With slab on grade construction, interior footings require 18 inches of cover. If foundations are constructed through the winter months, all soils on which footings will bear shall be protected from freezing.

7.3.5 Construction Observation

The geotechnical engineer shall periodically monitor excavations prior to installation of footings. Inspection of soil before placement of structural fill or concrete is required to detect any field conditions not encountered in the investigation, which would alter the recommendations of this report. All structural fill material shall be tested under direction of the Geotechnical Engineer for adequate compaction.

7.3.6 Foundation Drainage

Footings and foundations shall be designed according to the International Building Code (IBC 2003). According to the IBC 2003, soils with poor drainage characteristics require that a foundation drain be installed to allow water to drain away from the foundation.[6] During our field investigation, coarse grained soils were encountered from about one (1) to fifteen (15) feet below the ground surface. These soils are considered to be in group 1; therefore, a foundation drain is not required.[6]

7.4 Lateral Forces

7.4.1 Resistance for Footings

Wind and seismic forces, which cause lateral loads on foundations, are resisted by friction and passive earth pressures at the foundation ground interface. In the design of spread footings against shear forces, the total dead weight is multiplied by the coefficient of friction for lateral sliding (μ) which is estimated to be 0.25 for sands, and the resistance of lateral sliding is 130 psf for clays and silts.[7]

7.4.2 Lateral Earth Pressures on Foundation Walls

The following equivalent fluid weights are given for the design of sub-grade walls and retaining structures. Basement, foundation and retaining walls shall be designed to resist lateral soil loads.

Basement walls and other walls in which horizontal movement is restricted at the top and bottom (non-yielding) shall be designed for at-rest lateral earth pressure based on the equivalent fluid having a unit weight of 55 pcf for horizontal backfill and 70 pcf for backfill slopes upward at 2H:1V (26.7°). At-rest equivalent fluid pressure is a product of the soil unit weight times the coefficient of earth pressure at rest for coarse grained soils (Jaky, 1944).

Retaining walls free to move and rotate at the top are permitted to be designed for active pressure (Coulombs 1776). **Exception:** Basement walls extending not more than 8 feet

[6] International Building Code 2003, Section 1805

[7] International Building Code 2003, Ch. 18, Table 1804.2

below grade and supporting flexible floor systems shall be permitted to be designed for active pressure."[8] Both active and passive earth pressure coefficients and equivalent fluid pressures are provided in Table 7.4.1. Passive earth pressures are typically neglected in design to be conservative. However, they may be used, if required, as it can be expected that they will develop as active pressure increases. The equivalent fluid pressures below assume that the backfill material is fully drained where pore water pressures are not allowed to build up behind the wall. Internal angle of friction, ϕ was estimated as 32 degrees for coarse grained soils.

Table 7.4.1 Static Conditions

Equivalent Fluid Pressures and Coefficients				
Conditions	**Kγ**	γ	**K**	**2H:1V Slope**
At-rest ($K_o\gamma$)	55 pcf	120	K_o=0.47	70 pcf
Active ($K_a\gamma$)	35 pcf	120	K_a=0.31	75 pcf
Passive ($K_p\gamma$)	390 pcf	120	K_p=3.25	Not Applicable

7.4.3 Seismic Conditions

Under dynamic conditions, at rest earth pressure for non-yielding walls can be estimated using the procedure presented by Seed and Whitman (1970). The static component is known to act at H/3 above the base of the wall. Seed and Whitman (1970) recommended that it would be appropriate for the dynamic component be taken to act at approximately 0.6H for non-yielding walls. Non-yielding walls can be designed based on a seismic at-rest component of 55 pcf. This component shall be included in addition to the static equivalent at-rest earth pressure value from above.

The Mononobe-Okabe M-O Method (Mononobe and Matsuo (1929); Okabe (1924) and Kapila (1962)) is reused in determining active and passive, respectively, seismic earth pressure coefficients. Determining seismically induced active and passive lateral earth pressures is an extension of the Coulomb theory for static stress conditions. The method entails three fundamental assumptions:

- The driving soil wedge and the retaining structure act as rigid bodies and therefore experience uniform accelerations throughout the respective bodies.
- The driving soil wedge inducing the lateral earth pressures is formed by a planar failure surface starting at the base and extending to the free surface at the top of the wall with backfill. The maximum shear strength of the backfill is mobilized along this failure plane
- Wall movement (flexibility) is sufficient to ensure either active or passive conditions, as the case may be.

[8] International Building Code 2003, Section 1610, Table 1610.1

Active and passive seismic components have been estimated using the M-O method for seismic design in retaining walls.

Table 7.4.2 Dynamic Conditions

Yielding Wall Dynamic Pressures and Coefficients			
Conditions:	**Values**	γ	**K**
Active	81 pcf	120	K'_a=0.67
Passive	308 pcf	120	K'_p=2.56

The active seismic component shall be included in addition to the static equivalent active pressure value and, if relied upon, the passive seismic component shall be included as a reduction in the static passive resistance value.

During backfill placement and compaction below grade or behind retaining walls, the contractor shall use caution. Retaining walls can experience excessive build up of lateral pressures when backfill is over-compacted. We recommend using manual compaction practices (jumping jack, etc.). Avoid unnecessary large equipment or heavy items from being placed or operated with 5 feet of retaining wall. Backfill material should meet IBC 2003 requirements and should not have aggregate greater than 3 inches in size.

7.5 Concrete Slabs on Grade

Floor slabs are to be supported by either entirely on suitable native soils or on imported structural fill placed which shall be compacted to 95% of the modified proctor (maximum dry density as determined by the ASTM D 1557 method of compaction) extending to the undisturbed native soils. It is recommended that areas immediately below any exposed concrete, i.e., driveways, any side aprons, be placed with six (6) inches coarse aggregate base to distribute floor loads and provide proper drainage. A minimum of four (4) inches of coarse aggregate base is recommended to be placed immediately below slabs to aid in curing of the concrete and provide proper drainage. Floor slabs shall have adequate number of joints set by the structural engineer to reduce cracking resulting from any differential movements and shrinkage.

7.6 Seismic Information

7.6.1 Faulting

Based on the Salt Lake County Geologic Hazards Map the project site is located less than one mile to the west of the Wasatch Fault. Also, surface rupture had not been mapped and was not observed at the site. However, strong ground motion due to earthquake events must be considered. The International Building Code (IBC 2003), and the USGS Earthquake Hazards Program interpolated probabilistic ground motion values for S_S an S_1 are 1.05g and 0.38g respectively. (See table below)

