Geotechnical Report

APN 621-231-010 & 011

Twentynine Palms, California

Prepared for:

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August 2005

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August 12, 2005

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Geotechnical Investigation
Proposed Single-Family Residential Development
(APN 621-231-010 & 011)
Twentynine Palms, California
LCI Report No. LP05191

Dear Mr. Enochs:

This geotechnical report is provided for design and construction of the proposed single family residential development located on the northeast corner of Two Mile Road and Desert Knoll Avenue in Twentynine Palms, California. Our geotechnical investigation was conducted in response to your request for our services. The enclosed report describes our soil engineering investigation and presents our professional opinions regarding geotechnical conditions at the site to be considered in the design and construction of the project.

The findings of this study indicate the site is underlain by gravelly silty sands and sands. Groundwater was not encountered in the trenches during the time field exploration.

Elevated sulfate and chloride levels were not encountered in the soil samples tested for this study. However, the soil is moderately corrosive to metal. We recommend a minimum of 2,500 psi concrete Type II Portland Cement with a maximum water/cement ratio of 0.60 (by weight) should be used for concrete placed in contact with native soils of this project.

We did not encounter soil conditions that would preclude implementation of the proposed project provided the recommendations contained in this report are implemented in the design and construction of this project. Our findings, recommendations, and application options are related ***only through reading the full report***, and are best evaluated with the active participation of the engineer of record who developed them.

We appreciate the opportunity to provide our findings and professional opinions regarding geotechnical conditions at the site. If you have any questions or comments regarding our findings, please call our office at (760) 360-0665.

Respectfully Submitted,
Landmark Consultants, Inc.

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Section 1
INTRODUCTION

1.1 Project Description

This report presents the findings of our geotechnical investigation for the proposed single family residential development located on the northeast corner of Two Mile Road and Desert Knoll Avenue in Twentynine Palms, California (See Vicinity Map, Plate A-1). The proposed development will consist of several one to two story single family residential homes on approximately 64-acres. A site plan for the proposed development was not made available to us at the time that this report was prepared.

The structures are planned to consist of wood frame construction with shallow reinforced concrete foundations and slab-on grade concrete floors. Footing loads at exterior bearing walls are estimated at 1 to 3 kips per lineal foot. Column loads are estimated to range from 10 to 25 kips. If structural loads exceed those stated above, we should be notified so we may evaluate their impact on foundation settlement and bearing capacity. Site development will include building pad preparation, underground utility installation, street and parking lot construction, and concrete driveway and sidewalk placement.

1.2 Purpose and Scope of Work

The purpose of this geotechnical study was to investigate the upper 15 feet of subsurface soil at selected locations within the site for evaluation of physical/engineering properties. From the subsequent field and laboratory data, professional opinions were developed and are provided in this report regarding geotechnical conditions at this site and the effect on design and construction. The scope of our services consisted of the following:

- Field exploration and in-situ testing of the site soils at selected locations and depths.
- Laboratory testing for physical and/or chemical properties of selected samples.
- Review of the available literature and publications pertaining to local geology, faulting, and seismicity.
- Engineering analysis and evaluation of the data collected.

- Preparation of this report presenting our findings, professional opinions, and recommendations for the geotechnical aspects of project design and construction.
- In-situ testing of soil percolation for sanitary sewer leach fields.

This report addresses the following geotechnical issues:

- Subsurface soil and groundwater conditions
- Site geology, regional faulting and seismicity, near source factors, and site seismic accelerations
- Aggressive soil conditions to metals and concrete
- Soil percolation rates of the native soil for sewage disposal leach field

Professional opinions with regard to the above issues are presented for the following:

- Site grading and earthwork
- Building pad and foundation subgrade preparation
- Allowable soil bearing pressures and expected settlements
- Concrete slabs-on-grade
- Lateral earth pressures
- Excavation conditions and buried utility installations
- Mitigation of the potential effects of salt concentrations in native soil to concrete mixes and steel reinforcement
- Seismic design parameters
- Preliminary pavement structural sections

Our scope of work for this report did not include an evaluation of the site for the presence of environmentally hazardous materials or conditions.

1.3 Authorization

Mr. Steven Enochs of Sunwest Development provided authorization by written agreement to proceed with our work on July 8, 2005. We conducted our work according to our written proposal dated June 28, 2005.

Section 2
METHODS OF INVESTIGATION

2.1 Field Exploration

Subsurface exploration was performed on July 15, 2005 by using a backhoe to excavate eight (8) test pits to an approximate depth of 7.5 to 15 feet below the existing ground surface. The test pit locations are shown on the Site and Exploration Plan (Plate A-2). Bulk samples were obtained at selected depths in the test pits. The test pits were located by taped or paced measurements and should be considered approximate.

A staff geologist maintained logs of the test pits during exploration. The logs were edited in final form after a review of retrieved samples and the field and laboratory data. The test pit logs are presented on Plates B-1 through B-8 in Appendix B. Soils encountered have been classified according to the Unified Soil Classification System. A key to the test pit logs is presented on Plate B-9. The stratification lines shown on the subsurface logs represent the approximate boundaries between the various strata. However, the transition from one stratum to another may be gradual over some range of depth.

After logging and sampling the soil, the exploratory test pits were backfilled with the excavated material. The backfill was loosely placed and was not compacted to the requirements specified for engineered fill. The backhoe pits shall be located during the rough grading of the site to properly recompact the backfill.

2.2 Laboratory Testing

Laboratory tests were conducted on selected bulk and relatively undisturbed soil samples to aid in classification and evaluation of selected engineering properties of the site soils. The tests were conducted in general conformance to the procedures of the American Society for Testing and Materials (ASTM) or other standardized methods as referenced below. The laboratory testing program consisted of the following tests:

- Particle Size Analyses (ASTM D422) – used for soil classification.
- Collapse Potential (ASTM D5333) – used for hydroconsolidation potential evaluation.
- Moisture-Density Relationship (ASTM D1557) – used for soil compaction determinations.
- Chemical Analyses (soluble sulfates & chlorides, pH, and resistivity) (Caltrans Methods) – used for concrete mix evaluations and corrosion protection requirements.

The laboratory test results are presented on the subsurface logs and on Plates C-1 through C-4 in Appendix C.

Section 3
DISCUSSION

3.1 Site Conditions

The project site is irregularly shaped in plan view and consists of approximately 64-acres of vacant desert land. The southwest portion of the site slopes gently to the northeast and becomes flat-lying along the north. Moderate vegetation consisting of creosote, cactus, dry grasses and other indigenous desert plants covers the site. Single family residences and the Twentynine Palms Junior High and Elementary schools abut the property to the east. The site is bounded by Desert Knoll Avenue to the west, by Two Mile Road to the south and by Utah Trail to the east.

Single family residential homes and vacant desert land are located across Desert Knoll Avenue to the west. Across Two Mile Road to the south is an apartment complex, vacant desert land and isolated single family residences. Vacant desert land is located to the north and across Utah Trail to the east.

The project site lies at an elevation between approximately 1,870 to 1,900 feet above mean sea level (MSL) in the Mojave Desert region of the California high desert. Annual rainfall in this arid region is less than 8 inches per year with four months of average summertime temperatures above 100°F.

3.2 Geologic Setting

Twentynine Palms is located in the Mojave Desert region of the California high desert. The Mojave Desert is bounded on the southwest by the San Andreas Fault and the Transverse Ranges, on the east by the Colorado River and on the north by the Garlock Fault, the Tehachapi Mountains and the Basin Ranges.

The Mojave area contains Paleozoic and lower Mesozoic rocks. Jurassic and Cretaceous granitic rocks of the Nevadan batholith are widespread throughout the region's mountain blocks. Valleys between the mountain blocks are in-filled with Quaternary sediments. The region is dominated by broad alleviated basins that are mostly aggrading surfaces receiving nonmarine continental deposits from adjacent uplands. Tectonic activity continues at a high rate as evidenced by deformed young sedimentary deposits and high levels of seismicity. Faults are typically encountered along the valley – mountain transition.

3.3 Seismicity and Faulting

Faulting and Seismic Sources: We have performed a computer-aided search of known faults or seismic zones that lie within a 62 mile (100 kilometers) radius of the project site as shown on Figure 1 and Table 1. The search identifies known faults within this distance and computes deterministic ground accelerations at the site based on the maximum credible earthquake expected on each of the faults and the distance from the fault to the site. The Maximum Magnitude Earthquake (Mmax) listed was taken from published geologic information available for each fault (CDMG OFR 96-08 and Jennings, 1994).

Seismic Risk: The project site is located in the seismically active Mojave Desert region of southern California and is considered likely to be subjected to moderate to strong ground motion from earthquakes in the region. The proposed site structures should be designed in accordance with the California Building Code for near source factors derived from a "Design Basis Earthquake" (DBE). The DBE is defined as the motion having a 10 percent probability of being exceeded in 50 years.

Seismic Hazards.

► **Groundshaking.** The primary seismic hazard at the project site is the potential for moderate groundshaking during earthquakes along the Mesquite Lake Fault. A further discussion of groundshaking follows in Section 3.4.

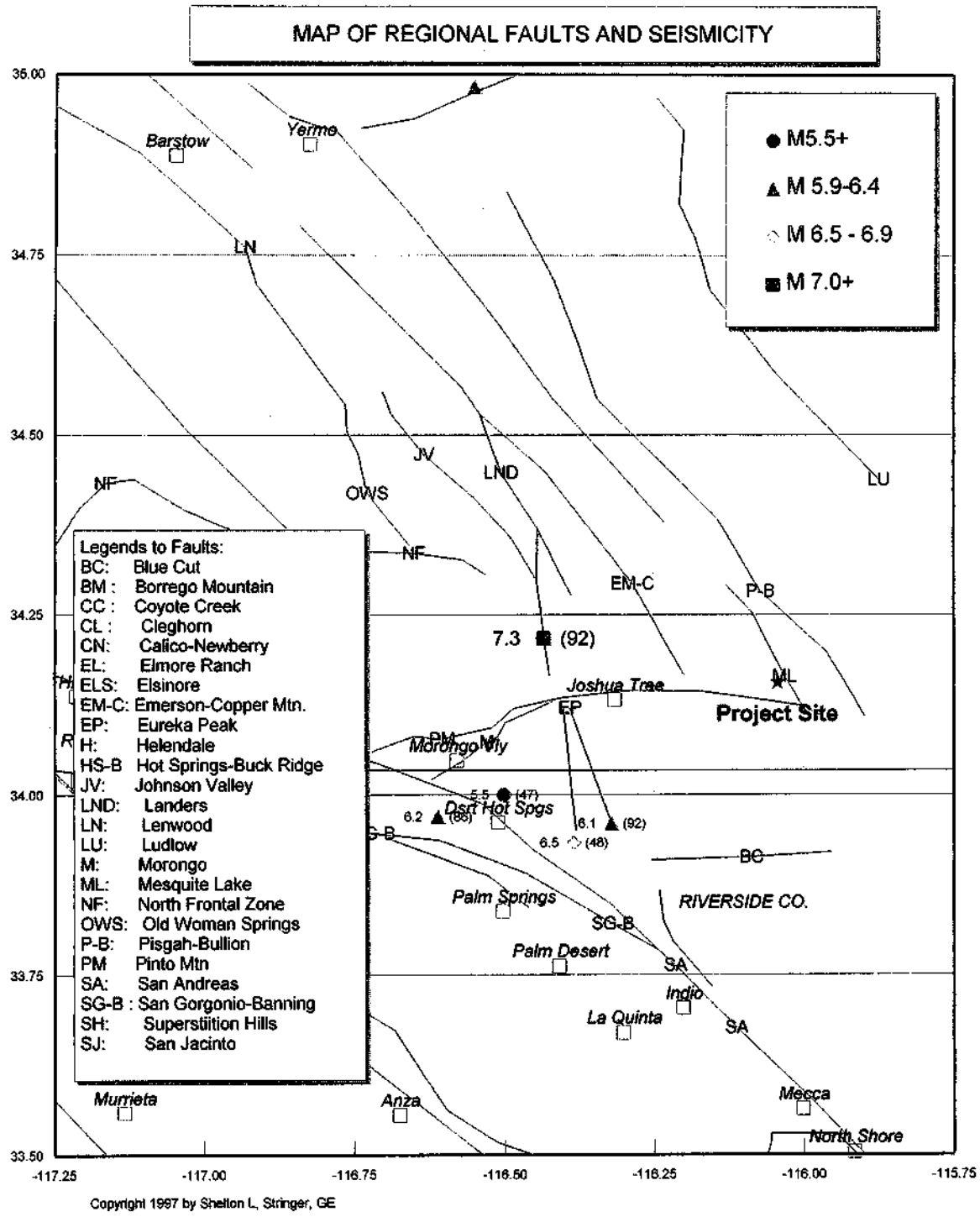
► **Surface Rupture.** The project site does not lie within a State of California, Alquist-Priolo Earthquake Fault Zone. Surface fault rupture is considered to be unlikely at the project site because of the well-delineated fault lines through the Mojave Desert region as shown on USGS and CDMG maps. However, because of the high tectonic activity and deep alluvium of the region, we cannot preclude the potential for surface rupture on undiscovered or new faults that may underlie the site.

► **Liquefaction.** Liquefaction is unlikely to be a potential hazard at the site since the groundwater is believed to be deeper than 50 feet (the maximum depth that liquefaction is known to occur).

Other Secondary Hazards.

► **Landsliding.** The hazard of landsliding is unlikely due to the regional planar topography. No ancient landslides are shown on geologic maps of the region and no indications of landslides were observed during our site investigation.

► **Volcanic hazards.** The site is not located in proximity to any known volcanically active area and the risk of volcanic hazards is considered very low.



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Faults and Seismic Zones from Jennings (1994), Earthquakes modified from Ellsworth (1990) catalog.

