May 31, 2006
J.N. 211-05

Mr. Richard Schlesinger
CITY OF MISSION VIEJO
200 Civic Center
Mission Viejo, CA 92691

Subject: Summary of Geotechnical Observation and Testing During Temporary Repair of the Ferrocarril Landslide, City of Mission Viejo, California.

Reference: Petra Geotechnical, Inc., 2005, Preliminary Geotechnical Investigation of the Ferrocarril Landslide, City of Mission Viejo, California, J.N. 173-05, dated September 30.

Dear Mr. Schlesinger:

In accordance with your request, we are pleased to submit this report that summarizes our geotechnical observation and testing services provided during temporary repair operations of the subject landslide conducted from December 2005 to February 2006. This work was performed in general accordance with the scope of services outlined in our Amendment Request (J.N. 211-05), dated September 6, 2005. Repairs to temporarily stabilize the landslide were conducted in February 2005 and more recently in December 2005 through February 2006.

This report addresses services that were performed during the most recent repairs and included the installation of 95 caissons along the bottom of the slope, re-grading of the slope face, placement of temporary erosion control mats, and installation of two slope inclinometers to monitor movement of the slope. The caissons and re-grading of the slope were designed by Leighton & Associates, Inc. (L&A) and reviewed by us during the course of this project. The opinions and recommendations provided in this report are based upon observations made during the aforementioned repairs, review of L&A's slope stability analyses, and the results of our recent slope inclinometer surveys.

BACKGROUND INFORMATION

The Ferrocarril landslide began moving on January 20, 2005 on an approximately 70 feet high graded slope that was constructed in 1967. The landslide covered an area of approximately ½ acre with maximum dimensions of about 275 feet wide by 140 feet long and up to 40 feet deep. The landslide impacted seven residences including 24432, 24442, 24452, 24472, 24482 and 24492 Ferrocarril and 24422 Encorvado Lane. The initial movement of the landslide began nine days after a series of heavy rainstorms swept through southern California that resulted in almost 10 inches of rain over a period of about two weeks. These storms commenced on December 28, 2004 and continued through January 11, 2005 and included heavy downpours resulting in daily totals of 1 to 2 inches. The above-average rainfall is believed to be the triggering mechanism for the landslide.

Shortly after the failure occurred, subsurface investigations were conducted in order to provide recommendations for temporary stabilization of the slope. The results of these investigations and related analyses are summarized in our report dated September 30, 2005 (see Reference). Based on the results of our preliminary engineering analyses, we recommended that soils from the upper portions of the landslide be removed and placed along its lower portion. This operation commenced on February 24, 2005 and was essentially completed on February 28, 2005. The City also contracted Leighton and Associates, Inc. (L&A) to review our results and provide geotechnical consulting services during temporary repair of the slope.

Upon completion of the temporary stabilization a survey monitoring system was established for the slope in March 2005. Survey monitoring data recorded from March 3, 2005 through July 7, 2005 indicated that the temporarily stabilized slope moved at an equivalent constant rate of about 1/8-inch per day. In other words, the movement of the sliding mass reduced from a few inches per day prior to temporary repair to about a few inches per month after repair. Based on this rate of movement and the results of engineering stability analyses, additional remedial measures were recommended to stabilize the slope. Utilizing the results of our preliminary report, L&A provided geotechnical services for design of a second phase of temporary remedial repairs. This design was reviewed by us and included installation of 95 caissons placed in two adjoining rows along the bottom of the slope. Upon completion of caisson installation, L&A also recommended re-grading of the slope. After the slope was re-graded, the City's contractor installed erosion control mats to minimize erosion of the slope face. As recommended in our September 30, 2005 report, two slope inclinometers were installed to monitor slope movement.

SUMMARY OF OBSERVATIONS AND TESTING

General

The main purpose of our geotechnical observation and testing services were to obtain additional near-surface and subsurface geotechnical data during repair operations and compare those observations with the geologic model used to design the remedial stabilization. In general, our observations compared closely with those used in the geotechnical model for remedial stabilization. Our services during the second phase of temporary stabilization included the following:

1. Geologic mapping during caisson installation and slope re-grading.

2. Drilling and downhole logging of one large diameter bucket-auger boring (Boring BA-5). The log is included Appendix A.