Table 7.6 USGS Earthquake Hazards Estimated Values

```
LOCATION                 40.7006 Lat.  -112.1068 Long.
The interpolated Probabilistic ground motion values, in %g,
at the requested point are:
            10%PE in 50 yr   2%PE in 50 yr
   PGA         22.06            42.31
0.2 sec SA     53.18            105.40
1.0 sec SA     18.02            38.79
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
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SEISMIC HAZARD: [Hazard by Lat/Lon, 2002]

The design spectral accelerations were determined according to IBC 2003 and ASCE 07-05 and were found to be 0.75g and 0.42g for S_{DS} and S_{D1} respectively. The figure below shows the spectral response parameters used to develop the design values and a code specified response spectrum for the site based upon a site class of “D” for a stiff soil profile.

Seismic Provisions ASCE 7-05

			Mapped MCE Spectral Response Acceleration Parameters F_a and F_v				
Site Class:	D	Short Period	1.6	1.4	1.2	1.1	1.0
		1 Second	2.4	2.0	1.8	1.6	1.5

Obtained S_s and S_1 from http://eqint.cr.usgs.gov/eq-men/cgi-bin/find-ll-2002-interp.cgi

S_S:	1.0504	F_a=	1.08	S_{MS}=	1.1343	S_{DS}=	0.7562
S_1:	0.3879	F_v=	1.62	S_{M1}=	0.6300	S_{D1}=	0.4200

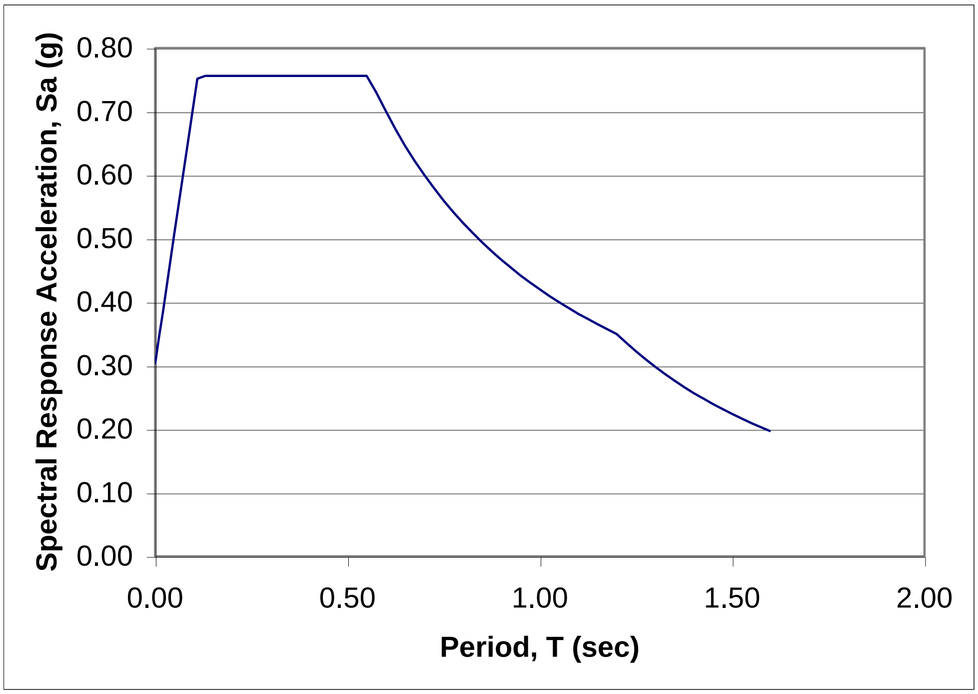

Figure 7.6 ASCE 7-05 Seismic Provisions

7.6.2 Liquefaction

A review of the geologic hazards maps for Salt Lake County indicates that the project site is located in an area designated as "low" in liquefaction potential.[9] This suggests that the potential is defined as having between five and ten percent chance in a 100 year return period. Two conditions must be present for liquefaction to occur in soils:

- The soil must be susceptible to liquefaction, i.e., granular layers with less than fifteen percent fines, existing below the groundwater table.

- Ground shaking strong enough to cause liquefaction.

[9] Geologic Hazards, Salt Lake County, Utah, L.R. Anderson, J.R. Keaton, J.E. Spitzley, and A.C, Allen in 1986 under U.S. Geological Survey Contract 14-08-0001-1991.

Ground water was not encountered during the subsurface exploration. These subsurface conditions indicate liquefaction is not a concern to the depth explored.

7.4.3 Structures

Structures are to be designed for lateral loading as defined in the International Building Code. The site location has a design spectral response acceleration of 0.75g for short periods (S_{DS}) and 0.42g for a one second period (S_{D1}). Lateral loading is to be the greater of seismic loads or wind loads.

7.7 Pavement Design and Construction

A flexible pavement design has been prepared for the anticipated roadways and drive areas through the subdivision. The pavement design was prepared based on the soil characteristics similar to those encountered in the test pit samples collected and relatively light traffic loads. The pavement design assumptions consist of traffic of about 40,000 and 50,000 Equivalent Single Axle Loads (ESALs) with a twenty (20) year design period at 80% reliability, a California Bearing Ratio CBR of 4, standard deviation of 0.35, and Initial and Terminal serviceability of 4.2 and 2.5, respectively. The following sections will provide preparation and design for pavement based on AASHTO design procedures.

7.7.1 Sub-grade Preparation

All topsoil, or any soil containing organic materials, must be removed from locations where structural loads will be applied. To evaluate its stability, the sub-grade shall be "proof rolled" with a loaded dump truck. Any unsuitable soils shall be removed and replaced with structural fill according to Section 7.2.4. Any areas of fill or disturbed areas shall be compacted to 95% of the ASTM D1557 modified proctor. A geotechnical engineer shall observe unsuitable sub-grade remediation.

Sub-grade below driveway areas shall be compacted to a minimum to 95% compaction of the maximum dry density using ASTM D1557 to minimize settlement.

7.7.2 Base Course

A minimum of eight (8) inches of untreated base course is required for all roadways. The base course shall comply with a ¾-inch mix per UDOT Standard Specifications, Section 02721, “Untreated Base Course.” Based on the AASHTO flexible pavement design the following pavement sections shall be used in pavement areas:

Table 7.7.1 Pavement Design Recommended Thickness

Pavement Materials	Recommended Minimum Thickness (inches)
Asphaltic Concrete	3
Granular Base Course	8

7.7.3 Surface Course

A minimum if three (3) inches of asphalt concrete pavement is required for all roadways. This asphalt concrete pavement is to comply with UDOT Standard Specifications, Section 02741, and “Hot Mix Asphalt (HMA).”