Figure 1. Map of Regional Faults and Seismicity

Table 1

FAULT PARAMETERS & DETERMINISTIC

ESTIMATES OF PEAK GROUND ACCELERATION (PGA)

Fault Name or Seismic Zone	Distance (mi) & Direction from Site	Fault Type		Fault Length (km)	Maximum Magnitude Mmax (Mw)	Avg Slip Rate (mm/yr)	Avg Return Period (yrs)	Date of Last Rupture (year)	Largest Historic Event >5.5M (year)	Est. Site PGA (g)
Reference Notes: (1)		(2)	(3)	(2)	(4)	(3)	(3)	(3)	(5)	(6)
Mojave Faults										
Bullion Mtn-Mesquite Lk.	0.9 NE	B	C	88	**7.0**	0.6	5,000			**0.55**
Pinto Mountain	1.8 S	B	B	73	**7.0**	2.5	499			**0.52**
S. Emerson-Copper Mtn.	8.9 W	B	C	54	**6.9**	0.6	5,000			**0.24**
Blue Cut	17 S	B	C	30	**6.8**	1	762			**0.15**
Calico - Hidalgo	19 NW	B	C	95	**7.1**	0.6	5,000			**0.16**
Eureka Peak	20 WSW	C	C	19	**6.4**	0.6	5,000	1992	6.1 1992	**0.11**
Burnt Mtn	21 W	B	C	20	**6.4**	0.6	5,000	1992	7.3 1992	**0.10**
Landers	21 WNW	B	C	83	**7.3**	0.6	5,000	1992	7.3 1992	**0.16**
Morongo	21 W	C	C	23	**6.5**	0.6	1,172		5.5 1947	**0.10**
Ludlow	22 NNE	B	C	23	**7.0**	0.6	5,000			**0.13**
N. Johnson Valley	25 WNW	B	C	36	**6.7**	0.6	5,000			**0.10**
North Frontal Fault Z. (E)	30 WNW	B	C	27	**6.7**	0.5	1,727			**0.11**
Lockhart-Old Wmn Spgs	37 WNW	B	C	149	**7.3**	0.6	5,000			**0.10**
North Frontal Fault Z. (W)	44 WNW	B	C	50	**7.0**	1	1,314			**0.10**
Helendale-S. Lockhart	49 WNW	B	C	97	**7.1**	0.6	5,000			**0.08**
Mannix	63 NNW	B	C	14	**6.6**	0.6	5,000		5.9 1947	**0.05**
San Andreas Fault System										
- Coachella Valley	27 SW	A	A	95	**7.4**	25	220	1690+/-	6.5 1948	**0.14**
- San Gorgonio-Banning	28 SW	A	A	98	**7.4**	10	---	1690+/-	6.2 1986	**0.14**
- San Bernardino Mtn	31 WSW	A	A	107	**7.3**	24	433	1812	6.5 1812	**0.12**
- Whole S. Calif. Zone	27 SW	A	A	456	**7.9**	---	---	1857	7.8 1857	**0.19**
San Jacinto Fault System										
- Hot Spgs-Buck Ridge	49 SW	B	A	70	**6.5**	2	354		6.3 1937	**0.06**
- Anza Segment	53 SW	A	A	90	**7.2**	12	250	1918	6.8 1918	**0.08**
- Coyote Creek	55 SW	B	A	40	**6.8**	4	175	1968	6.5 1968	**0.06**
- San Jacinto Valley	57 WSW	B	A	42	**6.9**	12	83		6.8 1899	**0.06**

Notes:

1. Jennings (1994) and CDMG (1996)
2. CDMG (1996), where Type A faults -- slip rate >5 mm/yr and well constrained paleoseismic data
   Type B faults – all other faults.
3. WGCEP (1995)
4. CDMG (1996) based on Wells & Coppersmith (1994)
5. Ellsworth Catalog in USGS PP 1515 (1990) and USBR (1976), Mw = moment magnitude,
6. The deterministic estimates of the Site PGA are based on the attenuation relationship of:
   Boore, Joyner, Fumal (1997)

► **Tsunamis, seiches, and flooding.** The site does not lie near any large bodies of water, so the threat of tsunami, seiches, or other seismically-induced flooding is unlikely. The northeasten portion of the project site is located within a Federal Emergency Management Agency (FEMA) 100-year and 500-year flood zone.

3.4 Site Acceleration and CBC Seismic Coefficients

Site Acceleration: Deterministic horizontal peak ground accelerations (PGA) from maximum probable earthquakes on regional faults have been estimated and are included in Table 1. Ground motions are dependent primarily on the earthquake magnitude and distance to the seismogenic (rupture) zone. Accelerations also are dependent upon attenuation by rock and soil deposits, direction of rupture and type of fault; therefore, ground motions may vary considerably in the same general area.

We have used the computer program FRISKSP (Blake, 2000) to provide a probabilistic estimate of the site PGA using the attenuation relationship of Boore, Joyner, and Fumal (1997) Soil (310). The PGA estimate for the project site having a 10% probability of occurrence in 50 years (return period of 475 years) is **0.45g**.

CBC Seismic Coefficients: The CBC seismic response coefficients are calculated from the near-source factors for Seismic Zone 4. The near-source factors are based on the distance from the fault and the seismic source type. The following table lists seismic and site coefficients (near source factors) determined by Chapter 16 of the 2001 CBC. ***This site lies within 1.5 km of a Type B fault overlying S_D (stiff) soil.***

CBC Seismic Coefficients for Chapter 16 Seismic Provisions

CBC Code Edition	Soil Profile Type	Seismic Source Type	Distance to Critical Source	Near Source Factors		Seismic Coefficients	
				Na	Nv	Ca	Cv
2001	S_D (stiff soil)	B	< 1.5 km	1.30	1.60	0.57	1.02
Ref. Table	16-J	16-U	---	16-S	16-T	16-Q	16-R

3.5 Subsurface Soil

Subsurface soils encountered during the field exploration conducted on July 7, 2005 consist of gravelly silty sands and sands. The subsurface logs (Plates B-1 through B-8) depict the stratigraphic relationships of the various soil types.

3.6 Groundwater

Groundwater was not encountered in the trenches during the time of exploration, but is believed to be deeper than 100 feet below ground surface at this site. There is uncertainty in the accuracy of short-term water level measurements, particularly in fine-grained soil. Groundwater levels may fluctuate with precipitation, irrigation of adjacent properties, drainage, and site grading. The groundwater level noted should not be interpreted to represent an accurate or permanent condition.

3.7 Hydroconsolidation

In arid climatic regions, granular soils have a potential to collapse upon wetting. This collapse (hydroconsolidation) phenomena is the result of the lubrication of soluble cements (carbonates) in the soil matrix causing the soil to densify from its loose configuration during deposition.

A collapse potential test indicated a slight risk of collapse upon inundation indicating at the project site. Therefore, building foundations are not required to include provisions for mitigating the hydroconsolidation caused by soil saturation from landscape irrigation or broken utility lines.

3.8 Soil Percolation Rate

A total of twenty four (24) percolation tests were conducted on July 29, 2005 at this site, as shown on Plate A-2. The percolation tests were performed in conformance with the San Bernardino County Soil Percolation Test Records Standards, as described in the "On–Site Waste Water Disposal Systems" published by the San Bernardino County Environmental Health Services.

The tests were performed using perforated pipes inside a 6-inch diameter hand auger borehole made to an approximate depth of 3.0 feet below the existing ground surface. The boreholes were filled with water and tests were performed on the same day using the sandy soil criteria test. Based on two 30 minutes readings, successive readings of drop in water levels were made at 10 minute intervals for an hour until a stabilized drop was recorded. The field test results are summarized with the percolation rate calculations in Appendix D of this report.

The test results indicate that the stabilized percolation rate in the soil ranges from 1.38 to 5.00 minutes per inch (mpi). As per guidelines of Department of Health Services, County of San Bernardino, and based on the percolation test results, a maximum soil percolation rate of 5.00 min/inch and a minimum absorption area of 1.00 square feet per gallon of effluent per day will be required for leachline design.

Section 4
RECOMMENDATIONS

4.1 Site Preparation

Clearing and Grubbing: All surface improvements, debris or vegetation including grass, trees, and weeds on the site at the time of construction should be removed from the construction area. Root balls should be completely excavated. Organic strippings should be hauled from the site and not used as fill. Any trash, construction debris, concrete slabs, old pavement, landfill, and buried obstructions such as old foundations and utility lines exposed during rough grading should be traced to the limits of the foreign material by the grading contractor and removed under our supervision. Any excavations resulting from site clearing should be dish-shaped to the lowest depth of disturbance and backfilled under the observation of the geotechnical engineer's representative.

Building Pad Preparation: The existing surface soil within the building pad/foundation areas should be removed to 36 inches below the building pad elevation or existing grade (whichever is lower) extending five feet beyond all exterior wall/column lines (including adjacent concreted areas). Exposed subgrade should be scarified to a depth of 8 inches, uniformly moisture conditioned to ±2% of optimum moisture content, and recompacted a minimum of 90% of the maximum density determined in accordance with ASTM D1557 methods.

The native granular soil is suitable for use as compacted fill and utility trench backfill. The native soil should be placed in maximum 8 inch lifts (loose) and compacted to a minimum of 90% of ASTM D1557 maximum dry density at optimum moisture ±2%.

Imported fill soil (if required) should similar to onsite soil or non-expansive, granular soil meeting the USCS classifications of SM, SP-SM, or SW-SM with a maximum rock size of 3 inches. The geotechnical engineer should approve imported fill soil sources before hauling material to the site. Imported granular fill should be placed in lifts no greater than 8 inches in loose thickness and compacted to a minimum of 90% of ASTM D1557 maximum dry density at optimum moisture ±2%.

In areas other than the building pad which are to receive area concrete slabs, the ground surface should be scarified to 8 inches, moisture conditioned to 2% over optimum, and recompacted to a minimum of 90% of ASTM D1557 maximum density just prior to concrete placement.

Trench Backfill: On-site soil free of debris, vegetation, and other deleterious matter may be suitable for use as utility trench backfill, but may be difficult to uniformly maintain at specified moistures and compact to the specified densities.

Backfill soil within roadways should be placed in layers not more that 6 inches in thickness and mechanically compacted to a minimum of 90% of the ASTM D1557 maximum dry density except for the top 12 inches of the trench which shall be compacted to at least 95%. Native backfill should only be placed and compacted after encapsulating buried pipes with suitable bedding and pipe envelope material. Pipe envelope/bedding should either be clean sand (Sand Equivalent SE>30) or crushed rock when encountering groundwater. A geotextile filter fabric (Mirafi 140N or equivalent) should be used to encapsulate the crushed rock to reduce the potential for in-washing of fines into the gravel void space. Precautions should be taken in the compaction of the backfill to avoid damage to the pipes and structures.

Moisture Control and Drainage: The moisture condition of the building pad should be maintained during trenching and utility installation until concrete is placed or should be rewetted before initiating delayed construction.

Adequate site drainage is essential to future performance of the project. Infiltration of excess irrigation water and stormwaters can adversely affect the performance of the subsurface soil at the site. Positive drainage should be maintained away from all structures (5% for 5 feet minimum across unpaved areas) to prevent ponding and subsequent saturation of the native soil. Gutters and downspouts may be considered as a means to convey water away from foundations. If landscape irrigation is allowed next to the building, drip irrigation systems or lined planter boxes should be used. Drainage should be maintained without ponding.

Observation and Density Testing: All site preparation and fill placement should be continuously observed and tested by a representative of a qualified geotechnical engineering firm. Full-time observation services during the excavation and scarification process is necessary to detect undesirable materials or conditions and soft areas that may be encountered in the construction area. The geotechnical firm that provides observation and testing during construction shall assume the responsibility of "*geotechnical engineer of record*" and, as such, shall perform additional tests and investigation as necessary to satisfy themselves as to the site conditions and the recommendations for site development.

Auxiliary Structures Foundation Preparation: Auxiliary structures such as free standing or retaining walls should have the existing soil beneath the structure foundation prepared in the manner recommended for the building pad except the preparation needed only to extend 18 inches below and beyond the footing.

4.2 Foundations and Settlements

Shallow spread footings and continuous wall footings are suitable to support the structures provided they are founded on a layer of properly prepared and compacted soil as described in Section 4.1. The foundations may be designed using an allowable soil bearing pressure of 1,500 psf. The allowable soil pressure may be increased by 20% for each foot of embedment depth in excess of 18 inches and by one-third for short term loads induced by winds or seismic events. The maximum allowable soil pressure at increased embedment depths shall not exceed 2,500 psf.

All exterior and interior foundations should be embedded a minimum of 18 inches below the building support pad or lowest adjacent final grade, whichever is deeper. Continuous wall footings should have a minimum width of 12 inches. Spread footings should have a minimum dimension of 24 inches. Recommended concrete reinforcement and sizing for all footings should be provided by the structural engineer.

Resistance to horizontal loads will be developed by passive earth pressure on the sides of footings and frictional resistance developed along the bases of footings and concrete slabs. Passive resistance to lateral earth pressure may be calculated using an equivalent fluid pressure of 350 pcf to resist lateral loadings. The top one foot of embedment should not be considered in computing passive resistance unless the adjacent area is confined by a slab or pavement. An allowable friction coefficient of 0.40 may also be used at the base of the footings to resist lateral loading.

Foundation movement under the estimated static (non-seismic) loadings and static site conditions are estimated to not exceed ¾ inch with differential movement of about two-thirds of total movement for the loading assumptions stated above when the subgrade preparation guidelines given above are followed.

4.3 Slabs-On-Grade

Concrete slabs and flatwork should be a minimum of 4 inches thick. Concrete floor slabs may either be monolithically placed with the foundation or dowelled after footing placement. The concrete slabs may be placed on granular subgrade that has been compacted at least 90% relative compaction (ASTM D1557) and moistened to near optimum moisture just before the concrete placement.

To provide protection against vapor or water transmission through the slabs, we recommend that the slabs-on-grade be underlain by a layer of clean concrete sand at least 4 inches thick. To provide additional protection against water vapor transmission through the slab in areas where vinyl or other moisture-sensitive floor covering is planned, we recommend that a 10-mil thick impermeable plastic membrane (visqueen) be placed at mid-height within the sand layer. The vapor retarder should be installed in accordance with the manufacturer's instructions. We recommend that at least a 2-foot lap be provided at the membrane edges or that the edges be sealed.

Concrete slab and flatwork reinforcement should consist of chaired rebar slab reinforcement (minimum of No. 4 bars at 18-inch centers, both horizontal directions) to resist potential forces related to soil movement and cracking. Slab thickness and steel reinforcement are minimums only and should be verified by the structural engineer/designer knowing the actual project loadings. All steel components of the foundation system should be protected from corrosion by maintaining a 3-inch minimum concrete cover of densely consolidated concrete at footings (by use of a vibrator). The construction joint between the foundation and any mowstrips/sidewalks placed adjacent to foundations should be sealed with a polyurethane based non-hardening sealant to prevent moisture migration between the joint. Epoxy coated embedded steel components or permanent waterproofing membranes placed at the exterior footing sidewall may also be used to mitigate the corrosion potential of concrete placed in contact with native soil.

Control joints should be provided in all concrete slabs-on-grade at a maximum spacing (in feet) of 2 to 3 times the slab thickness (in inches) as recommended by American Concrete Institute (ACI) guidelines. All joints should form approximately square patterns to reduce randomly oriented contraction cracks. Contraction joints in the slabs should be tooled at the time of the pour or sawcut (¼ of slab depth) within 6 to 8 hours of concrete placement. Construction (cold) joints in foundations and area flatwork should either be thickened butt-joints with dowels or a thickened keyed-joint designed to resist vertical deflection at the joint. All joints in flatwork should be sealed

to prevent moisture, vermin, or foreign material intrusion. Precautions should be taken to prevent curling of slabs in this arid desert region (refer to ACI guidelines).

All independent flatwork (sidewalks, patios) should be underlain by 12 inches of moisture conditioned and compacted soils. All flatwork should be jointed in square patterns and at irregularities in shape at a maximum spacing of 10 feet or the least width of the sidewalk. Driveway slabs should have a thickened edge extending a minimum of 4 inches below a 4-inch sand or aggregate base course which should be compacted to a minimum of 90% of ASTM D1557 maximum density.

4.4 Concrete Mixes and Corrosivity

Selected chemical analyses for corrosivity were conducted on bulk samples of the near surface soil from the project site (Plate C-4). The native soils have low levels of sulfate ion concentration (84-245 ppm). A minimum of 2,500 psi concrete of Type II Portland Cement with a maximum water/cement ratio of 0.60 (by weight) should be used for concrete placed in contact with native soil on this project (sitework including streets, sidewalks, driveways, patios, and other wall foundations).

The native soil has low levels of chloride ion concentration (130-140 ppm). Chloride ions can cause corrosion of reinforcing steel, anchor bolts and other buried metallic conduits. Resistivity determinations on the soil indicate moderate to severe potential for metal loss because of electrochemical corrosion processes. Mitigation of the corrosion of steel can be achieved by using steel pipes coated with epoxy corrosion inhibitors, asphaltic and epoxy coatings, cathodic protection or by encapsulating the portion of the pipe lying above groundwater with a minimum of 3 inches of densely consolidated concrete. ***No metallic pipes or conduits should be placed below foundations.***

Foundation designs shall provide a minimum concrete cover of three (3) inches around steel reinforcing or embedded components (anchor bolts, hold-downs, etc.) exposed to native soil or landscape water (to 18 inches above grade). Additionally, the concrete should be thoroughly vibrated at footings during placement to decrease the permeability of the concrete.