3. On-call geotechnical observation and testing during fill placement operations and associated laboratory testing. Test results are included in Appendix B.

4. Periodic groundwater level measurements in the temporary observation well in Boring BA-3. Groundwater and rainfall data are included in Appendix C.

5. Installation of two slope inclinometers near the completion of slope re-grading to monitor slope movement. Logs are included in Appendix A and results of the most recent surveys are included in Appendix D.

6. Preparation of this report.

Site Clearing and Access

Site clearing and access operations were conducted by LT Engineering, Inc. and performed on November 30, 2005 and December 1, 2005. These operations were necessary in order to gain access to the slope for the heavy equipment needed for caisson installation. Site clearing included demolition of the damaged residence and other improvements at 24452 Ferrocarril. The debris generated during the demolition operation was hauled offsite. An earthen access ramp was then constructed at the base of the slope using on-site materials. In conjunction with construction of the ramp, a horizontal bench, about 25 to 30 feet wide, was constructed along the alignment of the caissons to accommodate the heavy equipment.

Caisson Installation

Caisson installation commenced on December 8, 2005 and was completed on January 5, 2006, and was performed by Anderson Drilling under contract to LT Engineering, Inc. A Watson 2500 drill rig equipped with a 36-inch diameter auger was used to drill the 95 borings for caisson installation. The caissons were installed in two rows and identified with numbers (A1 through A48 and B1 through B47) as shown on Plate 1. Boring depths varied from about 50 to 55 feet to accommodate installation of the 43 feet long steel I-beams. The tops of the beams were placed approximately 7 to 12 feet below the surface of a horizontal bench created for ease of operations. The steel beams were aligned and centered with steel centralizers welded to the top of each beam. Concrete was placed around each beam to within a foot of the top of the beam in accordance with the project plans. The alignment and depth of the beams along with concrete placement were performed under the purview of others.

Caving conditions due to groundwater seepage were encountered in only a few of the borings between Caisson Nos. A41/B41 through A48/B47 at depths ranging from approximately 20 to 28 feet below bench grade. Where caving was severe, the borings were backfilled with cement slurry and then re-drilled several days later after the slurry had set.

Geologic data collected during caisson installation included surface logging of soil and bedrock types, approximate depth to groundwater seepage, and approximate depth to the landslide rupture surface. Also during caisson installation, a large-diameter bucket auger boring (BA-5) was drilled and downhole logged by an engineering geologist from this firm. The purpose of the boring was to directly observe the existing subsurface conditions and compare those observations with the conditions depicted in the geologic model used to assess the stability of the slope. Plate 1 shows the approximate location of the boring and the log is provided in Appendix A. A summary of these observations is provided in the Geologic Observations section of this report.

Slope Re-grading

Re-grading of the slope was conducted after the caissons were completed and commenced on January 10, 2006 and completed on February 3, 2006. The main purposes for re-grading the slope were to protect the structures along Ferrocarril from damage as a result of surficially unstable soil in front of the caissons that had crept up against the structure located at 24492 Ferrocarril and was threatening several others, and to provide better surficial drainage conditions and allow for installation of temporary erosion control measures. The conceptual grading plan was developed by L&A and grading operations were performed by LT Engineering, Inc. Re-grading of the slope included trimming the face of the lower and uppermost portions of the slope, construction of a stabilization key, fill placement, removal and recompaction of landslide materials below the main scarp of the landslide, and installation of an erosion control blanket. The approximate limits of the keyway and upper remedial removal area are depicted on Plates 1 and 2.

As part of the re-grading operations, the lower portion of the slope located below the caissons was trimmed back to provide more space behind the existing residences. Earthen swales were constructed along the toe of the slope and along some property boundaries to control surface flow. In addition, a portion of the main scarp of the landslide below 24422 Encorvado Lane was trimmed back to remove a surficially unstable portion of the slope. This area was located southeast of the existing pool.