7.7.4 Drainage and Maintenance

Drainage shall be designed to ensure direct positive surface water away from proposed buildings and into proper discharge locations. Water shall not be allowed to puddle in low areas of the pavement. Pooling areas could decrease the design life of the asphalt and cause cracking or uplift. Periodic seasonal maintenance should be anticipated by sealing cracks and joints. A storm drainage plan has been prepared by Wilding Engineering and shall be adhered to for detention and conveyance of storm water. IBC 2003 recommends that a minimum of five percent gradient for a ten feet distance away from any structures.

8 LIMITATIONS AND PROFESSIONAL STATEMENT

This report has been prepared in accordance with generally accepted geologic and geotechnical engineering practices in the area for the use of the client for design purposes. The conclusions and recommendations included within the report are based on the information obtained from the test pits excavated at the locations indicated on the site plan, laboratory results, data obtained from the U.S.G.S. Library, and previous reports and studies. Variations in the subsurface conditions may not become evident until additional exploration or excavation is conducted. If the subsurface soil or ground water conditions are found to be significantly different than that which is described in this report, we should be notified so that we can re-evaluate recommendations.

We have correlated soil types and properties such as bearing pressure and equivalent fluid lateral pressure with U.S.G.S. surveys, the International Building Code, and surrounding investigations. Any assumptions made, based on these correlations, are conservative.

We appreciate the opportunity of providing this service for you. If you have any questions concerning this report or require additional information or services please contact us at 801-553-8112.

Report prepared by:

WILDING ENGINEERING, INC.

David P. Wilding, PE	**Jeremy G Wright, PEI**
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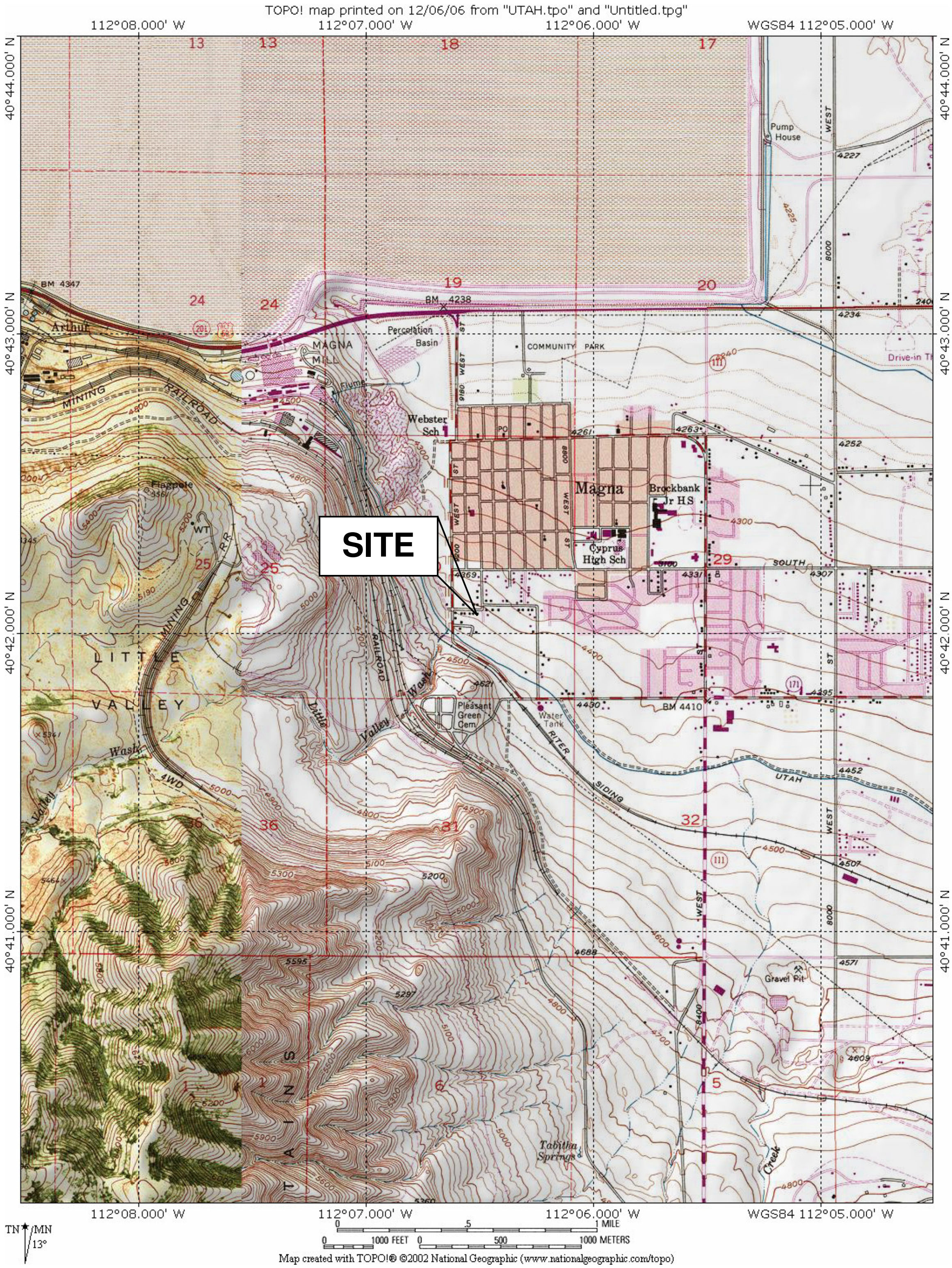
BSF/DPW

APPENDIX

VICINITY MAP



Project:

Fitzgerald Hopper Property
3287 South 9200 West
Magna, Utah

Project No: **06126**

Date: December 2006

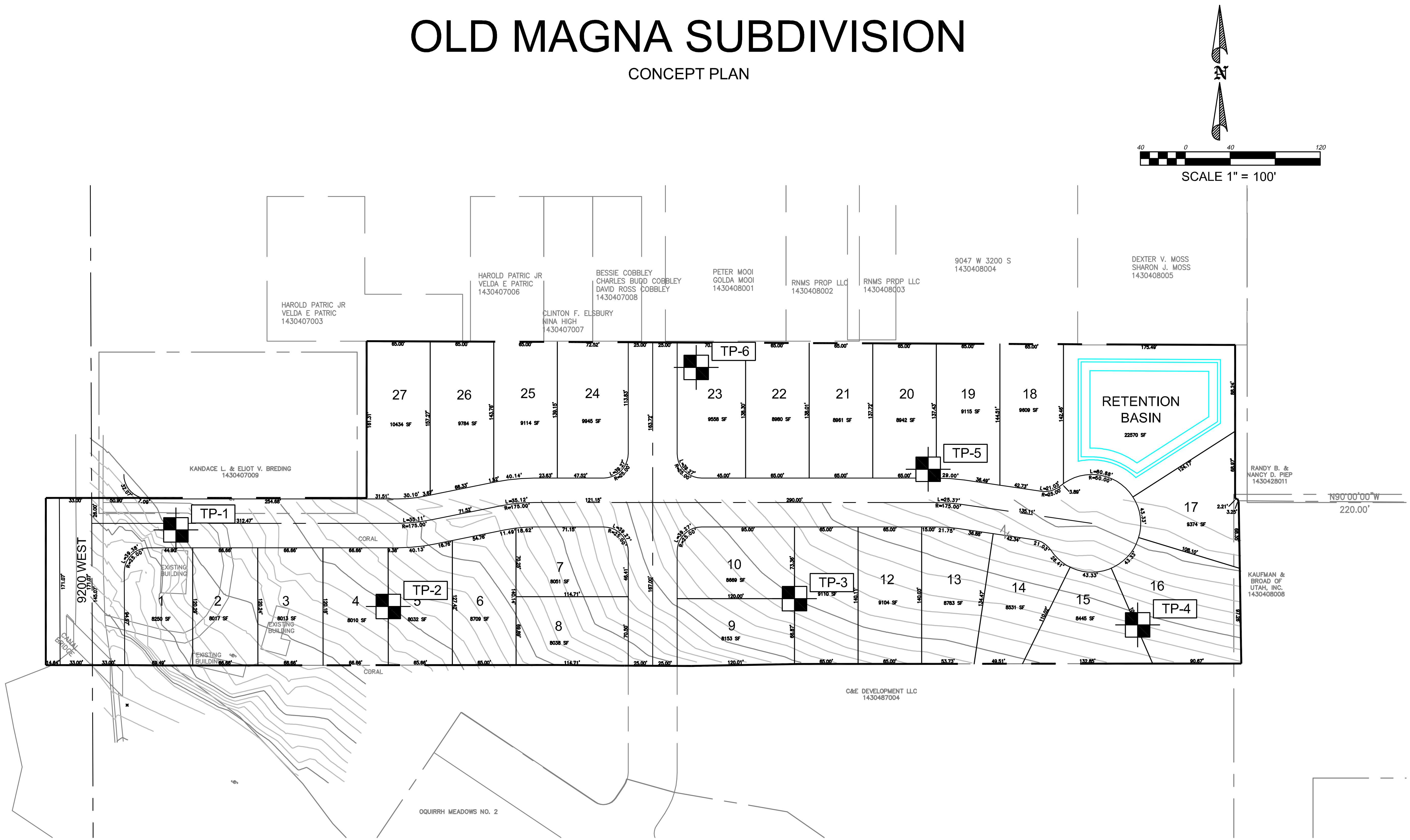
Drawn By: BSF

Figure: A-1

WILDING ENGINEERING, INC
14721 SOUTH HERITAGE CREST WAY
BLUFFDALE, UTAH 84065
(801)553-8112

OLD MAGNA SUBDIVISION

CONCEPT PLAN



Test Pit Locations

WILDING ENGINEERING, INC
14721 SOUTH HERITAGE CREST WAY
BLUFFDALE, UTAH 84065
(801)553-8112

NO.	REVISION	DATE

DRAWING TITLE: SITE PLAN AND TEST PIT LOCATIONS

LOCATION: 3287 SOUTH 9200 WEST

MAGNA, UTAH

PROJECT NAME: OLD MAGNA SUBDIVISION

DRAWN: JGW

CHECKED: DPW

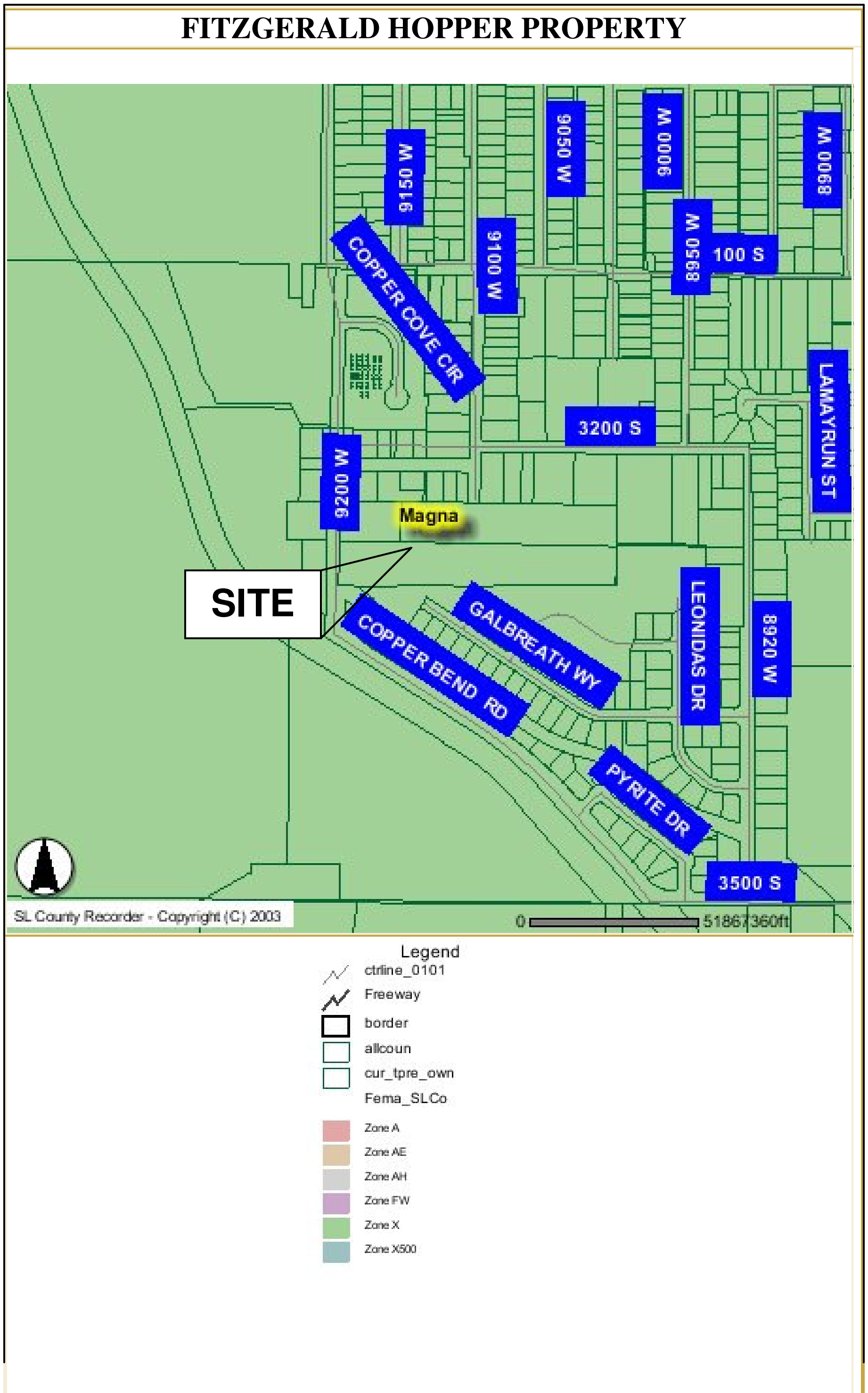
FILE NAME: G:\DATA\06126...\DWG\CONCEPT.DWG

DATE: 11/21/06

SCALE: 1" = 100'

SHEET: 1 OF 1

FEMA MAP



Project: **FITZGERALD HOPPER PROPERTY** **3287 S. 9200 W., Draper, UT** Project No: **06126**	Date: December 2006 Drawn By: BSF Figure: A-3	WILDING ENGINEERING, INC 14721 SOUTH HERITAGE CREST WAY BLUFFDALE, UTAH 84065 (801)553-8112

SITE PICTURES

Figure 1: Front of site viewing southeast

Figure 2: Test Pit 2 location viewing east through the site.

Figure 3: Test Pit 1 soil profile.

Figure 4: Test pit 3 soil profile.


Figure 5: Test pit 4 location backfilled viewing southeast.


Figure 6: Test Pit 5 soil profile.

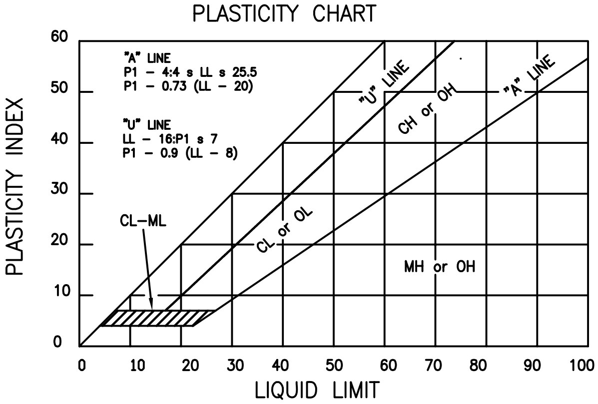
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified for engineering purposes by the Unified Soil Classification System. Grain–sized analyses and Atterberg Limits tests often are performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. Graphic symbols are used on boring logs presented on this report. For a more detailed description of the system, see "Standard Pratice for Description and Identification of Soils (Visual–Manual Procedure)" ASTM Designation:2488–84 and "Standard Test Method for Classification of Soils for Engineering Purposes" ASTM Designation: 2487–85.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE–GRAINED SOILS Less than 50% passes No. 200 sieve	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No, 200 sieve)			GW	WELL GRADED GRAVELS, GRAVEL–SAND MIXTURES, OR SAND –GRAVEL–COBBLE MIXTURES
					GP	POORLY GRADED GRAVELS, GRAVEL–SAND MIXTURES, OR SAND–GRAVEL–COBBLE MIXTURES
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Lines plot below "A" line & hatched zone on plasticity chart		GM	SILTY GRAVELS, GRAVEL–SAND–SILT MIXTURES