4.5 Excavations

All site excavations should conform to CalOSHA requirements for Type C soil. The contractor is solely responsible for the safety of workers entering trenches. Temporary excavations with depths of 4 feet or less may be cut nearly vertical for short duration. Temporary slopes should be no steeper than 1.5:1 (horizontal:vertical). Sandy soil slopes should be kept moist, but not saturated, to reduce the potential of raveling or sloughing.

Excavations deeper than 4 feet will require shoring or slope inclinations in conformance to CAL/OSHA regulations for Type C soil. Surcharge loads of stockpiled soil or construction materials should be set back from the top of the slope a minimum distance equal to the height of the slope. All permanent slopes should not be steeper than 3:1 to reduce wind and rain erosion. Protected slopes with ground cover may be as steep as 2:1. However, maintenance with motorized equipment may not be possible at this inclination.

4.6 Lateral Earth Pressures

Earth retaining structures, such as retaining walls, should be designed to resist the soil pressure imposed by the retained soil mass. Walls with granular drained backfill may be designed for an assumed static earth pressure equivalent to that exerted by a fluid weighing 30 pcf for unrestrained (active) conditions (able to rotate 0.1% of wall height), and 50 pcf for restrained (at-rest) conditions. These values should be verified at the actual wall locations during construction.

When applicable seismic earth pressure on walls may be assumed to exert a uniform pressure distribution of 7.5H psf against the back of the wall, where H is the height of the backfill. The total seismic load is assumed to act as a point load at 0.6H above the base of the wall.

Surcharge loads should be considered if loads are applied within a zone between the face of the wall and a plane projected behind the wall 45 degrees upward from the base of the wall. The increase in lateral earth pressure acting uniformly against the back of the wall should be taken as 50% of the surcharge load within this zone. Areas of the retaining wall subjected to traffic loads should be designed for a uniform surcharge load equivalent to two feet of native soil.

Walls should be provided with backdrains to reduce the potential for the buildup of hydrostatic pressure. The drainage system should consist of a composite HDPE drainage panel or a 2-foot wide zone of free draining crushed rock placed adjacent to the wall and extending 2/3 the height of the wall. The gravel should be completely enclosed in an approved filter fabric to separate the gravel and backfill soil. A perforated pipe should be placed perforations down at the base of the permeable material at least six inches below finished floor elevations. The pipe should be sloped to drain to an appropriate outlet that is protected against erosion. Walls should be properly waterproofed. The project geotechnical engineer should approve any alternative drain system.

4.7 Seismic Design

This site is located in the seismically active southern California area and the site structures are subject to strong ground shaking due to potential fault movements along the Mesquite Lake Fault. Engineered design and earthquake-resistant construction are the common solutions to increase safety and development of seismic areas. Designs should comply with the latest edition of the CBC for Seismic Zone 4 using the seismic coefficients given in Section 3.4 of this report. ***This site lies within1.5 km of a Type B fault overlying S_D (stiff) soil.***

4.8 Pavements

Pavements should be designed according to Caltrans or other acceptable methods. Traffic indices were not provided by the project engineer or owner; therefore, we have provided structural sections for several traffic indices for comparative evaluation. The public agency or design engineer should decide the appropriate traffic index for the site. Maintenance of proper drainage is necessary to prolong the service life of the pavements. Based on the current State of California Caltrans method, an estimated R-value of 50 for the subgrade soil and assumed traffic indices, the following table provides our estimates for asphaltic concrete (AC) pavement sections.

RECOMMENDED PAVEMENTS SECTIONS

R-Value of Subgrade Soil - 50 (estimated) Design Method - CALTRANS 1990

Traffic Index (assumed)	Flexible Pavements	
	Asphaltic Concrete Thickness (in.)	Aggregate Base Thickness (in.)
5.0	3.0	4.0
6.0	3.5	4.0
7.0	4.5	5.0
8.0	5.0	6.0

Notes:

1) Asphaltic concrete shall be Caltrans, Type B, ¾ inch maximum medium grading, (½ inch for parking areas) compacted to a minimum of 95% of the 50-blow Marshall density (ASTM D1559).
2) Aggregate base shall conform to Caltrans Class 2 (¾ inch maximum), compacted to a minimum of 95% of ASTM D1557 maximum dry density.
3) Place pavements on 8 inches of moisture conditioned (minimum 2% above optimum) native soil compacted to a minimum of 90% of the maximum dry density determined by ASTM D1557.

Final recommended pavement section may need to be based on sampling and R-Value testing when actual subgrade soils will be exposed during grading operations.

Section 5

LIMITATIONS AND ADDITIONAL SERVICES

5.1 Limitations

The recommendations and conclusions within this report are based on current information regarding the proposed single family residential development located on the northeast corner of Two Mile Road and Desert Knoll Avenue in Twentynine Palms, California. The conclusions and recommendations of this report are invalid if:

- Structural loads change from those stated or the structures are relocated.
- The Additional Services section of this report is not followed.
- This report is used for adjacent or other property.
- Changes of grade or groundwater occur between the issuance of this report and construction other than those anticipated in this report.
- Any other change that materially alters the project from that proposed at the time this report was prepared.

Findings and recommendations in this report are based on selected points of field exploration, geologic literature, laboratory testing, and our understanding of the proposed project. Our analysis of data and recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific exploratory locations. Variations in soil conditions can exist between and beyond the exploration points or groundwater elevations may change. If detected, these conditions may require additional studies, consultation, and possible design revisions.

This report contains information that may be useful in the preparation of contract specifications. However, the report is not worded is such a manner that we recommend its use as a construction specification document without proper modification. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

This report was prepared according to the generally accepted *geotechnical engineering standards of practice* that existed in San Bernardino County at the time the report was prepared. No express or implied warranties are made in connection with our services. This report should be considered invalid for periods after two years from the report date without a review of the validity of the findings and recommendations by our firm, because of potential changes in the Geotechnical

Engineering Standards of Practice.

The client has responsibility to see that all parties to the project including, designer, contractor, and subcontractor are made aware of this entire report. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

5.2 Additional Services

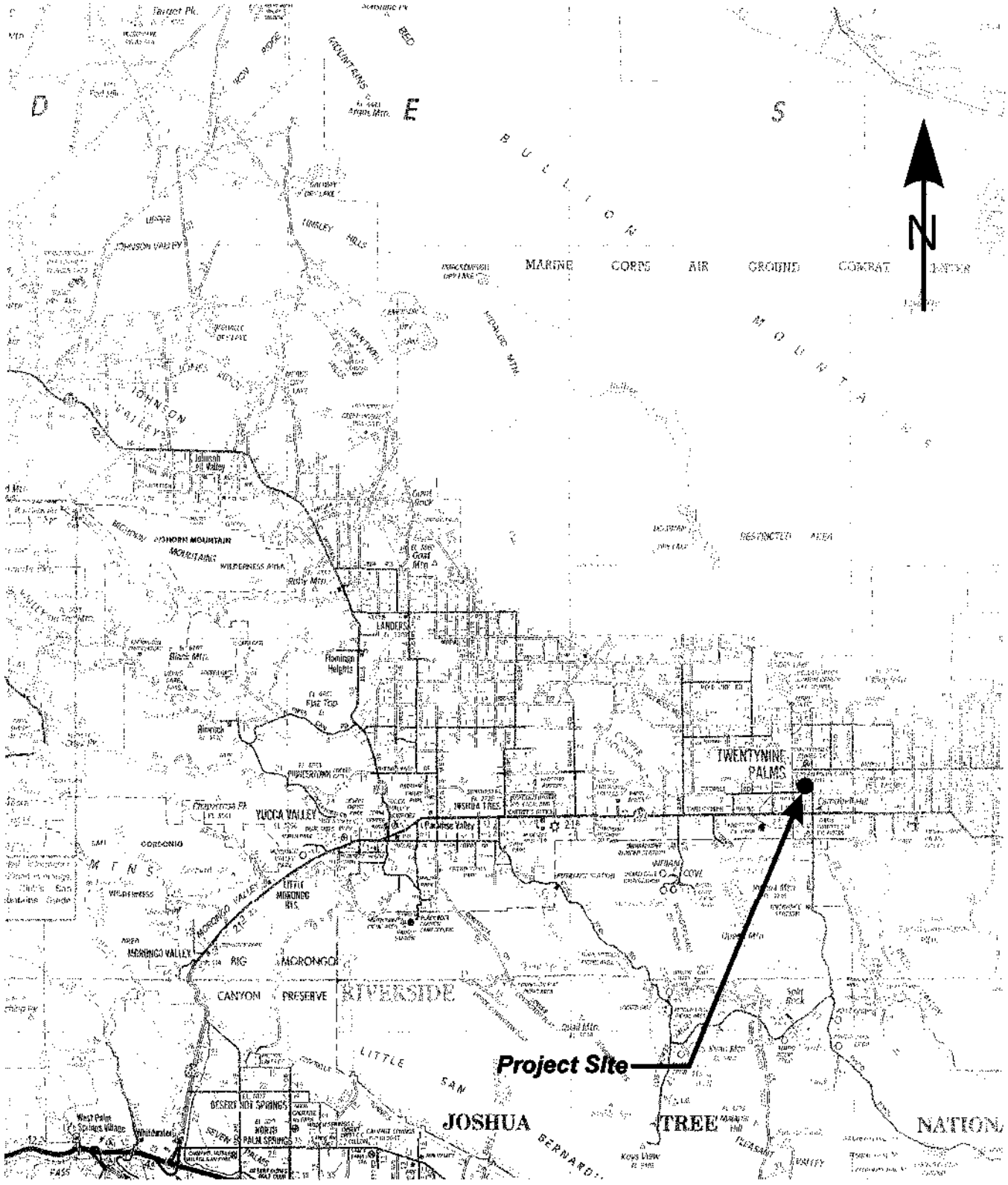
We recommend that Landmark Consultants, Inc. be retained as the geotechnical consultant to provide the tests and observations services during construction. If Landmark Consultants does not provide such services then *the geotechnical engineering firm providing such tests and observations shall become the geotechnical engineer of record and assume responsibility for the project.*

The recommendations presented in this report are based on the assumption that:

- Consultation during development of design and construction documents to check that the geotechnical recommendations are appropriate for the proposed project and that the geotechnical recommendations are properly interpreted and incorporated into the documents.
- Landmark Consultants will have the opportunity to review and comment on the plans and specifications for the project prior to the issuance of such for bidding.
- Continuous observation, inspection, and testing by the geotechnical consultant of record during site clearing, grading, excavation, placement of fills, building pad and subgrade preparation, and backfilling of utility trenches.
- Observation of foundation excavations and reinforcing steel before concrete placement.
- Other consultation as necessary during design and construction.

We emphasize our review of the project plans and specifications to check for compatibility with our recommendations and conclusions. Additional information concerning the scope and cost of these services can be obtained from our office.

APPENDIX A



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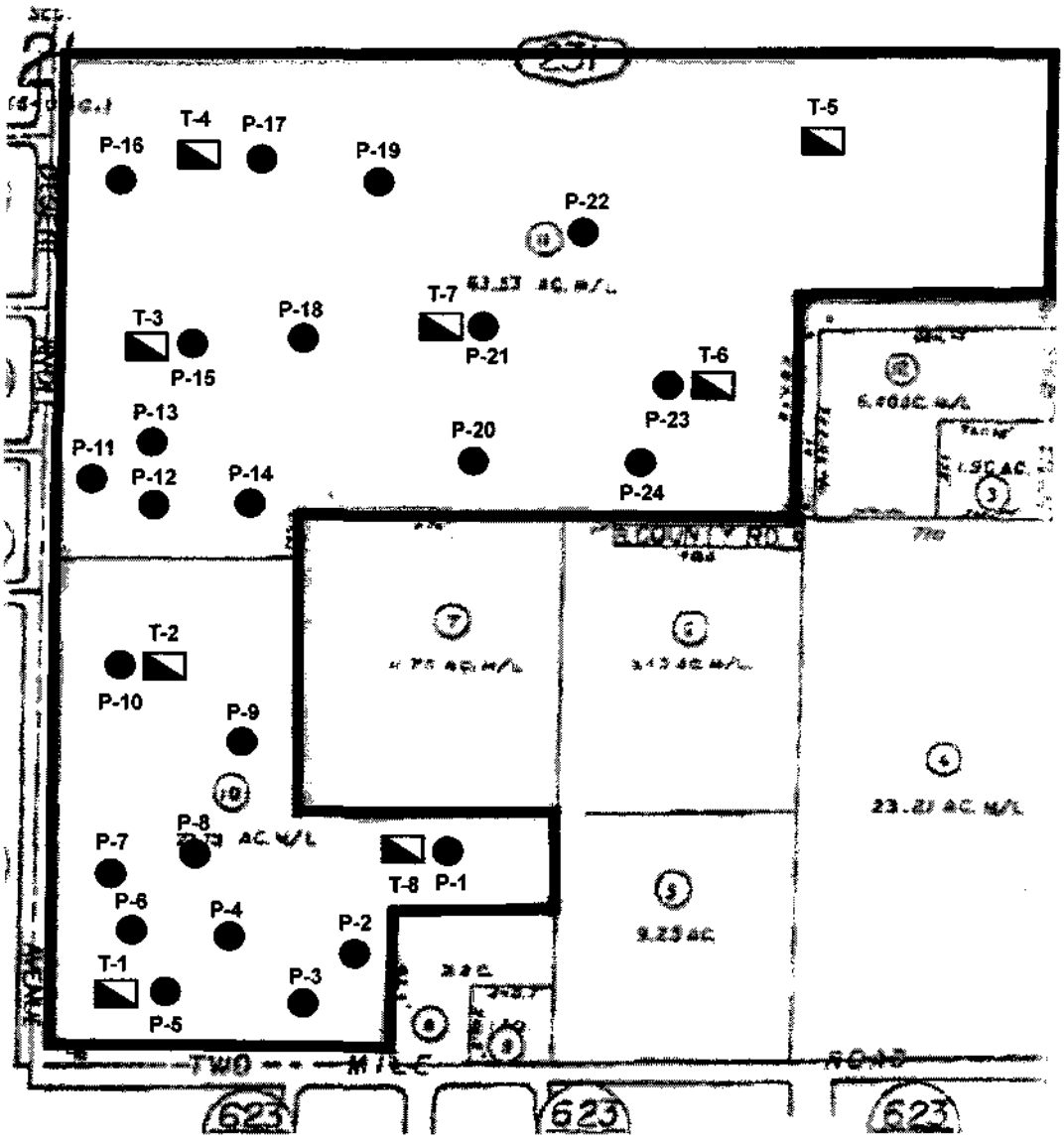
Project No.: LP05191