The keyway located behind the caissons was constructed in order to provide support of fills placed in the central and upper portions of the slope during re-grading. The keyway was about 15 feet wide and embedded at least two feet below the surface of the horizontal bench constructed for caisson installation. After the keyway was completed, fill materials consisting of blended on-site soils were placed in lifts restricted to approximately 8 to 12 inches in thickness, and then compacted in-place to a minimum relative compaction of 88 percent with an rubber-tired loader and studded vibratory steel drum compactor. The purpose of the compaction effort was to increase the density of the existing fill materials and provide a relatively uniform surface for erosion control purposes. Field soil density and moisture content tests were performed using Nuclear Methods ASTM D-2922 and D-3017. The laboratory maximum dry density and optimum moisture content for the on-site soils were determined in accordance with Test Method ASTM D-1557. Test results are presented in Appendix B, and approximate locations of the field density tests are shown on the accompanying grading plan (Plate 1).

Landslide debris located directly below the main scarp of the landslide was removed by an excavator to the approximate elevations shown on Plate 1. The main purpose of the removal operation was to reduce the amount of future settlement of the landslide debris located in this area. After the removal was completed, the underlying landslide debris was track-walked by an excavator. Fills were then placed by track-walking of the excavator, but were not tested for relative compaction.

Upon completion of re-grading, the slope face was covered with an erosion control blanket composed of coconut fiber and heavyweight polypropylene netting (North American Green C125). LT Engineering, Inc. installed the blanket in general accordance with the manufacturer's recommendations. In addition, surficial drainpipes were installed to capture runoff from the two concrete-lined v-ditches located on the eastern portion of the slope (Plate 1). These drain pipes were secured to the slope and outletted into the drainage ditch located between 24482 and 24492 Ferrocarril.

Groundwater Monitoring Well Observations

During the preliminary geotechnical investigation a temporary groundwater monitoring well was installed in boring BA-3 (see Plate 1). Periodic measurements of the groundwater level were recorded and are presented in Appendix C along with historical rainfall data from nearby Lake Mission Viejo. The weather station at Lake Mission Viejo is located about 2 ¾ miles northeast of the site at an elevation of about 700 feet.

The groundwater level in the well did show some response to rainfall during a series of storms that occurred in March and early April 2006. However, the total rainfall amounts and intensity were not as great as those encountered during the January 2005 rainstorms. These data are provided for use during final repair of the landslide, which is the responsibility of others.

Slope Inclinometer Installation

Upon completion of slope re-grading, two slope inclinometers were installed to monitor movement of the slope. The inclinometers were installed to depths of about 30 and 70 feet and consisted of 2.75-inch diameter QC inclinometer casing manufactured by the Slope Inclinometer Company. The inclinometers were installed in general accordance with the manufacturer's recommendations. Monitoring surveys conducted in February through early April 2006 showed no appreciable amounts of movement and are included in Appendix D. The results of subsequent surveys will be provided under separate cover. Plate 1 shows the locations of the two inclinometers and their boring logs are included in Appendix A.

Geologic Observations

Periodic geologic observation and mapping were performed during caisson installation and re-grading of the slope. Geologic data collected during this phase of work include distribution of geologic units, approximate depth to the landslide rupture surface and geologic structural attitudes, and approximate depth and location of groundwater seepage. Plates 1 and 2 depict these observations, which are summarized in the following sections of this report.

Geologic Units

Geologic units encountered during caisson installation and slope re-grading included artificial fill, landslide debris, and bedrock of the Niguel Formation. Descriptions of these units were provided in our preliminary geotechnical investigation report (see Reference) and are updated as follows:

- Artificial Fill (Map Symbols: Af, Af_1, and Af_2): All of these units generally consist of layers of silty clay, clayey silt, and silty sand, typically olive-brown to gray, moist to very moist, and soft to stiff/medium dense to dense. Unit Af is for the fill materials placed in 1967 by Geotechnical Consultants, Inc., and Units Af_1 and Af_2 are for the fills placed in February 2005 and January 2006 by Petra, respectively.

- Landslide Debris (Map Symbols: Qls/Olso): Landslide debris encountered within the active slide area consists of both artificial fill (Af) and the underlying bedrock. The debris was found to be soft to firm near the surface and consist mostly of silty clay and clayey silt with variable amounts of fine sand. Ancient landslide debris found outside the limits of the active landslide consist of bedrock-derived intensely fractured materials. An olive-gray clay layer, approximately ¼- to ½-inch-thick, consisting of plastic, remolded clay lays along the bottom of the landslide debris. Striations were observed along the clay layer indicating previous movement.