			Lines plot above "A" line & hatched zone on plasticity chart		GC	CLAYEY GRAVELS, GRAVEL–SAND–CLAY MIXTURES
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)			SW	WELL GRADED SANDS, GRAVELLY SANDS
					SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Lines plot below "A" line & hatched zone on plasticity chart		SM	SILTY SANDS, SAND–SILT MIXTURES
			Lines plot above "A" line & hatched zone on plasticity chart		SC	CLAYEY SANDS, SAND–CLAY MIXTURES
FINE–GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS Limited plot below "A" line & hatched zone on plasticity chart	SILTS OF LOW PLASTICITY (Liquid limit less than 50)			ML	INORGANIC SILTS, CLAYEY SILTS OF LOW TO MEDIUM PLASTICITY
		SILTS OF HIGH PLASTICITY (Liquid limit 50 or more)			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS, ELASTIC SILTS
	CLAYS Limited plot above "A" line & hatched zone on plasticity chart	CLAYS OF LOW PLASTICITY (Liquid limit less than 50)			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, AND SILTY CLAYS
		CLAYS OF HIGH PLASTICITY (Liquid limit 50 or more)			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS, SANDY CLAYS OF HIGH PLASTICITY
	ORGANIC SILTS AND CLAYS	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY (Liquid limit less than 50)			OL	ORGANIC SILTS AND CLAYS OF LOW TO MEDIUM PLASTICITY, SANDY ORGANIC SILTS AND CLAYS
		ORGANIC SILTS AND CLAYS OF HIGH PLASTICITY (Liquid limit 50 or more)			OH	ORGANIC SILTS AND CLAYS OF HIGH PLASTICITY, SANDY ORGANIC SILTS AND CLAYS
ORGANIC SOILS		PRIMARILY ORGANIC MATTER (dark in color and organic odor)			PT	PEAT

NOTE: Coarse–grained soils with between 5% and 12% passing thru No. 200 sieve and fine–grained soils with limit plotting in the hatched zone on the plasticity chart have dual classifications.

PLASTICITY CHART



DEFINITION OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 12 in.
Cobbles	12 in. to 3 in.
Gravel	3 in. to No. 4 sieve
Coarse Gravel	3 in. to 3/4 in.
Fine Gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200 sieve
Coarse sand	No. 4 to No. 10 sieve
Medium sand	No. 10 to No. 40 sieve
Fine sand	No. 40 to No. 200 sieve
Fines(silt and clay)	Less than No. 200 sieve

DATE 12/5/06

LOG OF TEST PIT NO. 1

PROJECT FITZGERALD HOPPER PROPERTY

PROJECT LOCATION 9200 WEST 3287 SOUTH

TEST PIT LOCATION ENTRANCE (LOT 1)

RIG TYPE TRACK MOUNTED EXCAVATOR

BORING TYPE OPEN PIT EXCAVATION

SURFACE ELEVATION 4440 ft (Estimated from SITE PLAN)

FIELD ENGINEER BSF

DEPTH IN FEET	GRAPHICAL LOG	SAMPLE NUMBER	SAMPLE TYPE	% FINER THAN #200 SIEVE	DRY DENSITY LBS PER CUBIC FOOT	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	VISUAL CLASSIFICATION	REMARKS
0								**TOPSOIL:** sandy silt with gravel, moist, dark brown with vegetation	
								SILTY GRAVEL: dry, cobbles, light brown tan.	Atterberg Limits @ 5-ft: Non Plastic Gradation@ 5-ft: Gravel = 72%, Sand = 12%, Fines = 16%
5		1	H	16		2.3		-- Considerable amount of cobble (rounded) with occasional 12" boulder.	
							GM		
10									
		2	H	3		2.6	GP	**POORLY GRADED GRAVEL WITH SAND:** dry, light brown tan.	Atterberg Limits @ 13-ft: Non Plastic Gradation@ 13-ft: Gravel = 78%, Sand = 19%, Fines = 3%
15								BOTTOM OF EXCAVATION @ 14-ft	-- Ground water was not encountered during excavation.
20									
25									

GROUND WATER ELEVATION

- DURING EXCAVATION
- AFTER EXCAVATION
- 24 HRS AFTER EXCAVATION

SAMPLE TYPE

A - AUGER CUTTINGS
S - 3" O.D. THIN WALLED SHELBY TUBE
U - 3" O.D. 2.42" I.D. TUBE SAMPLE
T - 3" O.D. DENSITY DRIVE SAMPLER TUBE
H - HAND SAMPLE

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DATE 12/5/06

LOG OF TEST PIT NO. 2

PROJECT FITZGERALD HOPPER PROPERTY

PROJECT LOCATION 9200 WEST 3287 SOUTH

TEST PIT LOCATION 75' N OF THE SE CORNER OF LOT 4(CONCEPT PLAN)
RIG TYPE TRACK MOUNTED EXCAVATOR
BORING TYPE OPEN PIT EXCAVATION
SURFACE ELEVATION 4435 ft (Estimated from SITE PLAN)
FIELD ENGINEER BSF

DEPTH IN FEET	GRAPHICAL LOG	SAMPLE NUMBER	SAMPLE TYPE	% FINER THAN #200 SIEVE	DRY DENSITY LBS PER CUBIC FOOT	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	VISUAL CLASSIFICATION	REMARKS
0								**TOPSOIL:** sandy silt with gravel, dark brown to brown, with roots and vegetation.	
5		3	H	6		4.2	SP	**POORLY GRADED SAND WITH GRAVEL:** dry, brown with occasional boulders.	Atterberg Limits @ 7-ft: Non Plastic Gradation@ 7-ft: Gravel = 70% Sand = 24% Fines = 6%
15		4	H	4		4.4	SP	**POORLY GRADED SAND:** dry, tan.	Atterberg Limits @ 16.5-ft: Non Plastic Gradation@ 16.5-ft: Gravel = 7% Sand = 89% Fines = 4%