Vicinity Map

Plate A-1

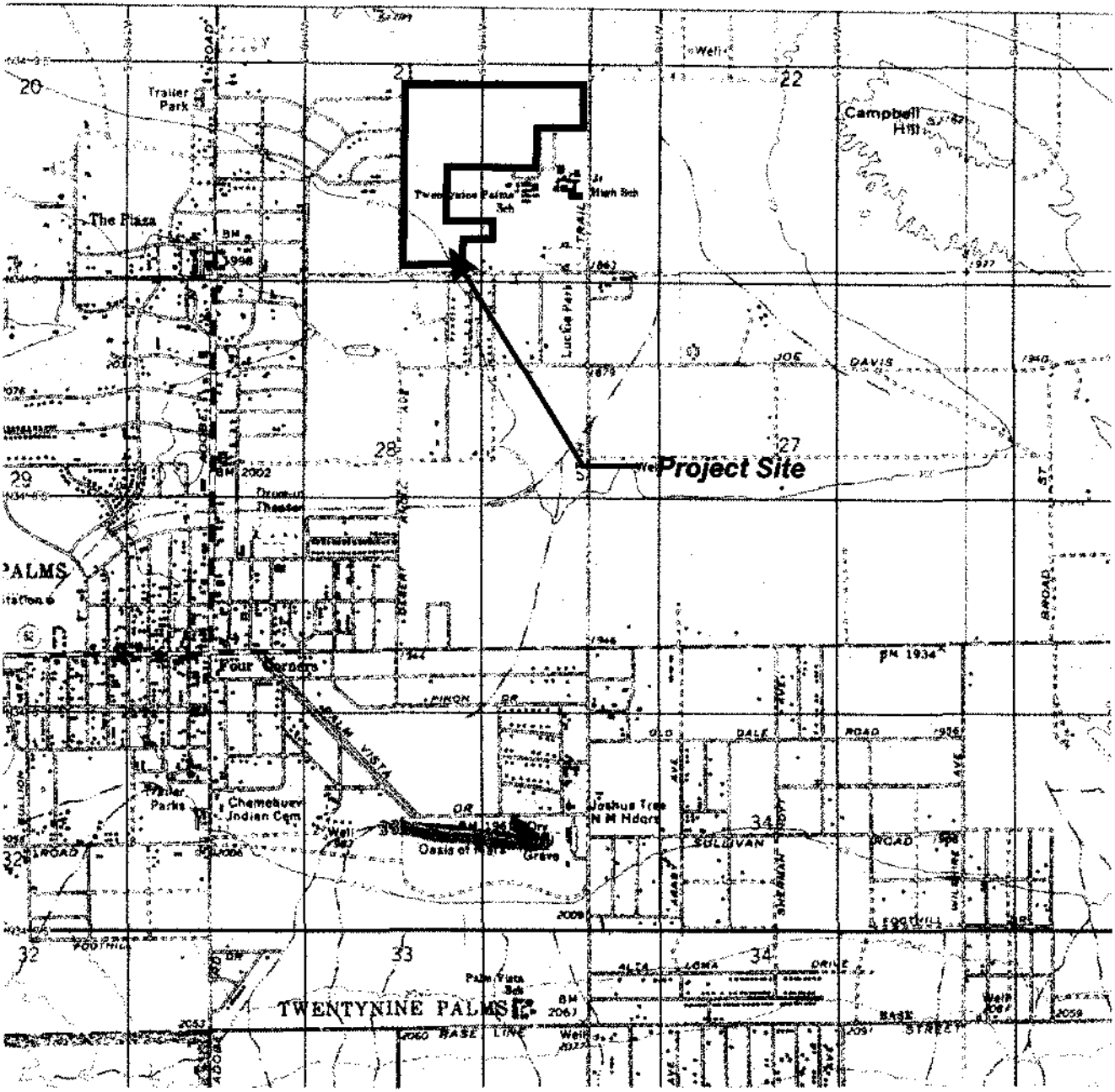


Legend

- *Approximate Test Pit Location (typ)*
- *Approximate Percolation Test Location (typ)*

N

LANDMARK Geo-Engineers and Geologists, a GSE/MBE/SBE Company **Project No.: LP05191**	**Site and Exploration Plan**	**Plate A-2**

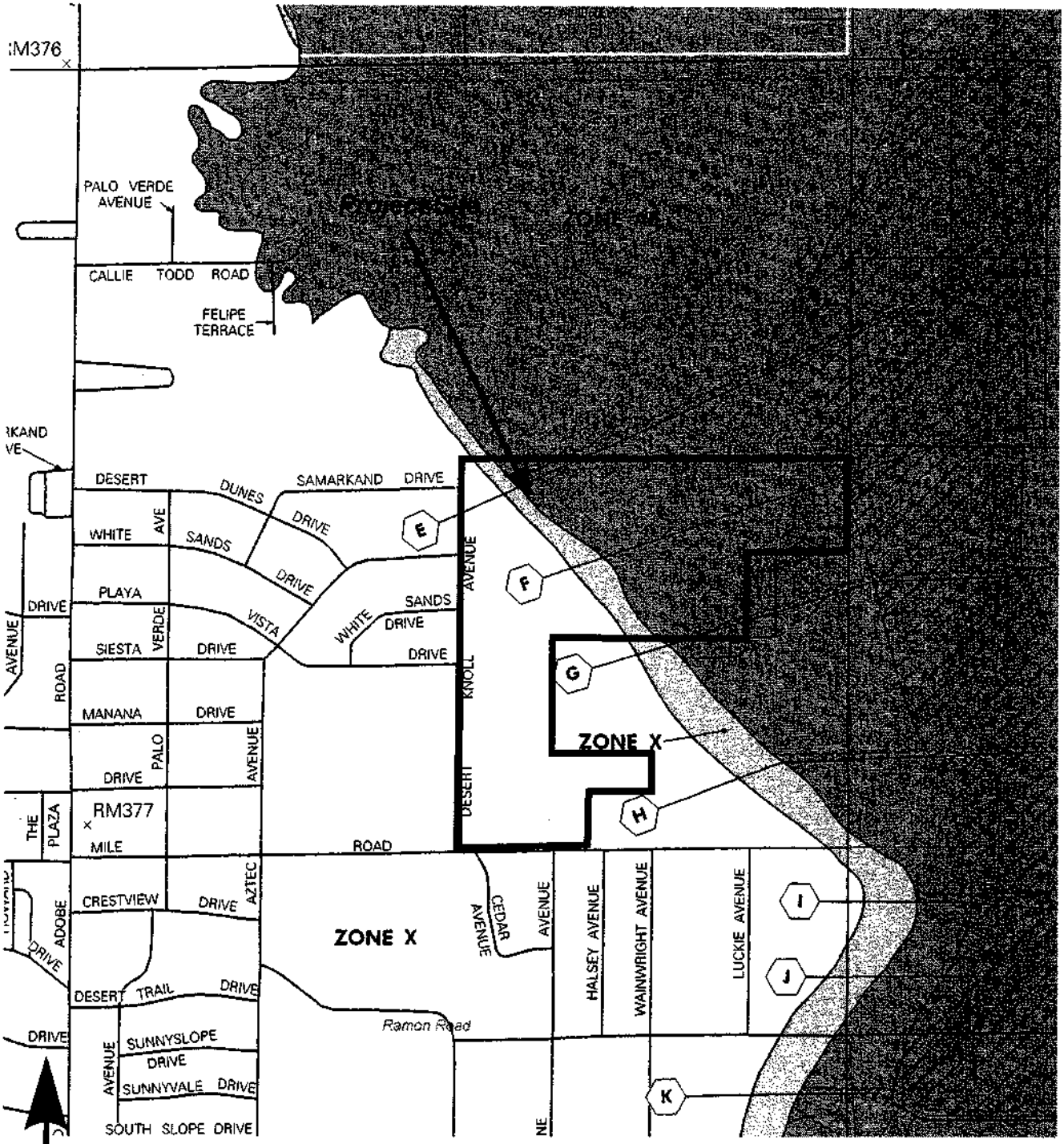


Reference: USGS Topographic Map
Twentynine Palms, CA Quadrangle
Scale 1:25,000

Site Coordinates
Lat: 34.155N
Long: 116.093W

N

LANDMARK Geo-Engineers and Geologists, a DBE/MBE/SBE Company **Project No.: LP05191**	**Topographic Map**	**Plate A-3**



Reference: Federal Emergency Management Agency (FEMA) San Bernardino County, California (Unincorporated Areas) Community-Panel Numbers 06071C 8195 F

LANDMARK Geo-Engineers and Geologists a GEI/AMEC/SBE Company **Project No.: LP05191**	**Flood Insurance Rate Map (FIRM)**	**Plate A-4**

APPENDIX B

CLIENT: Sunwest Development, LLC METHOD OF EXCAVATION: Backhoe

PROJECT: APN 621-231-010 & 011- Twentynine Palms, CA DATE OBSERVED: 07/15/05

LOCATION: See Site and Exploration Plan LOGGED BY: TB

LOG OF TEST PIT T-1

SHEET 1 OF 1

DEPTH (FEET)	CLASSIFICATION	SAMPLE TYPE	BLOWS/ FOOT	POCKET PEN. (TSF)	DESCRIPTION OF MATERIAL SURFACE ELEV. +/-	MOISTURE CONTENT (%)	DRY UNIT WT. (PCF)	RELATIVE COMPACTION (%)	LIQUID LIMIT	PLASTICITY INDEX	PASSING # 200
1											
2		●			GRAVELLY SILTY SAND (SM): Brown, damp, fine grained, with caliche.	7.0	105.4				
3											
4		●				2.6	105.2				
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20					Difficult Trenching from 5.0 to 10.0 ft						
21					End of Excavation at 10.0 ft No Groundwater Encountered						
22											

Project No: LP05191

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Plate B-1

CLIENT: Sunwest Development, LLC METHOD OF EXCAVATION: Backhoe

PROJECT: APN 621-231-010 & 011- Twentynine Palms, CA DATE OBSERVED: 07/15/05

LOCATION: See Site and Exploration Plan LOGGED BY: TB

LOG OF TEST PIT T-2

SHEET 1 OF 1

DEPTH (FEET)	CLASSIFICATION	SAMPLE TYPE	BLOWS/ FOOT	POCKET PEN. (TSF)	DESCRIPTION OF MATERIAL SURFACE ELEV. +/-	MOISTURE CONTENT (%)	DRY UNIT WT. (PCF)	RELATIVE COMPACTION (%)	LIQUID LIMIT	PLASTICITY INDEX	PASSING # 200
1		●				1.7	98.2				8
2					GRAVELLY SAND/SILTY SAND (SP/SM): Brown, damp, fine grained, with caliche.						
3		●				2.1					
4											
5		●				1.1					
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20					Difficult Trenching from 5.0 to 7.5 ft						
21					End of Excavation at 7.5 ft No Groundwater Encountered						
22											

Project No: LP05191

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Plate B-2

CLIENT: Sunwest Development, LLC
METHOD OF EXCAVATION: Backhoe
PROJECT: APN 621-231-010 & 011- Twentynine Palms, CA
DATE OBSERVED: 07/15/05
LOCATION: See Site and Exploration Plan
LOGGED BY: TB

LOG OF TEST PIT T-3

SHEET 1 OF 1

DEPTH (FEET)	CLASSIFICATION	SAMPLE TYPE	BLOWS/ FOOT	POCKET PEN. (TSF)	DESCRIPTION OF MATERIAL SURFACE ELEV. +/-	MOISTURE CONTENT (%)	DRY UNIT WT. (PCF)	RELATIVE COMPACTION (%)	LIQUID LIMIT	PLASTICITY INDEX	PASSING # 200
1											
2		●			SAND/SILTY SAND (SP/SM): Brown, damp, fine grained.	1.1	114.6				10
3											
4		●			partial caving	1.4	91.1				
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21					End of Excavation at 15.0 ft No Groundwater Encountered						
22											

Project No: LP05191

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Plate B-3

CLIENT: Sunwest Development, LLC METHOD OF EXCAVATION: Backhoe
PROJECT: APN 621-231-010 & 011- Twentynine Palms, CA DATE OBSERVED: 07/15/05
LOCATION: See Site and Exploration Plan LOGGED BY: TB

LOG OF TEST PIT T-4

SHEET 1 OF 1

DEPTH (FEET)	CLASSIFICATION	SAMPLE TYPE	BLOWS/ FOOT	POCKET PEN. (TSF)	DESCRIPTION OF MATERIAL SURFACE ELEV. +/-	MOISTURE CONTENT (%)	DRY UNIT WT. (PCF)	RELATIVE COMPACTION (%)	LIQUID LIMIT	PLASTICITY INDEX	PASSING # 200
1		●			SILTY SAND (SM): Brown, damp, fine grained.	2.3	106.9				
2											
3		●				0.6	110.8				
4					partial caving						
5		●				1.9					
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21					End of Excavation at 10.0 ft No Groundwater Encountered						
22											

Project No: LP05191

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Plate B-4

CLIENT: Sunwest Development, LLC METHOD OF EXCAVATION: Backhoe

PROJECT: APN 621-231-010 & 011- Twentynine Palms, CA DATE OBSERVED: 07/15/05

LOCATION: See Site and Exploration Plan LOGGED BY: TB

LOG OF TEST PIT T-5

SHEET 1 OF 1

DEPTH (FEET)	CLASSIFICATION	SAMPLE TYPE	BLOWS/ FOOT	POCKET PEN. (TSF)	DESCRIPTION OF MATERIAL SURFACE ELEV. +/-	MOISTURE CONTENT (%)	DRY UNIT WT. (PCF)	RELATIVE COMPACTION (%)	LIQUID LIMIT	PLASTICITY INDEX	PASSING # 200
1		●			SAND/SILTY SAND (SP/SM): Brown, damp, fine grained.	1.4	110.0				8
2											
3		●				2.5	115.2				
4					partial caving						
5		●				1.0					
6											
7											
8											
9											
10		●			moist						
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21					End of Excavation at 12.5 ft No Groundwater Encountered						
22											

CLIENT: Sunwest Development, LLC METHOD OF EXCAVATION: Backhoe

PROJECT: APN 621-231-010 & 011- Twentynine Palms, CA DATE OBSERVED: 07/15/05

LOCATION: See Site and Exploration Plan LOGGED BY: TB

LOG OF TEST PIT T-6

SHEET 1 OF 1

DEPTH (FEET)	CLASSIFICATION	SAMPLE TYPE	BLOWS/ FOOT	POCKET PEN. (TSF)	DESCRIPTION OF MATERIAL SURFACE ELEV. +/-	MOISTURE CONTENT (%)	DRY UNIT WT. (PCF)	RELATIVE COMPACTION (%)	LIQUID LIMIT	PLASTICITY INDEX	PASSING # 200
1											
2		●			SILTY SAND (SM): Brown, damp, fine grained.	2.2	100.8				
3											
4		●				0.9					
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21					End of Excavation at 10.0 ft No Groundwater Encountered						
22											

Project No: LP05191

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Geo-Engineers and Geologists
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Plate B-6

CLIENT: Sunwest Development, LLC METHOD OF EXCAVATION: Backhoe

PROJECT: APN 621-231-010 & 011- Twentynine Palms, CA DATE OBSERVED: 07/15/05

LOCATION: See Site and Exploration Plan LOGGED BY: TB

LOG OF TEST PIT T-7

SHEET 1 OF 1

DESCRIPTION OF MATERIAL

SURFACE ELEV. +/-

DEPTH (FEET)	CLASSIFICATION	SAMPLE TYPE	BLOWS/ FOOT	POCKET PEN. (TSF)	MOISTURE CONTENT (%)	DRY UNIT WT. (PCF)	RELATIVE COMPACTION (%)	LIQUID LIMIT	PLASTICITY INDEX	PASSING # 200
1	SM	●			2.6	113.0				29
2										
3		●			10.4	92.2				
4										
5		●			2.4					
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										

SILTY SAND (SM): Brown, damp, fine grained.