- Niguel Formation (Map Symbol: Tn): This unit consists of beds of siltstone, silty sandstone and conglomerate. The siltstone and silty sandstone beds typically contain micaceous fine-grained sand and vary in color from light yellowish-brown to olive-gray. These beds are moderately fractured, laminated to thickly bedded, and classified as soft bedrock materials. Sandstone and conglomerate beds consist of fine- to coarse-grained sand with occasional beds of rounded gravel and are poorly cemented. Conglomerate beds contain well-rounded boulders up to 14 inches.

Geologic Structure

Supplemental geologic structural data obtained during this phase of work includes depths and attitudes along the landslide rupture surface and the main scarp of the landslide (see Plates 1 and 2). The landslide rupture surface was observed in boring BA-5 and in several of the caisson borings, and found to lie at elevations of about 438 to 440 feet, which is within one to two feet of the elevations used for caisson design. Mapping and structural attitudes recorded along the main scarp of the landslide also coincided with the geologic model used for caisson design.

Open fractures were observed within the existing landslide debris in boring BA-5 and in excavations graded during re-grading of the slope. Fractures varied from about 1 to 6 inches in width and, where measured, up to 3 feet in depth. Fracture spacing varied widely from tens of feet to 1 to 2 feet apart.

Groundwater

Groundwater seepage was observed in some of the borings drilled during caisson installation and along the toe of the subject slope. Most of the seepage was encountered in the eastern portions of the slope. Heavy seepage was encountered in the borings for Caisson Nos. A41/B41 through A48/B47 at depths ranging from approximately 20 to 28 feet below bench grade. The elevation of the horizontal bench along the two rows of caissons varied from approximately 463 feet at the west end (A48/B47) to 465 feet at the east end (A1/B1). As previously discussed, the seepage encountered in some of these borings caused caving that required remedial action by the drilling contractor. During construction of the keyway, an increase in moisture content of the exposed artificial fill/landslide debris was observed in this same area.

Very slight seepage was observed in some of the borings between Caisson Nos. A13/B13 through A40/B40 at depths varying from about 15 to 20 feet below the grade of the horizontal bench. Seepage encountered in these borings did not cause any significant caving. Seepage was not encountered in the caisson borings along the western portion of the slope, between Caisson Nos. A1/B1 through A12/B12.

Groundwater was also observed flowing from a pre-existing subdrain outlet located along the toe of the slope behind the residence at 24482 Ferrocarril (see Plate 1). The outlet was composed of a 6-inch diameter corrugated metal pipe that was installed in 1967 when the slope was constructed. A flow rate of about ¼ gpm (gallon per minute) was measured from the pipe. An earthen swale was constructed to control the seepage from the pipe and direct it to the surface drain located between 24482 and 24492 Ferrocarril.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on our geologic observations and mapping, it is our opinion that the geotechnical model used by Leighton & Associates, Inc. for design of the caissons matches closely with the conditions encountered during caisson installation and slope re-grading. We recommend that the observations presented in this report be incorporated into future evaluations of the slope, especially during design of final slope repairs.

Homeowner Reoccupancy
(24432 through 24492 Ferrocarril and 24422 Encorvado Lane)

According to the stability analyses conducted by L&A, the existing slope with the installed caissons has a Factor of Safety (FS) of at least 1.25, which is less than the required Factor of Safety of 1.5 that is commonly accepted for long-term stability of slopes. It is our understanding that additional remedial repairs will be necessary in order for the slope to meet the current code requirements and that these additional repairs will be required before the property owners can regain permanent occupancy.

Although the slope does not meet the code requirements, it is our opinion that the subject residences along Ferrocarril, except for 24452 Ferrocarril, may be reoccupied. Our opinion is based upon the results of the slope inclinometer surveys, which indicate that the slope has not moved appreciably since installation of the caissons, and is no longer creeping. Reconstruction at 24452 Ferrocarril should not be allowed until such time that the slope meets the code requirement (i.e., FS of 1.5). The residence at 24422 Encorvado Lane can be reoccupied provided that a vertical barricade is maintained at least 5 feet behind the main scarp of the landslide located in the rear portion of the property. This barricade must have a minimum height of 5 feet. The existing swimming pool is to remain empty at all times until the descending slope is repaired.