20								BOTTOM OF EXCAVATION @ 17.5-ft	-- Ground water was not encountered during excavation.
25									

GROUND WATER ELEVATION
- DURING EXCAVATION
- AFTER EXCAVATION
- 24 HRS AFTER EXCAVATION

SAMPLE TYPE
- A - AUGER CUTTINGS
- S - 3" O.D. THIN WALLED SHELBY TUBE
- U - 3" O.D. 2.42" I.D. TUBE SAMPLE
- T - 3" O.D. DENSITY DRIVE SAMPLER TUBE
- H - HAND SAMPLE

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DATE 12/5/06

LOG OF TEST PIT NO. 3

PROJECT FITZGERALD HOPPER PROPERTY

PROJECT LOCATION 9200 WEST 3287 SOUTH

TEST PIT LOCATION INTERSECTION POINT OF LOTS 9, 10, AND 11

RIG TYPE TRACK MOUNTED EXCAVATOR

BORING TYPE OPEN PIT EXCAVATION

SURFACE ELEVATION 4414 ft (Estimated from SITE PLAN)

FIELD ENGINEER BSF

DEPTH IN FEET	GRAPHICAL LOG	SAMPLE NUMBER	SAMPLE TYPE	% FINER THAN #200 SIEVE	DRY DENSITY LBS PER CUBIC FOOT	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	VISUAL CLASSIFICATION	REMARKS
0								**TOPSOIL:** sandy silt with gravel, dark brown with roots and vegetation.	
							GP	**POORLY GRADED GRAVEL:** dry with cobbles.	--Calcite cemented layer, contractor had trouble excavating
5								**POORLY GRADED SAND:** dry, brown, stains of iron oxides.	Atterberg Limits @ 9-ft: Non Plastic Gradation@ 9-ft: Gravel = 8% Sand = 90% Fines = 2% Modified Proctor @ 9-ft: Maximum Dry Density = 128.8 pcf Optimum Moisture = 9.2%
							SP		
		5	H	2		3.4			
10									
								SILT: moist, light tan, with stains of iron oxides.	
15							ML		
		6	H	9		31			Atterberg Limits @ 16-ft: Non Plastic
								BOTTOM OF EXCAVATION @ 18.0-ft	-- Ground water was not encountered during excavation.
20									
25									

GROUND WATER ELEVATION

- DURING EXCAVATION
- AFTER EXCAVATION
- 24 HRS AFTER EXCAVATION

SAMPLE TYPE

- A - AUGER CUTTINGS
- S - 3" O.D. THIN WALLED SHELBY TUBE
- U - 3" O.D. 2.42" I.D. TUBE SAMPLE
- T - 3" O.D. DENSITY DRIVE SAMPLER TUBE
- H - HAND SAMPLE

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PROJECT FITZGERALD HOPPER PROPERTY

PROJECT LOCATION 9200 WEST 3287 SOUTH

LOG OF TEST PIT NO. 4

TEST PIT LOCATION 100' NW FROM SE CORNER OF LOT 16
RIG TYPE TRACK MOUNTED EXCAVATOR
BORING TYPE OPEN PIT EXCAVATION
SURFACE ELEVATION 4409 ft (Estimated from SITE PLAN)
FIELD ENGINEER BSF

DEPTH IN FEET	GRAPHICAL LOG	SAMPLE NUMBER	SAMPLE TYPE	% FINER THAN #200 SIEVE	DRY DENSITY LBS PER CUBIC FOOT	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	VISUAL CLASSIFICATION	REMARKS
0 – 3								**TOPSOIL:** sandy silt with gravel, dark to medium brown with roots and vegetation.	
3 – 4							GP	**POORLY GRADED GRAVEL:** dry.	-- Calcite cemented layer, 1 1/2" maximum. nominal size
4 – 12							CL-ML	**SILTY CLAY WITH SAND:** moist, tan, traces of iron oxides.	Atterberg Limits @ 7-ft: Liquid limit = 28% Plastic limit = 21% Plastic Index = 7%
7		7	H	77		25.1			Gradation@ 7-ft: Gravel = 0% Sand = 23% Fines = 77%
12 – 17							SM	**SILTY SAND WITH GRAVEL:** dry with cobbles and boulders.	Atterberg Limits @ 16-ft: Non Plastic
16		8	H	27		10.9			Gradation@ 16-ft: Gravel = 31% Sand = 42% Fines = 27%
17								BOTTOM OF EXCAVATION @ 17.0-ft	-- Ground water was not encountered during excavation.

GROUND WATER ELEVATION

- DURING EXCAVATION
- AFTER EXCAVATION
- 24 HRS AFTER EXCAVATION

SAMPLE TYPE

A - AUGER CUTTINGS
S - 3" O.D. THIN WALLED SHELBY TUBE
U - 3" O.D. 2.42" I.D. TUBE SAMPLE
T - 3" O.D. DENSITY DRIVE SAMPLER TUBE
H - HAND SAMPLE

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DATE 12/5/06

PROJECT FITZGERALD HOPPER PROPERTY

PROJECT LOCATION 9200 WEST 3287 SOUTH

LOG OF TEST PIT NO. 5

TEST PIT LOCATION SE CORNER OF LOT 20
RIG TYPE TRACK MOUNTED EXCAVATOR
BORING TYPE OPEN PIT EXCAVATION
SURFACE ELEVATION 4405 ft (Estimated from SITE PLAN)
FIELD ENGINEER BSF

DEPTH IN FEET	GRAPHICAL LOG	SAMPLE NUMBER	SAMPLE TYPE	% FINER THAN #200 SIEVE	DRY DENSITY LBS PER CUBIC FOOT	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	VISUAL CLASSIFICATION	REMARKS
0								**TOPSOIL:** sandy silt with gravel, dark brown with roots and vegetation.	
5							GP-GM	**POORLY GRADED GRAVEL WITH SILT:** dry, light brown. -- occasional cobbles.	1/2" max. nominal size, rounded
10		9	H	72		33.5	ML	**SILT WITH SAND:** dry, tan with stains of iron oxides.	Atterberg Limits @ 8-ft: Non Plastic Atterberg Limits @ 13.5-ft: Non Plastic Gradation@ 13.5-ft: Gravel = 37% Sand = 36% Fines = 26%
		10	H	26		15.7	GM	**SILTY GRAVEL WITH SAND:** moist, tan with stains of iron oxides present.	
15		11	H	88		35.5	ML	**SILT:** moist, tan and stains of iron oxides.	
							GP-GM	**POORLY GRADED GRAVEL WITH SILT AND SAND:** dry with cobbles and boulders.	Atterberg Limits @ 14.5-ft: Non Plastic