partial caving

End of Excavation at 10.0 ft
No Groundwater Encountered

Project No: LP05191

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Plate B-7

CLIENT: Sunwest Development, LLC METHOD OF EXCAVATION: Backhoe

PROJECT: APN 621-231-010 & 011- Twentynine Palms, CA DATE OBSERVED: 07/15/05

LOCATION: See Site and Exploration Plan LOGGED BY: TB

LOG OF TEST PIT T-8

SHEET 1 OF 1

DEPTH (FEET)	CLASSIFICATION	SAMPLE TYPE	BLOWS/ FOOT	POCKET PEN. (TSF)	DESCRIPTION OF MATERIAL SURFACE ELEV. +/-	MOISTURE CONTENT (%)	DRY UNIT WT. (PCF)	RELATIVE COMPACTION (%)	LIQUID LIMIT	PLASTICITY INDEX	PASSING # 200
1											
2		●			SILTY SAND (SM): Brown, damp, fine grained.	0.7					
3											
4		●				1.0					
5											
6					moist						
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21					End of Excavation at 10.0 ft No Groundwater Encountered						
22											

Project No: LP05191

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Plate B-8

DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS	SECONDARY DIVISIONS
Coarse grained soils More than half of material is larger than No. 200 sieve	**Gravels** More than half of coarse fraction is larger than No. 4 sieve	Clean gravels (less than 5% fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels, or gravel-sand mixtures, little or no fines
		Gravel with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines
			GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	Sands More than half of coarse fraction is smaller than No. 4 sieve	Clean sands (less than 5% fines)	SW	Well graded sands, gravelly sands, little or no fines
			SP	Poorly graded sands or gravelly sands, little or no fines
		Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines
			SC	Clayey sands, sand-clay mixtures, plastic fines
Fine grained soils More than half of material is smaller than No. 200 sieve	**Silts and clays** Liquid limit is less than 50%		ML	Inorganic silts, clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravely, sandy, or lean clays
			OL	Organic silts and organic clays of low plasticity
	Silts and clays Liquid limit is more than 50%		MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
Highly organic soils			PT	Peat and other highly organic soils

GRAIN SIZES

Silts and Clays	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

200 4 10 4 3/4" 3" 12"

US Standard Series Sieve — Clear Square Openings

Sands, Gravels, etc.	Blows/ft. *
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Clays & Plastic Silts	Strength **	Blows/ft. *
Very Soft	0-0.25	0-2
Soft	0.25-0.5	2-4
Firm	0.5-1.0	4-8
Stiff	1.0-2.0	8-16
Very Stiff	2.0-4.0	16-32
Hard	Over 4.0	Over 32

* Number of blows of 140 lb. hammer falling 30 inches to drive a 2 inch O.D. (1 3/8 in. I.D.) split spoon (ASTM D1586).

** Unconfined compressive strength in tons/s.f. as determined by laboratory testing or approximated by the Standard Penetration Test (ASTM D1586), Pocket Penetrometer, Torvane, or visual observation.

Type of Samples:

Ring Sample — Standard Penetration Test — Shelby Tube — Bulk (Bag) Sample

Drilling Notes:

1. Sampling and Blow Counts
   - Ring Sampler - Number of blows per foot of a 140 lb. hammer falling 30 inches.
   - Standard Penetration Test - Number of blows per foot.
   - Shelby Tube - Three (3) inch nominal diameter tube hydraulically pushed.
2. P. P. = Pocket Penetrometer (tons/s.f.).
3. NR = No recovery.
4. GWT ▼ = Ground Water Table observed @ specified time.

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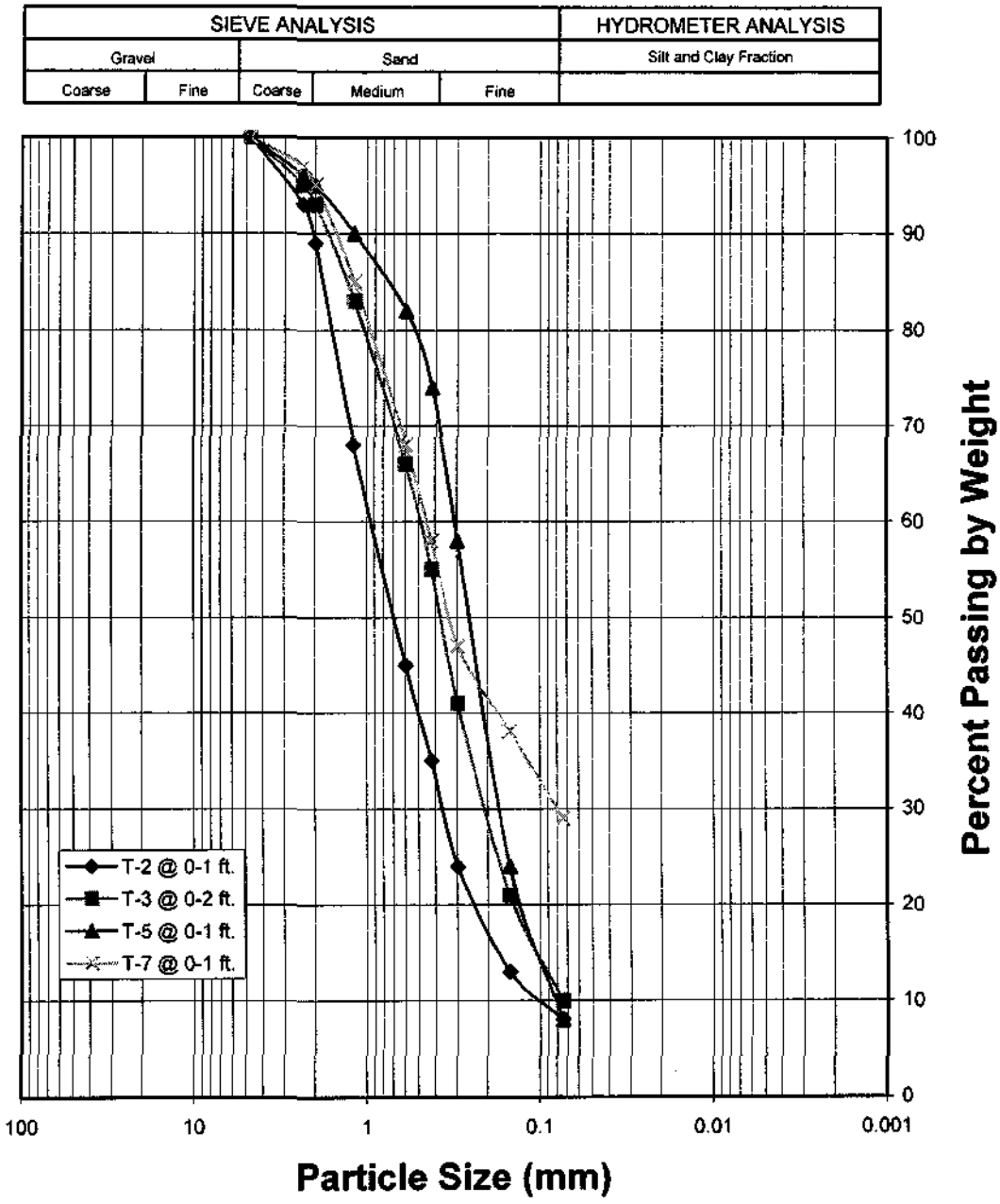
Project No: LP05191

Key to Logs

Plate B-9

APPENDIX C



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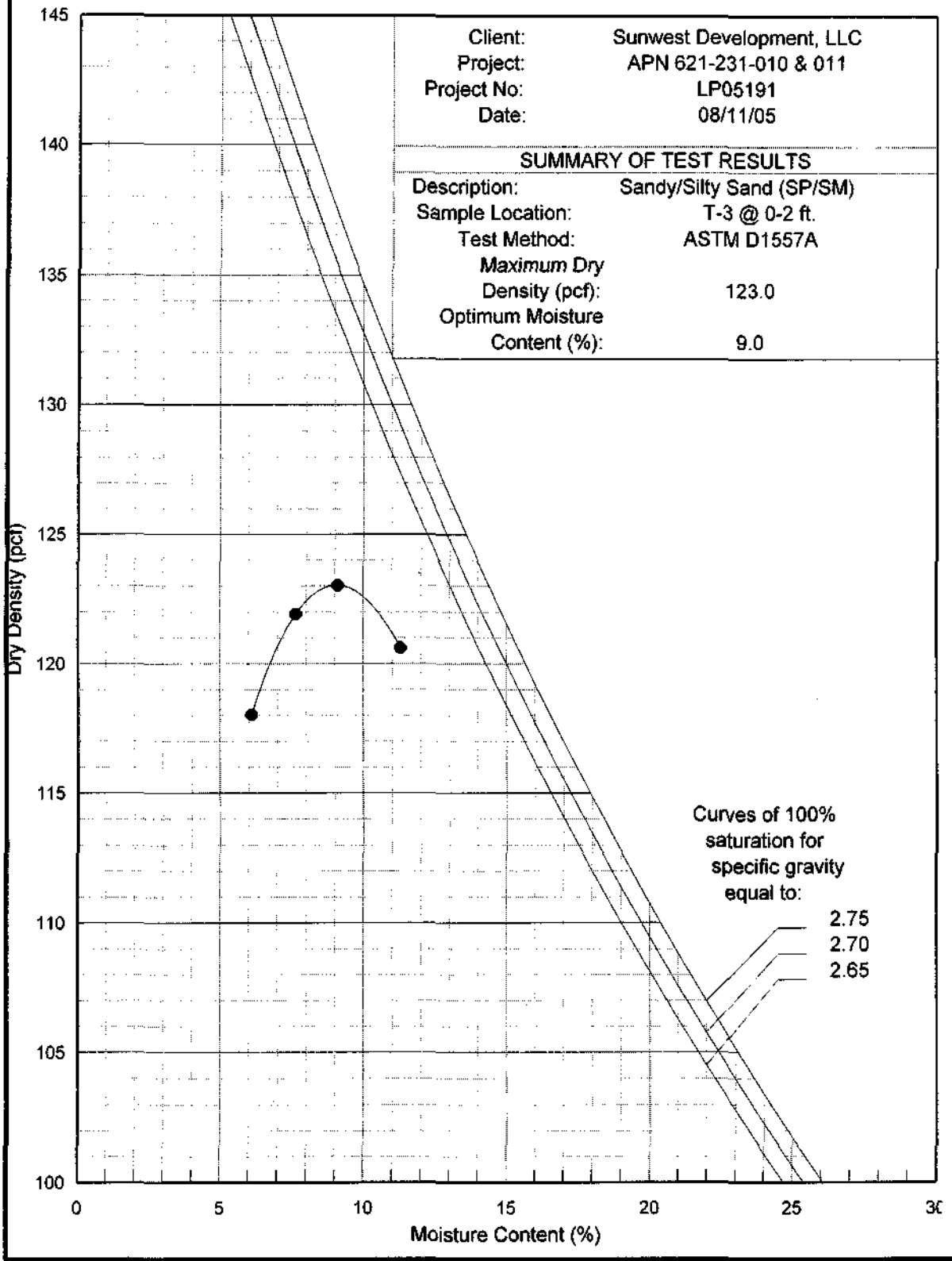
Project No.: LP05191

Grain Size Analysis

Plate C-1



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Project No: LP05191

Moisture Density Relationship

Plate C-2

LANDMARK CONSULTANTS, INC.

CLIENT: Sunwest Development, LLC
PROJECT: APN 621-231-010 & 011- Twentynine Palms, CA
JOB NO: LP05191
DATE: 08/05/05

CHEMICAL ANALYSES

	Boring:	T-2	T-8	CalTrans Method
	Sample Depth, ft:	0-1	0-2	
pH:		7.13	7.11	643
Resistivity (ohm-cm):		2,200	1,150	643
Chloride (Cl), ppm:		140	130	422
Sulfate (SO4), ppm:		245	84	417

General Guidelines for Soil Corrosivity

Material Affected	Chemical Agent	Amount in Soil (ppm)	Degree of Corrosivity
Concrete	Soluble Sulfates	0 -1000	Low
		1000 - 2000	Moderate
		2000 - 20000	Severe
		> 20000	Very Severe
Normal Grade Steel	Soluble Chlorides	0 - 200	Low
		200 - 700	Moderate
		700 - 1500	Severe
		> 1500	Very Severe
Normal Grade Steel	Resistivity	1-1000	Very Severe
		1000-2000	Severe
		2000-10,000	Moderate
		10,000+	Low

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Project No: LP05191

Selected Chemical Analyses Results

Plate C-3

APPENDIX D

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: *LP05191* ***Location:*** *See Site and Exploration Plan*

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-1 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	1.00	11.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	5.50	6.50	
2		10	20	12.00	6.00	6.00	
3		10	30	12.00	6.50	5.50	
4		10	40	12.00	6.75	5.25	
5		10	50	12.00	6.50	5.50	
6		10	60	12.00	7.00	5.00	**2.00**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-2 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	1.00	11.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.50	4.50	
2		10	20	12.00	8.00	4.00	
3		10	30	12.00	8.25	3.75	
4		10	40	12.00	7.75	4.25	
5		10	50	12.00	8.00	4.00	
6		10	60	12.00	8.50	3.50	**2.86**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-3 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	1.00	11.00	
2		30	60	12.00	2.00	10.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.50	4.50	
2		10	20	12.00	6.00	6.00	
3		10	30	12.00	6.50	5.50	
4		10	40	12.00	7.00	5.00	
5		10	50	12.00	6.75	5.25	
6		10	60	12.00	7.25	4.75	**2.11**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC
Date Excavated: 07/15/05
Project: APN'S:621-231-010 & 011-Twentynine Palms, CA
Technician: JB
Job No.: LP05191
Location: See Site and Exploration Plan
Date Tested: 07/29/05
Soil Type: Silty Sand (SM)
Test Hole No.: P-4
Total Depth of Test Hole: 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	1.00	11.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	6.50	5.50	
2		10	20	12.00	6.75	5.25	
3		10	30	12.00	6.25	5.75	
4		10	40	12.00	6.50	5.50	
5		10	50	12.00	7.00	5.00	
6		10	60	12.00	6.75	5.25	**1.90**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-5 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	2.00	10.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	8.50	3.50	
2		10	20	12.00	8.00	4.00	
3		10	30	12.00	8.00	4.00	
4		10	40	12.00	8.75	3.25	
5		10	50	12.00	8.50	3.50	
6		10	60	12.00	9.00	3.00	**3.33**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-6 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	1.00	11.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	6.00	6.00	
2		10	20	12.00	5.50	6.50	
3		10	30	12.00	5.25	6.75	
4		10	40	12.00	6.00	6.00	
5		10	50	12.00	6.50	5.50	
6		10	60	12.00	6.25	5.75	**1.74**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC
Date Excavated: 07/15/05
Project: APN'S:621-231-010 & 011-Twentynine Palms, CA
Technician: JB
Job No.: LP05191
Location: See Site and Exploration Plan
Date Tested: 07/29/05
Soil Type: Silty Sand (SM)
Test Hole No.: P-7
Total Depth of Test Hole: 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	1.00	11.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	8.75	3.25	
2		10	20	12.00	9.50	2.50	
3		10	30	12.00	9.00	3.00	
4		10	40	12.00	8.75	3.25	
5		10	50	12.00	10.00	2.00	
6		10	60	12.00	10.00	2.00	**5.00**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-8 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	1.00	11.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.00	5.00	
2		10	20	12.00	6.75	5.25	
3		10	30	12.00	7.00	5.00	
4		10	40	12.00	6.50	5.50	
5		10	50	12.00	7.25	4.75	
6		10	60	12.00	7.00	5.00	**2.00**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-9 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	3.75	8.25	
2		10	20	12.00	8.00	4.00	
3		10	30	12.00	4.50	7.50	
4		10	40	12.00	5.00	7.00	
5		10	50	12.00	4.50	7.50	
6		10	60	12.00	4.75	7.25	**1.38**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-10 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	6.00	6.00	
2		10	20	12.00	6.50	5.50	
3		10	30	12.00	7.00	5.00	
4		10	40	12.00	6.75	5.25	
5		10	50	12.00	7.25	4.75	
6		10	60	12.00	7.00	5.00	**2.00**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-11 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.00	5.00	
2		10	20	12.00	6.75	5.25	
3		10	30	12.00	6.25	5.75	
4		10	40	12.00	6.50	5.50	
5		10	50	12.00	6.50	5.50	
6		10	60	12.00	7.00	5.00	**2.00**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-11 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	1.00	11.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.50	4.50	
2		10	20	12.00	8.00	4.00	
3		10	30	12.00	8.00	4.00	
4		10	40	12.00	7.50	4.50	
5		10	50	12.00	8.00	4.00	
6		10	60	12.00	8.25	3.75	**2.67**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-13 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.00	5.00	
2		10	20	12.00	6.50	5.50	
3		10	30	12.00	7.25	4.75	
4		10	40	12.00	7.50	4.50	
5		10	50	12.00	7.25	4.75	
6		10	60	12.00	7.75	4.25	**2.35**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** *See Site and Exploration Plan*