In addition, we recommend that the properties be periodically monitored for signs of movement. A geotechnical consultant(s) under contract to the property owner(s) should perform the monitoring. We suggest that the monitoring be performed at intervals of every two to three months through April 15, 2007. Written summaries of the consultant's observations should be submitted to the City on a periodic basis. The property owners should observe the property on a continual basis and notify the City and request an interim visit by their consultant should any signs of new distress or worsening of any existing distress is observed between two successive visits.

Stability of Adjoining Properties
(24412 and 24422 Ferrocarril, 24412, 24421 and 24431 Encorvado Lane, and 24461, 24471 and 24481 Chrisanta)

The results of our previous analyses (see Reference) indicate that the portions of the slope adjacent to the repaired area may be marginally stable. These results are highly dependent upon the geologic model used in the analyses. The geologic model used in our analyses is based on the limited subsurface data that is currently available. Other geologic models can be derived utilizing the current information, resulting in other conclusions regarding the stability of the adjoining properties.

Based on the results of our previous study (see Reference), we recommend that the portions of the slope from 24412 through 24492 Ferrocarril be considered for geotechnical evaluation during preparation of plans for final stabilization of the slope. In order to adequately evaluate these areas, additional subsurface information should be obtained from 24412, 24422 and 24492 Ferrocarril, as well as 24412, 24421 and 24431 Encorvado Lane and possibly 24461, 24471 and 24481 Chrisanta. As previously mentioned, the calculated stability of these areas is highly dependent upon the actual subsurface conditions, which may not coincide with our geologic model that was based on the limited subsurface information that is currently available.

Stability of Neighborhood

Detailed analyses of other areas in the adjoining neighborhood underlain by the ancient landslide mass were not performed during this study. However, data collected during this study suggest that the residences on the west side of Ferrocarril and 24511 through 24571 Chrisanta Drive are most likely stable due to the buttressing effect of the continuous fill slope along their rear yards. The stability of other residences along Chrisanta Drive and Arcada Drive is difficult to assess at this time due to the limited amount of subsurface data. If, in the future, a Geologic Hazard Abatement District is proposed for the areas surrounding Ferrocarril, additional studies in theses areas should be performed.

Slope Maintenance and Landscape Irrigation

The repaired portion of the slope is currently covered with an erosion control blanket with a reported design life of about 36 months. Any damage to the blanket should be repaired in a timely fashion to reduce infiltration of rainfall into the slope. Based on the design life of the product, the blanket may require replacement at some time in the future. The drainage pipes and earthen swales should also be maintained and cleared of any debris that might impede the flow of surface waters. Positive drainage away from the existing structures should also be maintained.

Landscape irrigation for the repaired portion of the slope has been shut off and should remain so until such time that the slope is permanently repaired. Landscape irrigation for the adjoining portions of the slope should also be drastically reduced or shut off if not already done so until the slope is permanently repaired. Homeowners along Encorvado Lane should also be asked to minimize their landscape irrigation due to the fact that water from these areas percolates into the ground and flows toward the slope. Final plans for repair of the slope should incorporate proper drainage devices and recommendations for slope maintenance and planting.

REPORT LIMITATIONS

This report is based on the subject project and geotechnical data as described herein. The materials encountered on the project site, described in other literature and utilized in our laboratory investigation are believed representative of the project area, and the conclusions and recommendations contained in this report are presented on that basis. However, soils and bedrock can vary in characteristics both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein. Residents concerned about the conclusions and recommendations provided in this report should consider having this report independently reviewed by another geotechnical consultant.

This report has been prepared consistent with the level of care being provided by other professionals providing similar services at the same locale and in the same time period. This report provides our professional opinions and as such, they are not to be considered a guaranty or warranty.

This opportunity to be of service is sincerely appreciated. Please call if you have any questions pertaining to this report.

Respectfully submitted,

PETRA GEOTECHNICAL, INC.