20								BOTTOM OF EXCAVATION @ 17.0-ft	-- Ground water was not encountered during excavation.
25									

GROUND WATER ELEVATION
- DURING EXCAVATION
- AFTER EXCAVATION
- 24 HRS AFTER EXCAVATION

SAMPLE TYPE
- A - AUGER CUTTINGS
- S - 3" O.D. THIN WALLED SHELBY TUBE
- U - 3" O.D. 2.42" I.D. TUBE SAMPLE
- T - 3" O.D. DENSITY DRIVE SAMPLER TUBE
- H - HAND SAMPLE

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DATE 12/5/06

LOG OF TEST PIT NO. 6

PROJECT FITZGERALD HOPPER PROPERTY

PROJECT LOCATION 9200 WEST 3287 SOUTH

TEST PIT LOCATION NW CORNER OF LOT 23, 10' S OF N FENCE LINE
RIG TYPE TRACK MOUNTED EXCAVATOR
BORING TYPE OPEN PIT EXCAVATION
SURFACE ELEVATION 4410 ft (Estimated from SITE PLAN)
FIELD ENGINEER BSF

DEPTH IN FEET	GRAPHICAL LOG	SAMPLE NUMBER	SAMPLE TYPE	% FINER THAN #200 SIEVE	DRY DENSITY LBS PER CUBIC FOOT	MOISTURE CONTENT PERCENT OF DRY WEIGHT	UNIFIED SOIL CLASSIFICATION	VISUAL CLASSIFICATION	REMARKS
0								**TOPSOIL:** sandy silt with gravel, medium brown with roots and vegetation.	
5		12	H	9		4.8	GP-GM	**POORLY GRADED GRAVEL WITH SILT AND SAND:** dry, light brown, 1/2" maximum nominal size. -- occasional cobbles increase with depth.	Atterberg Limits @ 4.5-ft: Non Plastic Gradation@ 4.5-ft: Gravel = 51% Sand = 43% Fines = 6% Modified Proctor @ 4.5-ft: Maximum Dry Density = 134.4 pcf Optimum Moisture = 6.8%
10									
15							GM	**POORLY GRADED GRAVEL WITH SILT:** dry, reddish brown with cobbles and boulders.	
		13	H	81		22.8	CL-ML	**SILTY CLAY WITH SAND:** moist, white tan with stains of iron oxides.	Atterberg Limits @ 17-ft: Liquid limit = 27% Plastic limit = 21% Plastic index = 6%
20								BOTTOM OF EXCAVATION @ 19.0-ft	-- Ground water was not encountered during excavation.
25									

GROUND WATER ELEVATION
- DURING EXCAVATION
- AFTER EXCAVATION
- 24 HRS AFTER EXCAVATION

SAMPLE TYPE
- A - AUGER CUTTINGS
- S - 3" O.D. THIN WALLED SHELBY TUBE
- U - 3" O.D. 2.42" I.D. TUBE SAMPLE
- T - 3" O.D. DENSITY DRIVE SAMPLER TUBE
- H - HAND SAMPLE

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SUMMARY OF LAB TEST RESULTS

Test Pit	Depth	Natural		Modified (ASTM D1557)		Atterberg Limits (ASTM D4318)			Sieve Analysis (ASTM C136)			Consolidated Drained Direct Shear Test (ASTM D5321)		USCS CLASSIFICATION Symbol and Group Name
		Moisture	Dry Density	Optimum Moisture	Maximum Dry Density	Liquid Limit	Plastic Limit	Plastic Index	Gravel > No. 4 Sieve	Sand < No. 4 and > No. 200 Sieve	Fines Passing No. 200 Sieve	Phi Angle ø'	Cohesion *C′*	
	(ft)	%	lbs/ft^3	%	lbs/ft^3	%	%	%	%	%	%	(deg)	(psf)	
1	5	2.3				NP	NP	NP	72	12	16			GM, Silty Gravel
1	13	2.6							78	19	3			GP, Poorly Graded Gravel with Sand
2	7	4.2							70	24	6			GP-GM, Poorly Graded Gravel with Silt and Sand
2	16.5	4.4							7	89	4			SP, Poorly Graded Sand
3	9	3.4		9.2	128.8				8	90	2			SP, Poorly Graded Sand
3	16	31				NP	NP	NP			89			ML, Silt
4	7	25.1				28	21	7			77			CL-ML, Silty Clay with Sand
4	16	10.9				NP	NP	NP	31	42	27			SM, Silty Sand with Gravel
5	8	33.5				NP	NP	NP			72			ML, Silt with Sand
5	13.5	15.7							37	36	26			GM, Silty Gravel with Sand
5	14.5	35.5				NP	NP	NP			88			ML, Silt
6	4.5	3.5		7.5	132				51	43	6			GP-GM, Poorly Graded Gravel with Silt and Sand
6	17	22.8				27	21	6			81			CL-ML, Silty Clay with Sand

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GRAIN SIZE ANALYSIS-- MECHANICAL

Project:	Fitzgerald Hopper Property	Sample No:	TP-1
Location of Project:	3287 South 9400 West, Magna Utah	Depth of Sample:	5-feet
Location of Sample:	Entrance to proposed subdivision	Date of Testing:	November 28, 2006
Description of Soil:	Silty Gravel, light brown		

Tested by: A. Caus

Soil Sample Size (ASTM D 1140-54)

Wt of wet sample	965.50
Wt of dry sample	943.80

Percent Content

Gravel:	72	
Sand:	12	
Fines:	16	
	100	Total

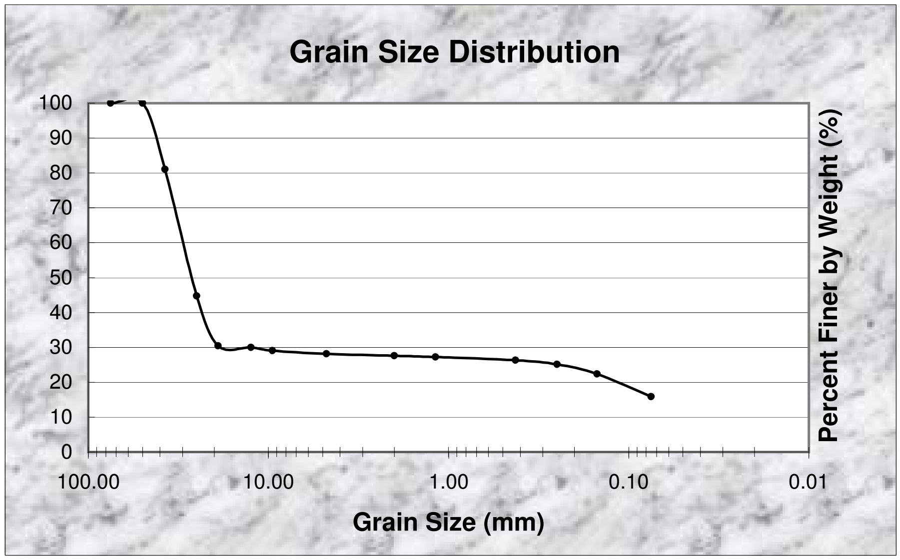

Table - U.S. Standard Sieve Analysis

Sieve No.	Diam. (mm)	Wt retained	% retained	% passing
3.00	75.00	0.0	0.0	100.00
2.00	50.00	0.0	0.0	100.00
1.50	37.50	178.9	19.0	81.04
1.00	25.00	521.6	55.3	44.73
0.75	19.000	656.3	69.5	30.46
0.50	12.500	661.0	70.0	29.96
0.38	9.500	669.5	70.9	29.06
4	4.750	678.4	71.9	28.12
10	2.000	683.4	72.4	27.59
16	1.180	687.1	72.8	27.20
40	0.425	695.5	73.7	26.31
60	0.250	706.6	74.9	25.13
100	0.150	732.4	77.6	22.40
200	0.075	794.0	84.1	15.87

NOTE: % passing = 100 - % retained

USCS Classification: **GM, Silty Gravel**

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GRAIN SIZE ANALYSIS-- MECHANICAL

Project: Fitzgerald Hopper Property

Sample No: TP-1

Location of Project: 3287 South 9400 West, Magna Utah