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-14 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	5.50	6.50	
2		10	20	12.00	5.50	6.50	
3		10	30	12.00	5.50	6.50	
4		10	40	12.00	5.50	6.50	
5		10	50	12.00	5.50	6.50	
6		10	60	12.00	5.50	6.50	**1.54**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-15 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.00	5.00	
2		10	20	12.00	7.00	5.00	
3		10	30	12.00	7.00	5.00	
4		10	40	12.00	7.00	5.00	
5		10	50	12.00	7.00	5.00	
6		10	60	12.00	7.00	5.00	**2.00**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-16 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.50	4.50	
2		10	20	12.00	7.50	4.50	
3		10	30	12.00	7.50	4.50	
4		10	40	12.00	7.50	4.50	
5		10	50	12.00	7.50	4.50	
6		10	60	12.00	7.50	4.50	**2.22**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-17 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.00	5.00	
2		10	20	12.00	7.00	5.00	
3		10	30	12.00	7.00	5.00	
4		10	40	12.00	7.00	5.00	
5		10	50	12.00	7.00	5.00	
6		10	60	12.00	7.00	5.00	**2.00**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-18 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.50	4.50	
2		10	20	12.00	7.50	4.50	
3		10	30	12.00	7.50	4.50	
4		10	40	12.00	7.50	4.50	
5		10	50	12.00	7.50	4.50	
6		10	60	12.00	7.50	4.50	**2.22**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-19 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.00	5.00	
2		10	20	12.00	7.00	5.00	
3		10	30	12.00	7.00	5.00	
4		10	40	12.00	7.00	5.00	
5		10	50	12.00	7.00	5.00	
6		10	60	12.00	7.00	5.00	**2.00**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-20 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.50	4.50	
2		10	20	12.00	7.50	4.50	
3		10	30	12.00	8.00	4.00	
4		10	40	12.00	8.00	4.00	
5		10	50	12.00	8.00	4.00	
6		10	60	12.00	8.00	4.00	**2.50**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-21 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.50	4.50	
2		10	20	12.00	7.50	4.50	
3		10	30	12.00	8.00	4.00	
4		10	40	12.00	8.00	4.00	
5		10	50	12.00	8.00	4.00	
6		10	60	12.00	8.00	4.00	**2.50**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-22 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.50	4.50	
2		10	20	12.00	7.50	4.50	
3		10	30	12.00	7.50	4.50	
4		10	40	12.00	8.00	4.00	
5		10	50	12.00	8.00	4.00	
6		10	60	12.00	8.00	4.00	**2.50**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-23 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.50	4.50	
2		10	20	12.00	7.50	4.50	
3		10	30	12.00	7.50	4.50	
4		10	40	12.00	7.50	4.50	
5		10	50	12.00	7.50	4.50	
6		10	60	12.00	7.50	4.50	**2.22**

LANDMARK CONSULTANTS, INC.

SUMMARY OF PERCOLATION TESTING

Client: Sunwest Development, LLC **Date Excavated:** 07/15/05

Project: APN'S:621-231-010 & 011-Twentynine Palms, CA **Technician:** JB

Job No.: LP05191 **Location:** See Site and Exploration Plan

Date Tested: 07/29/05 **Soil Type:** Silty Sand (SM)

Test Hole No.: P-24 **Total Depth of Test Hole:** 3.0 ft

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Fall in Water Level (in)	
1		30	30	12.00	0.00	12.00	
2		30	60	12.00	0.00	12.00	

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in.)	Final Water Level (in.)	Fall in Water Level (in.)	Percolation Rate (min/in)
1		10	10	12.00	7.50	4.50	
2		10	20	12.00	7.50	4.50	
3		10	30	12.00	7.50	4.50	
4		10	40	12.00	7.50	4.50	
5		10	50	12.00	8.00	4.00	
6		10	60	12.00	10.00	3.00	**3.33**

APPENDIX E

REFERENCES

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November 3, 2025

Project No. 544-25300
25-10-502

Good Standing Build Corporation
Hakeem Milbes
2525 El Camino Real, #165
Carlsbad, California

Project: Desert Knoll Residential Development
Tentative Tract No. 17168
Phase 3 & Phase 4
Twentynine Palms, California

Subject: Geotechnical Update

Ref: Geotechnical Investigation Report prepared by Landmark Consultants, Inc. dated April 12, 2005; LCI Report No. LP05191

In accordance with your request, we have reviewed the above referenced Geotechnical Investigation report as it relates to the design and construction of the proposed Desert Knoll Residential Development (identified as Tentative Tract No. 17168). The project site is located on the northeast corner of Two Mile Road and Desert Knoll Avenue in the City of Twentynine Palms, California. It is our understanding that the proposed residential structures will be of relatively lightweight wood-frame construction and will be supported by conventional shallow spread footings and concrete slabs on grade.

The referenced report includes recommendations pertaining to the design and construction of residential structure foundations. Based upon our review of the referenced report, our previous experience on the project site and our understanding of the proposed construction, it is our opinion that the structural values and remedial grading recommendations included in this report remain applicable for use in the design and construction of the proposed residential structures, except as amended herein.

The proposed residential structures may be supported upon conventional shallow spread footings. Conventional shallow spread footings should be bottomed into properly compacted engineered fill soil a minimum of 12 inches below lowest adjacent grade. Continuous footings should be at least 12 inches wide and isolated pad footings should be at least 2 feet wide. Continuous footings and isolated pad footings may be designed utilizing allowable bearing pressures of 1500 psf. Allowable increases of 250 psf for each additional 1 foot of width and 250 psf for each additional 6 inches of depth may be utilized, if desired. The maximum allowable bearing pressure should be 2500 psf. The recommended allowable bearing pressures are intended for combined dead and sustained live loads and may be increased by one-third when considering wind and seismic loading.

Static settlement resulting from the anticipated foundation loads should be tolerable provided that the recommendations included in this report are considered in foundation design and construction. The ultimate static settlement is expected to be less than 1.0 inch when using the recommended allowable foundation bearing pressures. As a practical matter, differential static settlement between footings can be assumed as one-half of the total static settlement.

Lateral forces may be resisted by friction along the base of the foundations and passive resistance along the sides of the footings. A friction coefficient of 0.40 times the normal dead load forces is recommended for use in design. Passive resistance may be estimated using an equivalent fluid weight of 300 pcf. If used in combination with the passive resistance, the frictional resistance should be reduced by one third.

The bearing soil is non-expansive and falls within the "very low" expansion category in accordance with 2022 California Building Code (CBC) classification criteria. Slab thickness and reinforcement should be determined by the structural engineer. We recommend a minimum floor slab thickness of 4.0 inches and minimum reinforcement of #3 bars at 24 inches on center in both directions. All slab reinforcement should be supported on concrete chairs to ensure that reinforcement is placed at slab mid-height.

Slabs with moisture sensitive surfaces should be underlain with a moisture vapor retarder consisting of a polyvinyl chloride membrane such as 10-mil Visqueen, or equivalent. All laps within the membrane should be sealed and at least 2 inches of clean sand should be placed over the membrane to promote uniform curing of the concrete. To reduce the potential for punctures, the membrane should be placed on a pad surface that has been graded smooth without any sharp protrusions. If a smooth surface cannot be achieved by grading, consideration should be given to placing a thin leveling course of sand across the pad surface prior to placement of the membrane.

Minor retaining walls may be necessary to accomplish the proposed construction. Lateral pressures for use in retaining wall design can be estimated using an equivalent fluid weight of 35 pcf for level free-draining native backfill conditions. For walls that are to be restrained at the top, the equivalent fluid weight should be increased to 55 pcf for level free-draining native backfill conditions. Back drains should be provided for the full height of the walls. Seismic pressures should be incorporated into any retaining walls greater than 6 feet in height. Seismic deign pressures may be provided once specific wall heights and locations are known.

The seismic design category for a structure may be determined in accordance with Section 1613 of the 2022 CBC or ASCE7-16. According to the 2022 CBC, Site Class D measured may be used to estimate design seismic loading for the proposed structures. The 2022 CBC Site Specific Seismic Hazard Analyses are attached. The project Structural Engineer should verify that all design parameters provided are applicable for the subject project.

To provide firm and uniform foundation bearing conditions, the primary foundation bearing soil should be over-excavated and recompacted. Over-excavation should extend to a minimum depth of 3 feet below existing grade or 2 feet below the bottom of the footings, whichever is deeper. Once adequate removals have been verified, the exposed native soil should be moisture conditioned to near optimum moisture content and compacted to at least 90 percent relative compaction. The previously removed material may then be placed in thin lifts at near optimum moisture content and compacted to at least 90 percent relative compaction compacted engineered fill. Removals should extend at least 5 feet laterally beyond the footing limits.

We appreciate the opportunity to provide service to you on this project. If you have any questions regarding this letter or the referenced report, please contact the undersigned.

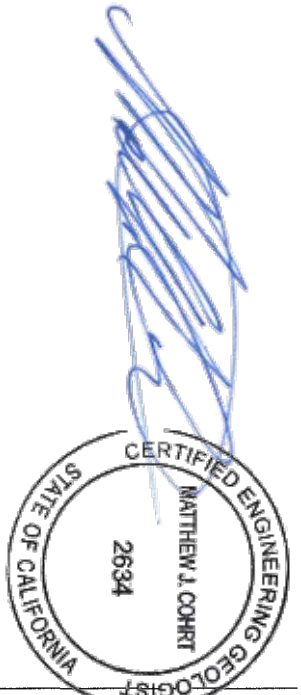
Respectfully submitted,
SLADDEN ENGINEERING

Brett L. Anderson
Principal Engineer

Matthe
Princ Geologist

SER/cg

Copies: pdf/ Addressee



SITE-SPECIFIC GROUND MOTION ANALYSIS
(ASCE 7-16)

Project: Desert Knoll Development; Tentative Tract No. 17168; Phase 3 and Phase 4
Project Number: 544-25300
Client: Good Standing Build Corporation
Site Lat/Long: 34.1547/-116.0444
Controlling Seismic Source: Pisgah-Bullion Mtn-Mesquite Lake

REFERENCE	NOTATION	VALUE
Site Class	C, D, D default, or E	D measured
Site Class D - Table 11.4-1	F_a	1.0
Site Class D - 21.3(ii)	F_v	2.5
$0.2*(S_{D1}/S_{DS})$	T_0	0.186
S_{D1}/S_{DS}	T_S	0.930
Fundamental Period (12.8.2)	T	Period
Seismic Design Maps or Fig 22-14	T_L	8
Equation 11.4-4 - $2/3*S_{M1}$	S_{D1}	1.0717
Equation 11.4-2 - F_V*S_1 [1]	S_{M1}	1.6075

[1] - F_V as determined by Section 21.3

REFERENCE	NOTATION	VALUE
Fv (Table 11.4-2)[Used for General Spectrum]	F_v	1.7
Design Maps	S_s	1.728
Design Maps	S_1	0.643
Equation 11.4-1 - F_A*S_S	S_{MS}	1.728*
Equation 11.4-3 - $2/3*S_{MS}$	S_{DS}	1.152*
Design Maps	PGA	0.775
Table 11.8-1	F_{PGA}	1.1
Equation 11.8-1 - $F_{PGA}*PGA$	PGA_M	0.853*
Section 21.5.3	80% of PGA_M	0.682
Design Maps	C_{RS}	0.887
Design Maps	C_{R1}	0.886

REFERENCE	NOTATION	VALUE
$0.2*(S_{D1}/S_{DS})$	T_0	0.127*
S_{D1}/S_{DS}	T_S	0.633*
Equation 11.4-4 - $2/3*S_{M1}$	S_{D1}	0.7287*
Equation 11.4-2 - F_V*S_1	S_{M1}	1.0931*

RISK COEFFICIENT

Cr - At Perods <=0.2, Cr=C_{RS}	C_{RS}	0.887
Cr - At Periods >=1.0, Cr=C_{R1}	C_{R1}	0.886

Cr - At Periods between 0.2 and 1.0 use trendline formula to complete

Period	Cr
0.200	0.887
0.300	0.887
0.400	0.887
0.500	0.887
0.600	0.887
0.680	0.886
1.000	0.886

* Code based design value. See accompanying data for Site Specific Design values.