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DCS/SJ/nls

Attachments:

- References
- Appendix A – Exploratory Boring Logs
- Appendix B – Summary of Field and Laboratory Testing
- Appendix C – Groundwater Monitoring and Rainfall Data
- Appendix D – Slope Inclinometer Surveys
- Plate 1 – Geotechnical As-Graded Map (In Pocket)
- Plate 2 – Geotechnical Cross-Section A-A' (In Pocket)
- Plate 3 – Geotechnical Cross-Section B-B' (In Pocket)

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APPENDIX A

EXPLORATION LOGS

PETRA

Key to Soil and Bedrock Symbols and Terms

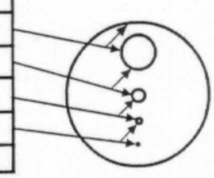
PETRA

Unified Soil Classification System

Coarse-grained Soils > 1/2 of materials is larger than #200 sieve	The No. 200 U.S. Standard Sieve is about the smallest particle visible to the naked eye	GRAVELS more than half of coarse fraction is larger than #4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
			Gravels with fines	GM	Silty Gravels, poorly-graded gravel-sand-silt mixtures
				GC	Clayey Gravels, poorly-graded gravel-sand-clay mixtures
		SANDS more than half of coarse fraction is smaller than #4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly-graded sands, gravelly sands, little or no fines
			Sands with fines	SM	Silty Sands, poorly-graded sand-gravel-silt mixtures
				SC	Clayey Sands, poorly-graded sand-gravel-clay mixtures
Fine-grained Soils > 1/2 of materials is smaller than #200 sieve		SILTS & CLAYS Liquid Limit Less Than 50		ML	Inorganic silts & very fine sands, silty or clayey fine sands, clayey silts with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
				OL	Organic silts & clays of low plasticity
		SILTS & CLAYS Liquid Limit Greater Than 50		MH	Inorganic silts, micaceous or diatomaceous fine sand or silt
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic silts and clays of medium-to-high plasticity
Highly Organic Soils				PT	Peat, humus swamp soils with high organic content

Grain Size

Description		Sieve Size	Grain Size	Approximate Size
Boulders		>12"	>12"	Larger than basketball-sized
Cobbles		3 - 12"	3 - 12"	Fist-sized to basketball-sized
Gravel	coarse	3/4 - 3"	3/4 - 3"	Thumb-sized to fist-sized
	fine	#4 - 3/4"	0.19 - 0.75"	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19"	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079"	Sugar-sized to rock salt-sized
	fine	#200 - #40	0.0029 - 0.017"	Flour-sized to sugar-sized to
Fines		Passing #200	<0.0029"	Flour-sized and smaller



Laboratory Test Abbreviations

MAX	Maximum Dry Density	MA	Mechanical (Particle Size) Analysis
EXP	Expansion Potential	AT	Atterberg Limits
SO4	Soluble Sulfate Content	#200	#200 Screen Wash
RES	Resistivity	DSU	Direct Shear (Undisturbed Sample)
pH	Acidity	DSR	Direct Shear (Remolded Sample)
CON	Consolidation	HYD	Hydrometer Analysis
SW	Swell	SE	Sand Equivalent
CL	Chloride Content	OC	Organic Content
RV	R-Value	COMP	Mortar Cylinder Compression

Modifiers

Trace	< 1 %
Few	1 - 5%
Some	5 - 12 %
Numerous	12 - 20 %

Sampler and Symbol Descriptions

- Approximate Depth of Seepage
- Approximate Depth of Standing Groundwater
- Modified California Split Spoon Sample
- Standard Penetration Test
- Bulk Sample
- Shelby Tube
- No Recovery in Sampler

Bedrock Hardness

Soft	Can be crushed and granulated by hand; "soil like" and structureless
Moderately Hard	Can be grooved with fingernails; gouged easily with butter knife; crumbles under light hammer blows
Hard	Cannot break by hand; can be grooved with a sharp knife; breaks with a moderate hammer blow
Very Hard	Sharp knife leaves scratch; chips with repeated hammer blows

Notes:
Blows Per Foot: Number of blows required to advance sampler 1 foot (unless a lesser distance is specified). Samplers in general were driven into the soil or bedrock at the bottom of the hole with a standard (140 lb.) hammer dropping a standard 30 inches unless noted otherwise in Log Notes. Drive samples collected in bucket auger borings may be obtained by dropping non-standard weight from variable heights. When a SPT sampler is used the blow count conforms to ASTM D-1586

EXPLORATION LOG

Project: **Ferrocarril Landslide**		Test Pit No.: **B- 5A**	
Location: **Mission Viejo, California**		Elevation: **463'**	
Job No.: **211-05**	Client: **City of Mission Viejo**	Date: **12/12/06**	
Excavation Method: **Bucket Auger**	Driving Weight:	Logged By: **DS**	