Depth of Sample: 13-feet

Location of Sample: Entrance to proposed subdivision

Date of Testing: November 28, 2006

Description of Soil: Poorly Graded Gravel with Sand, tan to light brown

Tested by: A. Caus

Soil Sample Size (ASTM D 1140-54)

Wt of wet sample	1038.10
Wt of dry sample	1011.80

Percent Content

Gravel:	78	
Sand:	19	
Fines:	3	
	100	Total

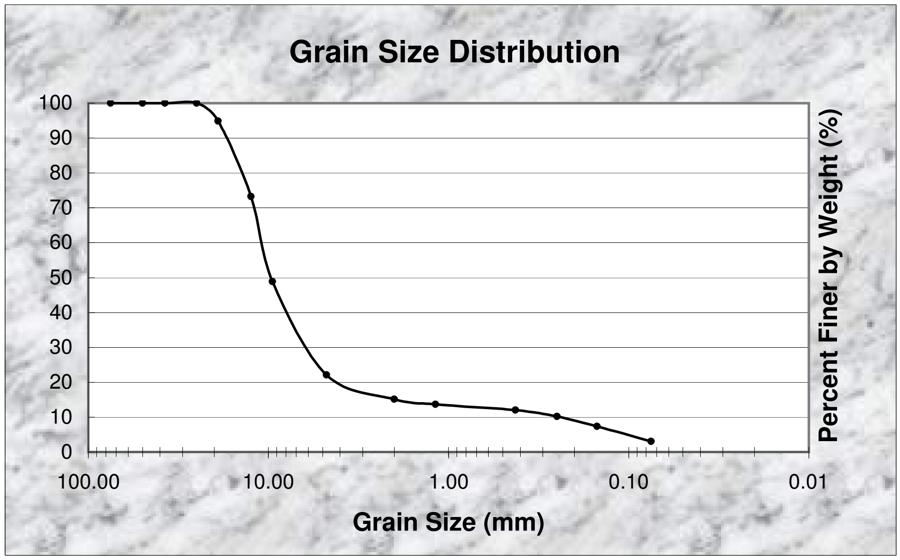

Table - U.S. Standard Sieve Analysis

Sieve No.	Diam. (mm)	Wt retained	% retained	% passing
3.00	75.00	0.0	0.0	100.00
2.00	50.00	0.0	0.0	100.00
1.50	37.50	0.0	0.0	100.00
1.00	25.00	0.0	0.0	100.00
0.75	19.000	51.7	5.1	94.89
0.50	12.500	271.2	26.8	73.20
0.38	9.500	517.5	51.1	48.85
4	4.750	788.1	77.9	22.11
10	2.000	859.0	84.9	15.10
16	1.180	873.9	86.4	13.63
40	0.425	890.5	88.0	11.99
60	0.250	908.4	89.8	10.22
100	0.150	937.5	92.7	7.34
200	0.075	981.2	97.0	3.02

NOTE: % passing = 100 - % retained

USCS Classification: **GP, Poorly Graded Gravel with Sand**

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GRAIN SIZE ANALYSIS-- MECHANICAL

Project:	Fitzgerald Hopper Property	Sample No:	TP-2
Location of Project:	3287 South 9400 West, Magna Utah	Depth of Sample:	7-feet
Location of Sample:	Between Lots 4 and 5	Date of Testing:	November 28, 2006
Description of Soil:	Poorly Graded Gravel with Silt and Sand, tan to light brown		

Tested by: A. Caus

Soil Sample Size (ASTM D 1140-54)

Wt of wet sample	1054.20
Wt of dry sample	1011.70

Percent Content

Gravel:	70
Sand:	24
Fines:	6
	100 Total

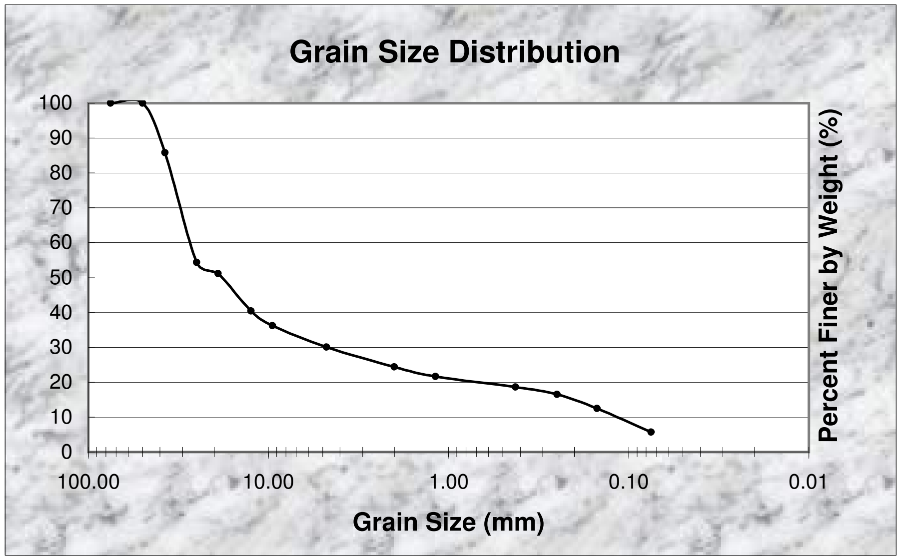

Table - U.S. Standard Sieve Analysis

Sieve No.	Diam. (mm)	Wt retained	% retained	% passing
3.00	75.00	0.0	0.0	100.00
2.00	50.00	0.0	0.0	100.00
1.50	37.50	143.8	14.2	85.79
1.00	25.00	462.0	45.7	54.33
0.75	19.000	493.8	48.8	51.19
0.50	12.500	602.6	59.6	40.44
0.38	9.500	645.8	63.8	36.17
4	4.750	707.8	70.0	30.04
10	2.000	764.7	75.6	24.41
16	1.180	792.9	78.4	21.63
40	0.425	823.5	81.4	18.60
60	0.250	845.2	83.5	16.46
100	0.150	885.6	87.5	12.46
200	0.075	954.1	94.3	5.69

NOTE: % passing = 100 - % retained

USCS Classification: **GP, Poorly Graded Gravel with Silt and Sand**

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GRAIN SIZE ANALYSIS-- MECHANICAL

Project: Fitzgerald Hopper Property

Sample No: TP-2

Location of Project: 3287 South 9400 West, Magna Utah

Depth of Sample: 16.5-feet

Location of Sample: Between Lots 4 and 5

Date of Testing: November 28, 2006

Description of Soil: Poorly Graded Sand, tan

Tested by: A. Caus

Soil Sample Size (ASTM D 1140-54)

Wt of wet sample	808.50
Wt of dry sample	774.40

Percent Content

Gravel: 7

Sand: 89

Fines: 4

100 Total

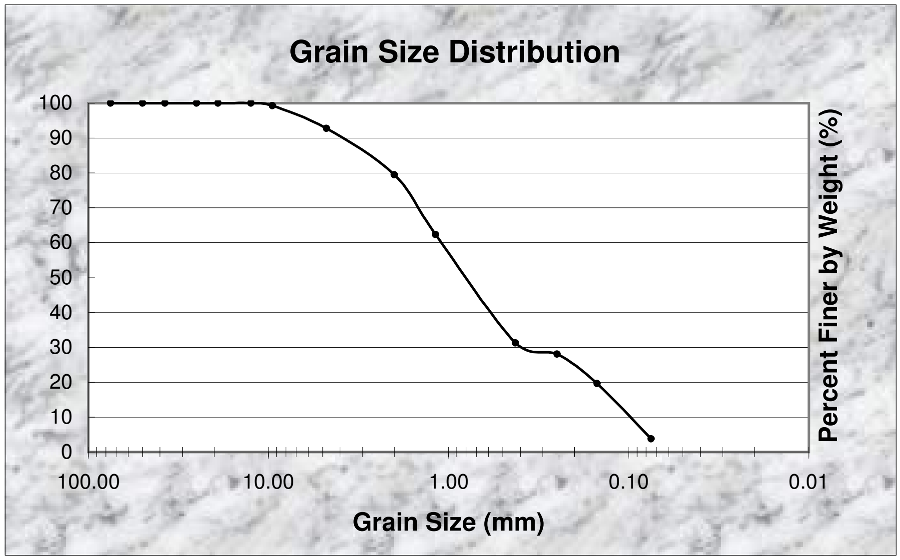

Table - U.S. Standard Sieve Analysis

Sieve No.	Diam. (mm)	Wt retained	% retained	% passing
3.00	75.00	0.0	0.0	100.00
2.00	50.00	0.0	0.0	100.00
1.50	37.50	0.0	0.0	100.00
1.00	25.00	0.0	0.0	100.00
0.75	19.000	0.0	0.0	100.00
0.50	12.500	0.0	0.0	100.00
0.38	9.500	5.7	0.7	99.26
4	4.750	55.8	7.2	92.79
10	2.000	158.9	20.5	79.48
16	1.180	291.6	37.7	62.35
40	0.425	532.3	68.7	31.26
60	0.250	557.0	71.9	28.07
100	0.150	622.8	80.4	19.58
200	0.075	745.3	96.2	3.76

NOTE: % passing = 100 - % retained

USCS Classification: **SP, Poorly Graded Sand**

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GRAIN SIZE ANALYSIS-- MECHANICAL

Project:	Fitzgerald Hopper Property	Sample No:	TP-3
Location of Project:	3287 South 9400 West, Magna Utah	Depth of Sample:	9-feet
Location of Sample:	Between Lots 10 and 11	Date of Testing:	November 28, 2006
Description of Soil:	Poorly Graded Sand, brown with stains of iron oxides		

Tested by: A. Caus

Soil Sample Size (ASTM D 1140-54)

Wt of wet sample	901.30
Wt of dry sample	871.60

Percent Content

Gravel:	8
Sand:	90
Fines:	2
	100 Total

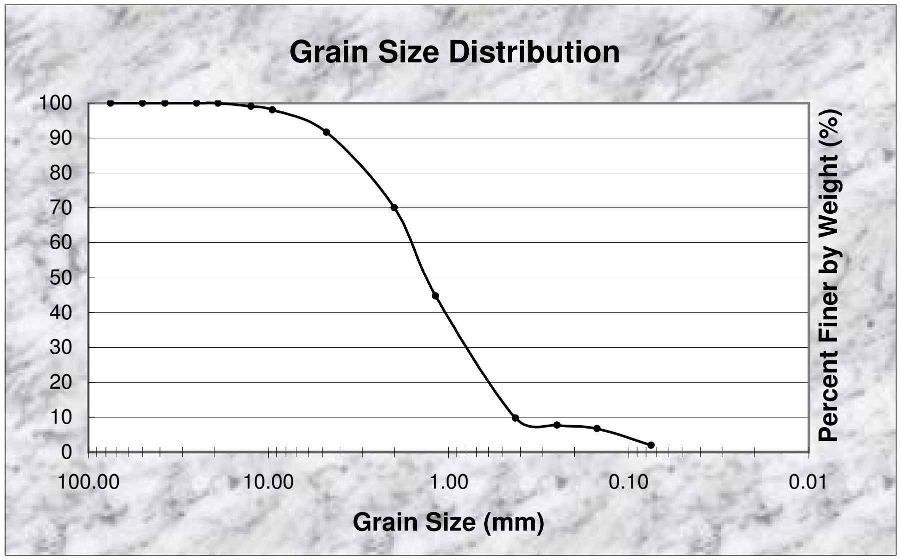

Table - U.S. Standard Sieve Analysis

Sieve No.	Diam. (mm)	Wt retained	% retained	% passing
3.00	75.00	0.0	0.0	100.00
2.00	50.00	0.0	0.0	100.00
1.50	37.50	0.0	0.0	100.00
1.00	25.00	0.0	0.0	100.00
0.75	19.000	0.0	0.0	100.00
0.50	12.500	7.8	0.9	99.11
0.38	9.500	16.4	1.9	98.12
4	4.750	72.9	8.4	91.64
10	2.000	261.5	30.0	70.00
16	1.180	481.6	55.3	44.75
40	0.425	787.2	90.3	9.68
60	0.250	804.1	92.3	7.74
100	0.150	813.5	93.3	6.67
200	0.075	854.5	98.0	1.96

NOTE: % passing = 100 - % retained

USCS Classification: **<u>SP, Poorly Graded Sand</u>**

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GRAIN SIZE ANALYSIS-- MECHANICAL

Project: Fitzgerald Hopper Property

Sample No: TP-4

Location of Project: 3287 South 9400 West, Magna Utah

Depth of Sample: 16-feet

Location of Sample: Between Lots 15 and 16