Mapped values from https://hazards.atcouncil.org/
https://www.seismicmaps.org/

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PROBABILISTIC SPECTRA[1]
2% in 50 year Exceedence

Project No: 544-25300

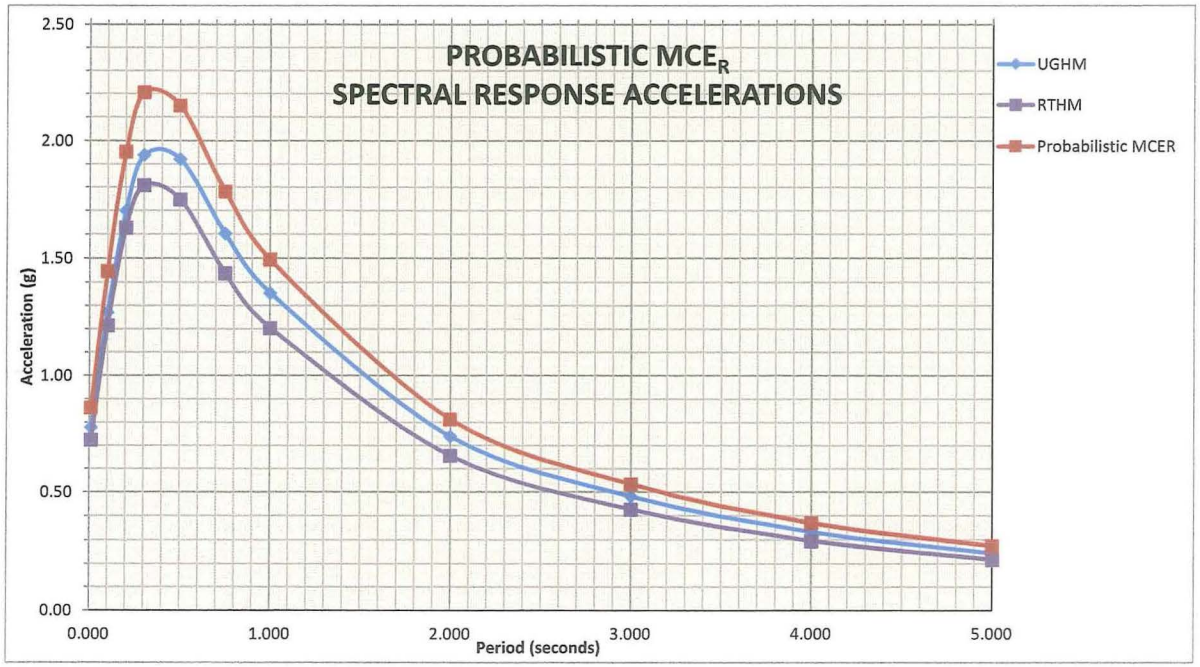
Period	UGHM	RTGM	Max Directional Scale Factor[2]	Probabilistic MCE
0.010	0.778	0.725	1.19	0.863
0.100	1.269	1.215	1.19	1.446
0.200	1.699	1.627	1.20	1.952
0.300	1.940	1.809	1.22	2.207
0.500	1.921	1.747	1.23	2.149
0.750	1.602	1.437	1.24	1.782
1.000	1.354	1.205	1.24	1.494
2.000	0.739	0.656	1.24	0.813
3.000	0.481	0.426	1.25	0.533
4.000	0.332	0.295	1.25	0.369
5.000	0.244	0.217	1.26	0.273

[1] Data Sources:
https://earthquake.usgs.gov/hazards/interactive/
https://earthquake.usgs.gov/designmaps/rtgm/

[2] Shahi-Baker RotD100/RotD50 Factors (2014)

Probabilistic PGA: 0.778

Is Probabilistic $Sa_{(max)} < 1.2F_a$? NO



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DETERMINISTIC SPECTRUM

Largest Amplitudes of Ground Motions Considering All Sources Calculated using Weighted Mean of Attenuation Equations[1]

Controlling Source: Pisgah-Bullion Mtn-Mesquite Lake

Is Probabilistic $Sa_{(max)}$<1.2Fa? NO

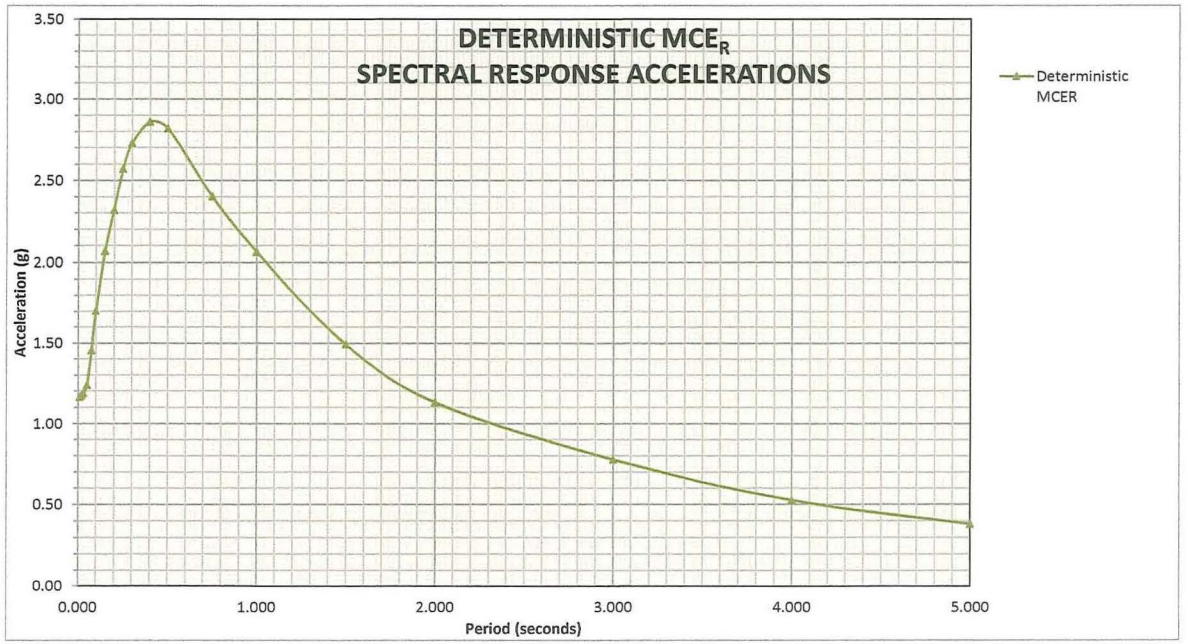
Period	Deterministic PSa Median + 1.σ for 5% Damping	Max Directional Scale Factor[2]	Deterministic MCE	Section 21.2.2 Scaling Factor Applied
0.010	0.977	1.19	1.163	1.163
0.020	0.985	1.19	1.172	1.172
0.030	0.997	1.19	1.186	1.186
0.050	1.039	1.19	1.236	1.236
0.075	1.221	1.19	1.452	1.452
0.100	1.430	1.19	1.701	1.701
0.150	1.723	1.20	2.068	2.068
0.200	1.931	1.20	2.317	2.317
0.250	2.124	1.21	2.570	2.570
0.300	2.237	1.22	2.729	2.729
0.400	2.326	1.23	2.860	2.860
0.500	2.292	1.23	2.819	2.819
0.750	1.936	1.24	2.400	2.400
1.000	1.663	1.24	2.062	2.062
1.500	1.202	1.24	1.490	1.490
2.000	0.911	1.24	1.129	1.129
3.000	0.620	1.25	0.775	0.775
4.000	0.419	1.25	0.523	0.523
5.000	0.303	1.26	0.382	0.382

Project No: 544-25300

Is Determinstic $Sa_{(max)}$<1.5*Fa?	NO
Section 21.2.2 Scaling Factor:	N/A
Deterministic PGA:	0.977
Is Deterministic PGA >=F_{PGA}*0.5?	YES

[1] NGAWest 2 GMPE worksheet and Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3) - Time Dependent Model

[2] Shahi-Baker RotD100/RotD50 Factors (2014)



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SITE SPECIFIC SPECTRA

Period	Probabilistic MCE	Deterministic MCE	Site-Specific MCE	Design Response Spectrum (Sa)
0.010	0.863	1.163	0.863	0.575
0.100	1.446	1.701	1.446	0.964
0.200	1.952	2.317	1.952	1.302
0.300	2.207	2.729	2.207	1.471
0.500	2.149	2.819	2.149	1.433
0.750	1.782	2.400	1.782	1.188
1.000	1.494	2.062	1.494	0.996
2.000	0.813	1.129	0.813	0.542
3.000	0.533	0.775	0.533	0.355
4.000	0.369	0.523	0.369	0.246
5.000	0.273	0.382	0.273	0.182

ASCE 7-16: Section 21.4
Site Specific

	Calculated Value	Design Value
SDS:	1.324	1.324
SD1:	1.085	1.085
SMS:	1.986	1.986
SM1:	1.627	1.627
Site Specific PGAm:	0.778	0.778
Site Class:	D measured	

Seismic Design Category - Short* D
Seismic Design Category - 1s* D
* Risk Categories I, II, or III

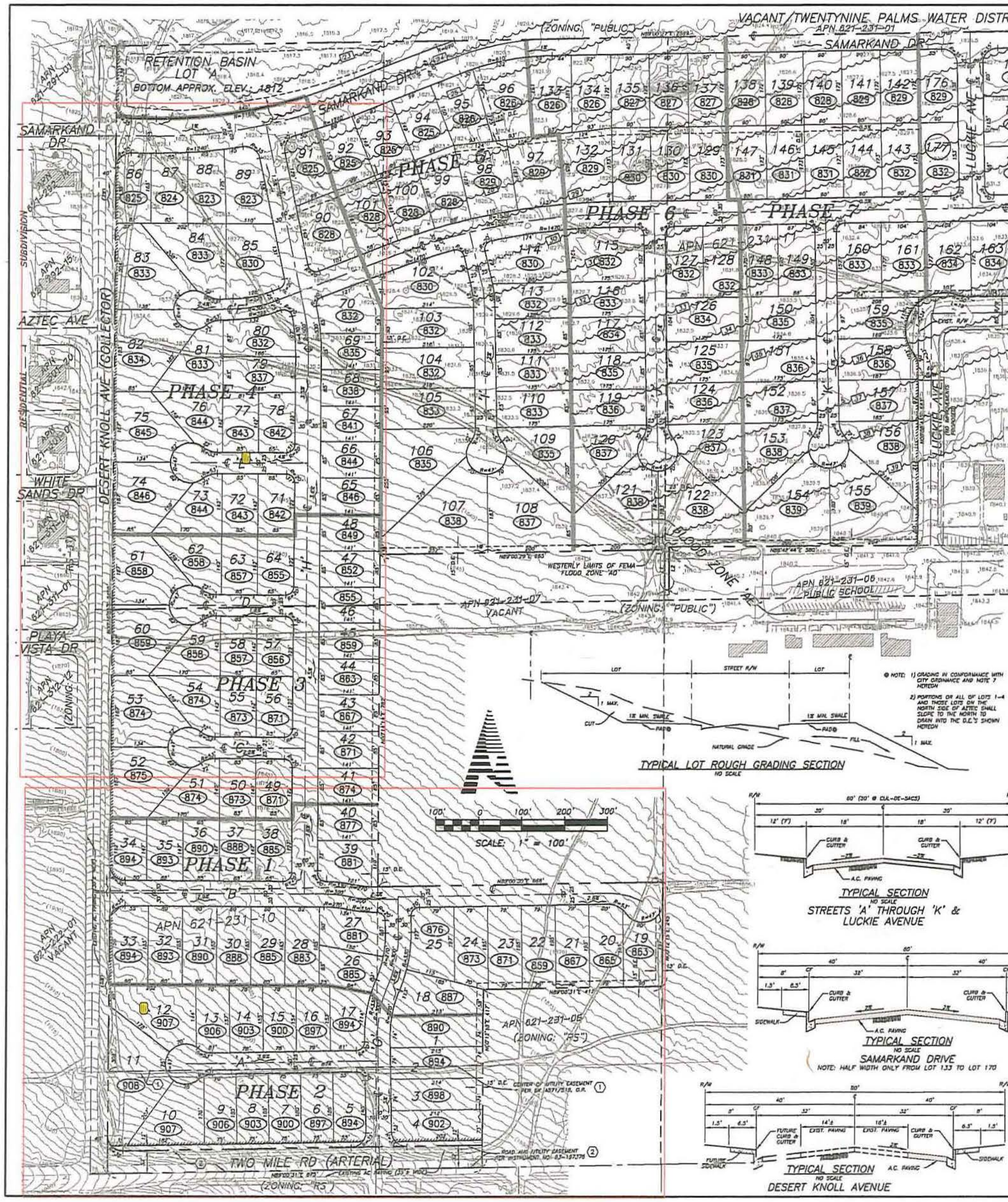
Period	ASCE 7 SECTION 21.3 General Spectrum	80% General Response Spectrum
0.005	0.479	0.384
0.010	0.498	0.398
0.020	0.535	0.428
0.030	0.572	0.458
0.050	0.647	0.517
0.060	0.684	0.547
0.075	0.739	0.592
0.090	0.795	0.636
0.100	0.832	0.666
0.110	0.869	0.696
0.120	0.907	0.725
0.136	0.966	0.773
0.150	1.018	0.814
0.160	1.055	0.844
0.170	1.092	0.874
0.180	1.130	0.904
0.200	1.152	0.922
0.250	1.152	0.922
0.300	1.152	0.922
0.400	1.152	0.922
0.500	1.152	0.922
0.600	1.152	0.922
0.640	1.152	0.922
0.750	1.152	0.922
0.850	1.152	0.922
0.900	1.152	0.922
0.930	1.152	0.922
1.000	1.072	0.857
1.500	0.714	0.572
2.000	0.536	0.429
3.000	0.357	0.286
4.000	0.268	0.214
5.000	0.214	0.171

IN THE CITY OF TWENTYNINE PALMS, COUNTY OF SAN BERNARDINO

TENTATIVE TRACT NO. 17168

~~JANUARY 17, 2005~~

MAY 5, 2005



● NOTE: 1) GRADING IN CONFORMANCE WITH CITY ORDINANCE AND NOTE 7 HEREON

2) PORTIONS OR ALL OF LOTS 1–4 AND THOSE LOTS ON THE NORTH SIDE OF AZTEC SHALL SLOPE TO THE NORTH TO DRAIN INTO THE D.E.'S SHOWN HEREON

LEGAL DESCRIPTION

APN 621-231-10

THE SOUTHWEST 1/4 OF THE SOUTHEAST 1/4 OF SECTION 21, TOWNSHIP 1 NORTH, RANGE 9 EAST, SAN BERNARDINO BASE AND MERIDIAN.

EXCEPTING THEREFROM THE EAST 417.4 FEET OF THE SOUTH 417.4 FEET.

ALSO EXCEPTING THEREFROM THE NORTHEAST 1/4 OF THE SOUTHWEST 1/4 OF THE SOUTHEAST 1/4 OF SAID SECTION.

ALSO EXCEPTING THEREFROM THE WEST 40 FEET AS CONVEYED TO COUNTY OF SAN BERNARDINO FOR HIGHWAY PURPOSES BY DEED RECORDED JULY 28, 1960 AS INSTRUMENT NO. 606, OF OFFICIAL RECORDS OF SAN BERNARDINO COUNTY, CALIFORNIA.

APN 621-231-11

THE NORTH 1/2 OF THE SOUTHEAST 1/4 OF SECTION 21, TOWNSHIP 1 NORTH, RANGE 9 EAST, SAN BERNARDINO BASE AND MERIDIAN.

EXCEPTING THE SOUTH 25 FEET OF THE EAST 1/2 OF THE NORTH 1/2 OF THE SOUTHEAST 1/4 AND EXCEPTING COMMENCING NORTH 00° 8' 10" EAST 1433.82 FEET FROM THE SOUTHEAST CORNER OF SAID SECTION 21;

THENCE SOUTH 89° 41' 41" WEST 383.24 FEET;

THENCE NORTH 00° 24' 43" WEST 259.00 FEET;

THENCE NORTH 89° 38' 58" EAST 367.92 FEET TO THE EAST LINE OF SAID SECTION;

THENCE SOUTH 00° 8' 10" WEST 259.05 FEET TO THE POINT OF BEGINNING.

ALSO EXCEPTING THE EAST 80 FEET FOR COUNTY ROADS.

ALSO EXCEPTING COMMENCING NORTH 00° 8' 10" EAST 1433.82 FEET FROM THE SOUTHEAST CORNER OF SAID SECTION;

THENCE SOUTH 89° 41' 41" WEST 30.00 FEET TO THE TRUE POINT OF BEGINNING;

THENCE CONTINUING SOUTH 89° 41' 41" WEST 1270 FEET;

THENCE SOUTH TO A POINT WHICH IS 685 FEET NORTH OF SAID LINE OF NORTH 3/4 SAID SOUTHEAST 1/4;

THENCE EASTERLY TO A POINT WHICH IS 30.00 FEET WESTERLY OF THE EAST LINE OF SAID SECTION;

THENCE NORTHERLY TO THE POINT OF BEGINNING.

ALSO EXCEPTING THEREFROM THE SOUTH 119.73 FEET OF THE SOUTHEAST 1/4 OF THE NORTHWEST 1/4 OF THE SOUTHEAST 1/4 OF SAID SECTION.

ALSO EXCEPTING THEREFROM THAT PORTION OF THE SOUTH 1/2 OF THE NORTHEAST 1/4 OF THE SOUTHEAST 1/4 OF SECTION 21, TOWNSHIP 1 NORTH, RANGE 9 EAST, SAN BERNARDINO BASE AND MERIDIAN, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT IN THE EAST LINE OF THE SOUTHEAST 1/4 OF SAID SECTION 21 WHICH IS SOUTH 00° 8' 58" WEST A DISTANCE OF 662.52 FEET FROM THE NORTHEAST CORNER OF THE SOUTHEAST 1/4 OF SECTION 21;

THENCE SOUTH 89° 00' 12" WEST ALONG THE NORTH LINE OF SAID SOUTH 1/2 OF THE NORTHEAST 1/4 OF THE SOUTHEAST 1/4 OF SECTION 21, A DISTANCE OF 710.12 FEET;

THENCE SOUTH 00° 08' 58" WEST A DISTANCE OF 543.02 FEET, MORE OR LESS, TO THE NORTH LINE OF PROPERTY OWNED BY MORONGO UNIFIED SCHOOL DISTRICT;

THENCE NORTH 89° 42' 27" EAST ALONG SAID NORTH LINE A DISTANCE OF 344.75 FEET, MORE OR LESS TO THE SOUTHWEST CORNER OF PROPERTY OWNED BY CAROLYN K. PRATT;

THENCE NORTH 00° 26' 38" WEST ALONG THE WEST LINE OF SAID PRATT PROPERTY A DISTANCE OF 259 FEET, MORE OR LESS, TO THE NORTHWEST CORNER THEREOF;

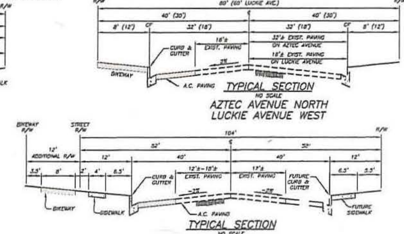
THENCE NORTH 89° 42' 02" EAST ALONG THE NORTH LINE OF SAID PRATT PROPERTY A DISTANCE OF 357.82 FEET, MORE OR LESS, TO THE EAST LINE OF SAID SECTION 21;

THENCE NORTH 00° 8' 58" EAST ALONG SAID EAST LINE WHICH IS THE CENTERLINE OF UTAH TRAIL A DISTANCE OF 292.69 FEET, MORE OR LESS, TO THE TRUE POINT OF BEGINNING.

ALSO EXCEPTING THEREFROM THE EAST 740 FEET OF THE SOUTH 40 FEET OF THE NORTH 1/2 OF THE NORTHEAST 1/4 OF THE SOUTHEAST 1/4 OF SAID SECTION.

ALSO EXCEPTING THEREFROM THE NORTH 543.2 FEET OF THE WEST 30 FEET TO THE EAST 740 FEET OF THE SOUTH 1/2 OF THE NORTHEAST 1/4 OF THE SOUTHEAST 1/4 OF SAID SECTION AS CONVEYED TO THE COUNTY OF SAN BERNARDINO FOR HIGHWAY PURPOSES BY DEED RECORDED MARCH 4, 1964 AS INSTRUMENT NO. 615.

ALSO EXCEPTING THEREFROM THE WEST 40 FEET OF THE SOUTHEAST 1/4 OF SAID SECTION AS CONVEYED TO THE COUNTY OF SAN BERNARDINO FOR HIGHWAY PURPOSES BY DEED RECORDED JULY 28, 1960 AS INSTRUMENT NO. 606, OF OFFICIAL RECORDS OF SAN BERNARDINO COUNTY, CALIFORNIA.



PREPARED BY:

Warner engineering
CIVIL ENGINEERING / PLANNING / LAND SURVEYING

7245 JOSHUA LANE
YUCCA VALLEY, CALIFORNIA 92284
PHONE: (760)365-7638 FAX: (760)365-2146

REGISTERED PROFESSIONAL ENGINEER WILLIAM H. WARNER No. 23256 Exp. 12/31/05 CIVIL STATE OF CALIFORNIA

SUBDIVIDER/APPLICANT

SUNWEST29, LLC
ATTN: STEVE ENOCHS
29371 MODJESKA CANYON RD.
SILVERADO, CA 92676
(714) 649-2763

OWNER OF RECORD

SUNWEST DEVELOPMENT, LLC
29371 MODJESKA CANYON RD.
SILVERADO, CA 92676

ZONING

RS-3

TOTAL ACREAGE

87.70 ACRES

ASSESSOR'S PARCEL NUMBERS

621-231-10 AND 11

PROPOSED LAND USE

177 – LOT SINGLE FAMILY RESIDENTIAL SUBDIVISION IN UP TO 8 PHASES

LEGEND

- [39] INDICATES BFE FROM FEMA FIRM
- / / / / / INDICATES PROPOSED NON-VEHICULAR ACCESS
- INDICATES DRAINAGE FLOW ARROW WITH APPROXIMATE GRADIENT (WHERE SHOWN)
- INDICATES TRACT BOUNDARY
- (842) APPROXIMATE PAD ELEVATION
- N.B.A. INDICATES NO-BUILD AREA
- —12" W— EXISTING 12" WATER MAIN (APPROX. LOCATION)
- —W— EXISTING 4" WATER MAIN (APPROX. LOCATION)
- BSL INDICATES PROPOSED BUILDING SETBACK LINE
- PROPOSED PHASE LINE
- INDICATES EASEMENT
- D.E. INDICATES PROPOSED DRAINAGE EASEMENT (APPROX. WIDTH SHOWN)
- —I— INDICATES EXISTING UTILITY LINE
- —(1840)— INDICATES APPROX. EXISTING GROUND CONTOUR

EASEMENT DATA

① THE SOUTHWEST 1/4 OF THE SOUTHEAST 1/4 OF SECTION 21, TOWNSHIP 1 NORTH, RANGE 9 EAST, SAN BERNARDINO BASE AND MERIDIAN.

EXCEPTING THEREFROM THE SOUTH 417.4 FEET OF THE EAST 417.4 FEET AND THE NORTHEAST 1/4 OF.

THE CENTERLINE OF THE 10 FOOT EASEMENT HEREBY GRANTED IS DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE WEST LINE OF THE SOUTHWEST 1/4 OF THE SOUTHEAST 1/4 OF SAID SECTION 21, SAID POINT BEING 240 FEET DISTANT FROM THE SOUTHWEST CORNER THEREOF AND RUNNING THENCE EASTERLY IN A STRAIGHT LINE 240 FEET DISTANT FROM AND PARALLEL TO THE SOUTH LINE OF SAID SECTION 21 TO THE EAST LINE OF SAID PARCEL.

② THE SOUTH 52 FEET AS MEASURED AT RIGHT ANGLES, OF THE SOUTHWEST 1/4 OF THE SOUTHEAST 1/4 OF SECTION 21, TOWNSHIP 1 NORTH, RANGE 9 EAST, SAN BERNARDINO BASE AND MERIDIAN.

EXCEPTING THEREFROM THE EAST 417.4 FEET THEREOF, AND ALSO EXCEPTING THEREFROM THE WEST 40 FEET THEREOF AS CONVEYED TO THE COUNTY OF SAN BERNARDINO FOR HIGHWAY PURPOSES BY DEED RECORDED JULY 28, 1960 AS INSTRUMENT NO. 606, OFFICIAL RECORDS OF SAN BERNARDINO COUNTY, CALIFORNIA.

③ THE WEST 2 FEET AS MEASURED AT RIGHT ANGLES, OF THE EAST 52 FEET, AS MEASURED AT RIGHT ANGLES, OF THE SOUTHEAST 1/4 OF SECTION 21, TOWNSHIP 1 NORTH, RANGE 9 EAST, SAN BERNARDINO BASE AND MERIDIAN

EXCEPTING THEREFROM THE SOUTH 40 FEET THEREOF.

④ A RIGHT OF WAY FOR DITCHES AND CANALS AS RESERVED BY THE UNITED STATES OF AMERICA IN THE PATENT RECORDED APRIL 21, 1930 IN BOOK 607, PAGE 252 OF OFFICIAL RECORDS. AFFECTS THE SUBJECT PROPERTY

LINE TABLE

NO.	BEARING	LENGTH
L1	N00°12'18"E	94.75'
L2	N00°00'00"E	102.01'
L3	N89°00'29"E	10.53'

NOTES:

1) THERE ARE 177 NUMBERED LOTS AND 2 LETTERED LOT PROPOSED
2) NEW PUBLIC STREET LENGTH: 11,080±ft
3) MINIMUM LOT SIZE: 12,000 SF
   MAXIMUM LOT SIZE: 38,316 SF
   AVERAGE LOT SIZE: 18,987 SF
4) LOT DENSITY 2 LOTS/ACRE

LOT	SQ. FT.	ACRES	LOT	SQ. FT.	ACRES
1	[illegible]	0.37	89	[illegible]	[illegible]
2	[illegible]	[illegible]	90	17,974	0.41
3	15,774	0.36	91	[illegible]	0.32
4	[illegible]	[illegible]	92	[illegible]	[illegible]
5	[illegible]	[illegible]	93	[illegible]	[illegible]
6	[illegible]	[illegible]	94	[illegible]	[illegible]
7	[illegible]	[illegible]	95	[illegible]	[illegible]
8	[illegible]	[illegible]	96	[illegible]	[illegible]
9	[illegible]	[illegible]	97	[illegible]	[illegible]
10	[illegible]	[illegible]	98	[illegible]	[illegible]
11	[illegible]	[illegible]	99	[illegible]	[illegible]
12	[illegible]	[illegible]	100	[illegible]	[illegible]
13	[illegible]	[illegible]	101	[illegible]	[illegible]
14	[illegible]	[illegible]	102	[illegible]	[illegible]
15	[illegible]	[illegible]	103	[illegible]	[illegible]
16	[illegible]	[illegible]	104	[illegible]	[illegible]
17	[illegible]	[illegible]	105	[illegible]	[illegible]
18	[illegible]	[illegible]	106	[illegible]	[illegible]
19	[illegible]	[illegible]	107	[illegible]	[illegible]
20	[illegible]	[illegible]	108	[illegible]	[illegible]
21	[illegible]	[illegible]	109	[illegible]	[illegible]
22	[illegible]	[illegible]	110	[illegible]	[illegible]
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27	[illegible]	[illegible]	115	[illegible]	[illegible]
28	[illegible]	[illegible]	116	[illegible]	[illegible]
29	[illegible]	[illegible]	117	[illegible]	[illegible]
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31	[illegible]	[illegible]	119	[illegible]	[illegible]
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34	[illegible]	[illegible]	122	[illegible]	[illegible]
35	[illegible]	[illegible]	123	[illegible]	[illegible]
36	[illegible]	[illegible]	124	16,914	[illegible]
37	[illegible]	[illegible]	125	16,914	[illegible]
38	[illegible]	[illegible]	126	[illegible]	[illegible]
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52	21,143	[illegible]	140	[illegible]	[illegible]
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55	[illegible]	[illegible]	143	[illegible]	[illegible]
56	[illegible]	[illegible]	144	[illegible]	[illegible]
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58	[illegible]	[illegible]	146	[illegible]	[illegible]
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60	[illegible]	[illegible]	148	[illegible]	0.34
61	[illegible]	[illegible]	149	14,720	0.34
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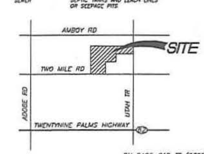
63	[illegible]	[illegible]	151	16,914	[illegible]
64	[illegible]	[illegible]	152	16,914	[illegible]
65	[illegible]	[illegible]	153	[illegible]	[illegible]
66	[illegible]	[illegible]	154	[illegible]	[illegible]
67	[illegible]	[illegible]	155	[illegible]	[illegible]
68	[illegible]	[illegible]	156	[illegible]	[illegible]
69	[illegible]	[illegible]	157	[illegible]	[illegible]
70	[illegible]	[illegible]	158	[illegible]	[illegible]
71	[illegible]	[illegible]	159	[illegible]	[illegible]
72	[illegible]	[illegible]	160	[illegible]	[illegible]
73	[illegible]	[illegible]	161	[illegible]	0.41
74	[illegible]	[illegible]	162	[illegible]	[illegible]
75	[illegible]	[illegible]	163	[illegible]	[illegible]
76	[illegible]	[illegible]	164	[illegible]	[illegible]
77	[illegible]	[illegible]	165	[illegible]	0.41
78	[illegible]	[illegible]	166	[illegible]	[illegible]
79	[illegible]	[illegible]	167	[illegible]	[illegible]
80	[illegible]	[illegible]	168	[illegible]	[illegible]
81	[illegible]	0.41	169	[illegible]	[illegible]
82	[illegible]	[illegible]	170	[illegible]	[illegible]
83	[illegible]	[illegible]	171	[illegible]	[illegible]
84	[illegible]	[illegible]	172	[illegible]	[illegible]
85	[illegible]	[illegible]	173	[illegible]	[illegible]
86	[illegible]	[illegible]	174	[illegible]	[illegible]
87	[illegible]	[illegible]	175	[illegible]	[illegible]
88	15,177	0.35	176	[illegible]	0.35
			177	[illegible]	0.35

5) SEWAGE DISPOSAL METHOD: PRIVATE, INDIVIDUAL SEPTIC SYSTEMS
6) PROPOSED MINIMUM SETBACK LINES:
   FRONT: 25 FEET
   SIDE: 10 FEET
   REAR: 20 FEET
   SIDE STREET: 15 FEET
7) ALL FIRST FLOORS SHALL BE ELEVATED ABOVE THE BFE'S SHOWN HEREON AND ON THE FIRM, IN ACCORDANCE WITH THE CITY ORDINANCE AND FEMA REQUIREMENTS
8) A RIGHT OF WAY FOR DITCHES AND CANALS AS RESERVED BY THE UNITED STATES OF AMERICA IN THE PATENT RECORDED APRIL 21, 1930 IN BOOK 607, PAGE 252 OF OFFICIAL RECORDS
9) ALL UTILITIES SHALL BE INSTALLED IN ACCORDANCE WITH SECTION 19.08.070 OF THE CITY OF TWENTYNINE PALMS DEVELOPMENT CODE

UTILITY COMPANIES

WATER	TWENTY-NINE PALMS WATER DISTRICT 72401 HATCH ROAD TWENTYNINE PALMS, CA 92277 PHONE: (760) 367-7546
TELEPHONE	VERIZON ENGINEERING, CO 295 N. SUNRISE WAY PALM SPRINGS, CALIFORNIA 92262-5295 ATTENTION: LARRY MOORE PHONE: (760)778-3610
ELECTRICITY	SOUTHERN CALIFORNIA EDISON FACILITIES MAPPING, BLDG. D P.O. BOX 11982 SANTA ANA, CALIFORNIA 92711-1982 ATTENTION: ARLAN AVERY PHONE: (714)796-9920
GAS	THE GAS COMPANY ENGINEERING/LINE LOCATION P.O. BOX 3003, SC8031 REDLANDS, CALIFORNIA 92374-0306 ATTENTION: BRUCE WADDELL PHONE: (909)335-7581
TV CABLE	ADELPHIA ENGINEERING/LINE LOCATION 7500 KICKAPOO TRAIL YUCCA VALLEY, CALIFORNIA 92284 ATTENTION: LEN DUPUIS PHONE: (760)365-3378
SEWER	SEPTIC TANKS AND LEACH LINES OR SEEPAGE PITS



PN 0406-019 TT (9705)