Date of Testing: November 28, 2006

Description of Soil: Silty Sand with Gravel, brown

Tested by: A. Caus

Soil Sample Size (ASTM D 1140-54)

Wt of wet sample	797.40
Wt of dry sample	719.02

Percent Content

Gravel:	31	
Sand:	42	
Fines:	27	
	100	Total

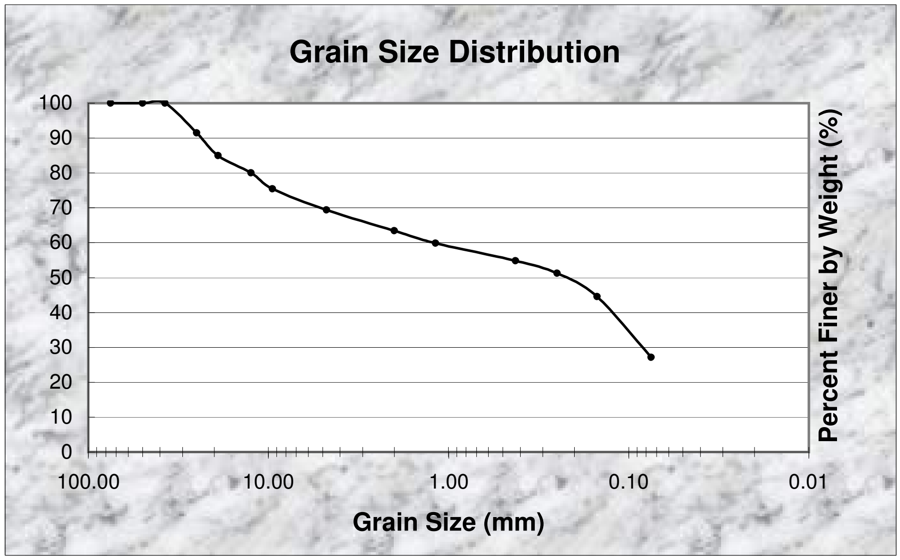

Table - U.S. Standard Sieve Analysis

Sieve No.	Diam. (mm)	Wt retained	% retained	% passing
3.00	75.00	0.0	0.0	100.00
2.00	50.00	0.0	0.0	100.00
1.50	37.50	0.0	0.0	100.00
1.00	25.00	61.0	8.5	91.52
0.75	19.000	108.4	15.1	84.92
0.50	12.500	144.0	20.0	79.97
0.38	9.500	176.8	24.6	75.41
4	4.750	220.2	30.6	69.37
10	2.000	263.2	36.6	63.39
16	1.180	288.5	40.1	59.88
40	0.425	324.7	45.2	54.84
60	0.250	350.4	48.7	51.27
100	0.150	398.6	55.4	44.56
200	0.075	523.9	72.9	27.14

NOTE: % passing = 100 - % retained

USCS Classification: SM, Silty Sand with Gravel

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GRAIN SIZE ANALYSIS-- MECHANICAL

Project: Fitzgerald Hopper Property

Sample No: TP-5

Location of Project: 3287 South 9400 West, Magna Utah

Depth of Sample: 13.5-feet

Location of Sample: Between Lots 19 and 20

Date of Testing: November 28, 2006

Description of Soil: Silty Gravel with Sand, tan

Tested by: A. Caus

Soil Sample Size (ASTM D 1140-54)

Wt of wet sample	945.10
Wt of dry sample	816.85

Percent Content

Gravel:	37
Sand:	36
Fines:	26
	100 Total

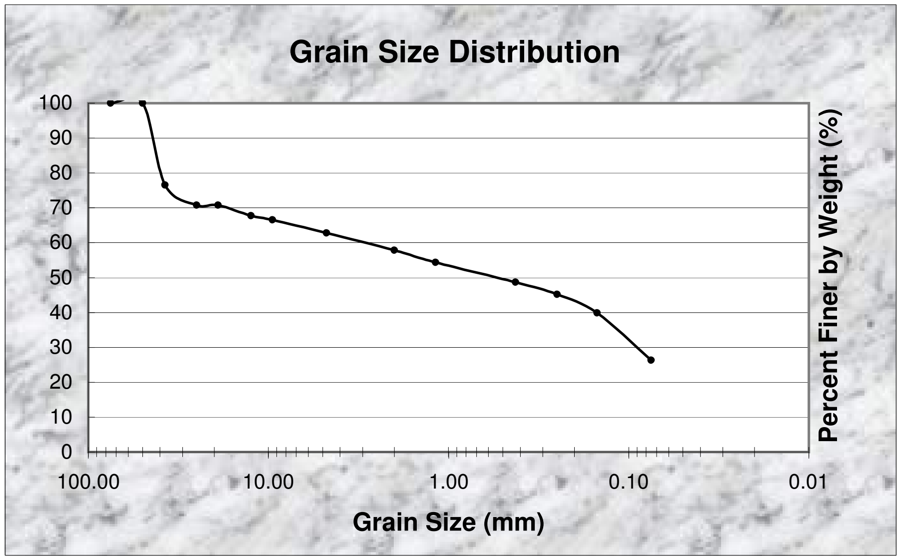

Table - U.S. Standard Sieve Analysis

Sieve No.	Diam. (mm)	Wt retained	% retained	% passing
3.00	75.00	0.0	0.0	100.00
2.00	50.00	0.0	0.0	100.00
1.50	37.50	191.7	23.5	76.53
1.00	25.00	238.9	29.2	70.75
0.75	19.000	238.9	29.2	70.75
0.50	12.500	263.4	32.2	67.75
0.38	9.500	273.5	33.5	66.52
4	4.750	304.3	37.3	62.75
10	2.000	344.6	42.2	57.81
16	1.180	372.9	45.7	54.35
40	0.425	419.6	51.4	48.63
60	0.250	447.4	54.8	45.23
100	0.150	491.3	60.1	39.85
200	0.075	602.1	73.7	26.29

NOTE: % passing = 100 - % retained

USCS Classification: **GM, Silty Gravel with Sand**

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GRAIN SIZE ANALYSIS-- MECHANICAL

Project: Fitzgerald Hopper Property

Sample No: TP-6

Location of Project: 3287 South 9400 West, Magna Utah

Depth of Sample: 4.5-feet

Location of Sample: Lot 23, North and center of subdivision

Date of Testing: November 28, 2006

Description of Soil: Poorly Graded Gravel with Silt and Sand, reddish brown

Tested by: A. Caus

Soil Sample Size (ASTM D 1140-54)

Wt of wet sample	1061.50
Wt of dry sample	1025.60

Percent Content

Gravel:	51
Sand:	43
Fines:	6
	100 Total

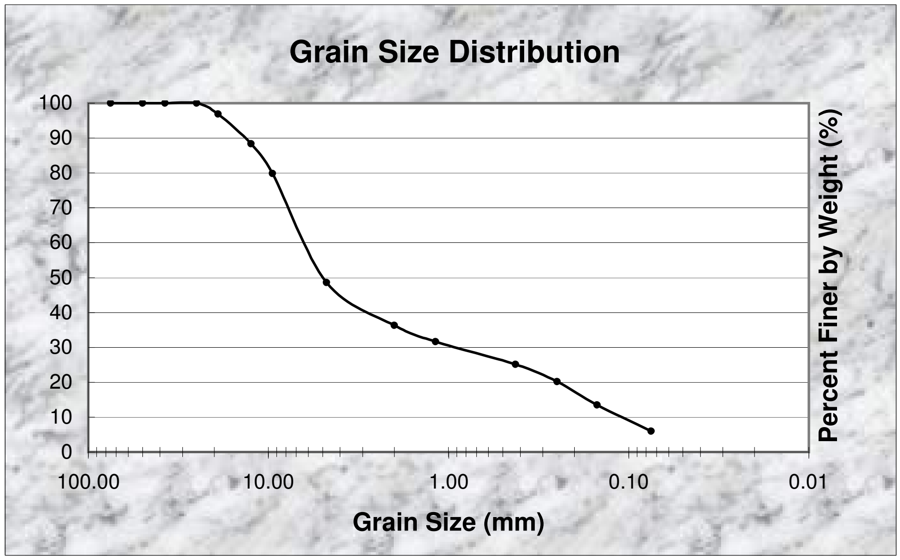

Table - U.S. Standard Sieve Analysis

Sieve No.	Diam. (mm)	Wt retained	% retained	% passing
3.00	75.00	0.0	0.0	100.00
2.00	50.00	0.0	0.0	100.00
1.50	37.50	0.0	0.0	100.00
1.00	25.00	0.0	0.0	100.00
0.75	19.000	32.0	3.1	96.88
0.50	12.500	119.2	11.6	88.38
0.38	9.500	206.6	20.1	79.86
4	4.750	527.6	51.4	48.56
10	2.000	653.7	63.7	36.26
16	1.180	701.0	68.4	31.65
40	0.425	768.0	74.9	25.12
60	0.250	819.1	79.9	20.13
100	0.150	887.7	86.6	13.45
200	0.075	964.2	94.0	5.99

NOTE: % passing = 100 - % retained

USCS Classification: **GP-GM, Poorly Graded Gravel with Silt and Sand**

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SAMPLE ANALYSIS RESULTS

TESTED FOR: Upstart Housing **PROJECT NO.:** 06126

DATE: November 28, 2006 **PROJECT:** Fitzgerald Hopper Property
LAB NO:. L6058-3

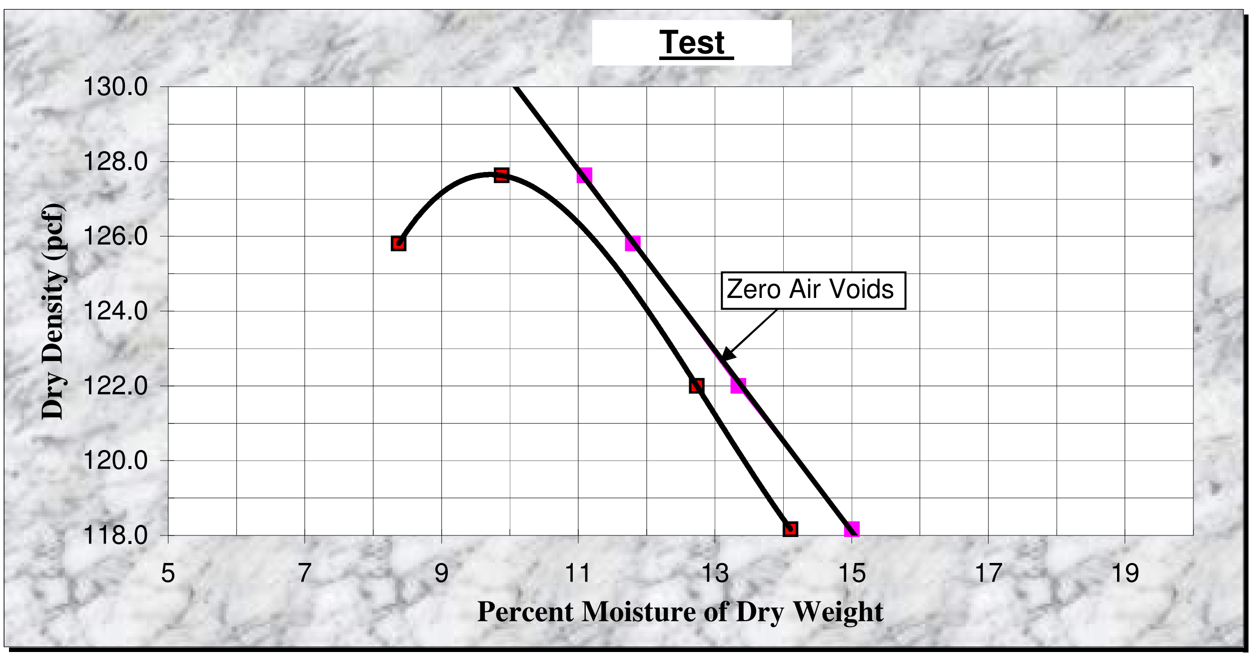
Visual Classification:	Poorly Graded Sand, brown
Sample Location:	Test Pit 3 @ 9 - feet
Method of Compaction:	ASTM D 1557 Method B
Rammer:	Manual

Test Results	Rock Correction	No Rock Correction
Maximum Dry Density:	128.8 pcf	127.7 pcf
Optimum Moisture Conter	9.2 %	9.5 %

Other Tests

Atterberg Limits (ASTM D4318-98)
LL: NP PL: NP PI: NP
Specific Gravity: 2.65 (estimate)

Gradation (ASTM 422-63)
Gravel: 8
Sand: 90
Fines: 2



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SAMPLE ANALYSIS RESULTS

TESTED FOR: Upstart Housing **PROJECT NO.:** 06126

DATE: November 28, 2006 **PROJECT:** Old Magna Subdivision
LAB NO:. L6058-1

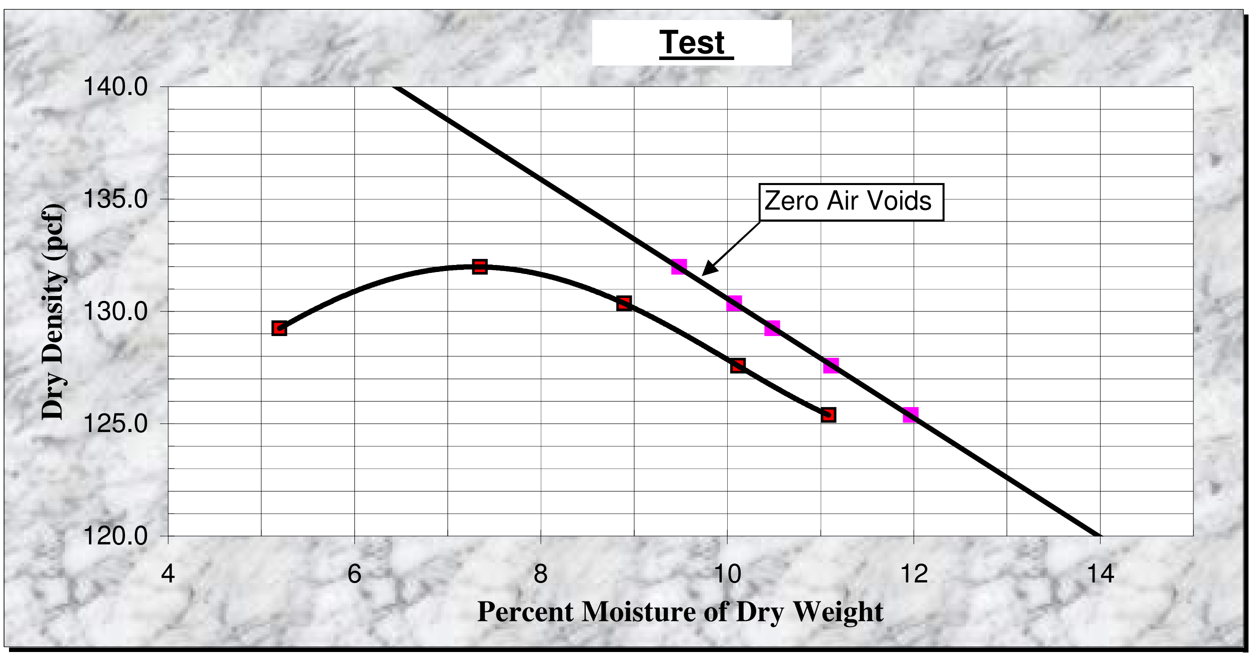
Visual Classification: Poorly Graded Gravel with Silt and Sand
Sample Location: Test Pit 6 @ 4.5-feet
Method of Compaction: ASTM D 1557 Method C
Rammer: Manual

Test Results	Rock Correction	No Rock Correction
Maximum Dry Density:	134.4 pcf	132 pcf
Optimum Moisture Conter	6.8 %	7.3 %

Other Tests

Atterberg Limits (ASTM D4318-98)
LL: NP PL: NP PI: NP
Specific Gravity: 2.65 (estimate)

Gradation (ASTM 422-63)
Gravel: 51
Sand: 43
Fines: 6



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