Depth (Feet)	Lithology	Material Description	Water	Samples: Blows	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		LANDSLIDE DEBRIS (Qls)							
		Silty Clay to Clayey Silt (CL/ML): Mottled olive gray, brown and dark brown; moist; soft to firm; some fine grained sand; (Fill).							
5		@ 5 Feet: Layer of sandy silt (ML); mottled olive gray and brown; moist; firm; micaceous.							
		@ 5.5 Feet: Grades to clayey silt with sand; occasional coarse gravel.							
10		Silty Sand (SM): Light olive-gray; moist; medium dense; fine-grained sand; micaceous.							
		Silty Clay to Clayey Silt (CL/ML): Mottled yellowish-brown and olive-gray; moist; firm.							
		@ 10.8 Feet: Open fracture, about 2" wide; near vertical; extends at least 12" into sidewall of boring.							
		@ 12 Feet: Open fracture; JOINT- N80W / 72NE.							
		@ 13 Feet: Apparent increase in moisture content.							
15									
20		@ 20 Feet: Very minor seepage from fracture that starts at 19.5 feet.							
		@ 22.5 Feet: Layer of coarse gravel, 3" thick.							
		@ 22.8 Feet: Clay; olive; remolded 1/4" thick; CLAY SEAM - N30-40W / 3-4SW; (Rupture Surface); below rupture surface is intensely fractured zone of siltstone, about 12" thick.							
		BEDROCK - Niguel Formation (Tn)							
25		Siltstone to Clayey Siltstone: Mottled light olive brown and olive gray; moist; soft; very thinly to thinly bedded; moderately fractured; moderately weathered; micaceous.							
		@ 24.6 Feet: JOINT - NS / 70E.							
		@ 25 Feet: 6" layer of concretions.							

EXPLORATION LOG - V3 211-05.GPJ PETRA.GDT 4/21/06

PLATE A-1

EXPLORATION LOG

Project: **Ferrocarril Landslide**		Test Pit No.: **B- 5A**	
Location: **Mission Viejo, California**		Elevation: **463'**	
Job No.: **211-05**	Client: **City of Mission Viejo**	Date: **12/12/06**	
Excavation Method: **Bucket Auger**	Driving Weight:	Logged By: **DS**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		@ 30.5 Feet: Grades to unoxidized; dark gray; moderately hard.							
		@ 30.9 Feet: Zone of discontinuous laminae.							
35									
		@ 37.5 Feet: Occasional shell fragments.							
40									
		@ 43 Feet: Sand laminae; discontinuous; dipping 3 to 5 degrees SW.							
45									
		@ 48.5 Feet: Zone of discontinuous sand laminae; white; near horizontal.							
50		@ 49.2 Feet: 3/4- to 1-inch thick bed of siltstone overlying white sand laminae; polished surfces within siltstone; contact with sand wavy; inclined 1 to 3 degrees.							
55									
		Notes: Total Depth = 55 Feet; Very Minor Seepage at 20 Feet; Backfilled with Drill Cuttings, Tamped with Bucket.							

PLATE A-2

Petra Geotechnical

EXPLORATION LOG

Project: **Ferrocarril Landslide**		Test Pit No.: **SI-1**	
Location: **Mission Viejo, California**		Elevation: **466'**	
Job No.: **211-05**	Client: **City of Mission Viejo**	Date: **1/26/06**	
Excavation Method: **Limited Access Rig**	Driving Weight: **140 lbs / 30 in**	Logged By: **DO/DS**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ARTIFICIAL FILL (Af2)** Silty Clay to Clayey Silt (CL/ML): Mottled olive-gray and pale olive (5Y 5/2 - 6/3); moist; stiff to very stiff; micaceous; 25% fine to medium sand (Fill).				X			MAX; #200
5		Clayey Silt with Fine Sand (ML): Gray to olive gray; slightly moist; very stiff; micaceous.		11 15 19	X		16.8	101.0	
		LANDSLIDE DEBRIS (Qls).							
10		Silty Sand (SM): Light olive (2.5Y 5/6); moist; medium dense; fine- to coarse-grained sand; micaceous.		9 13 20	X		14.2	107.8	
15		Pale yellow (2.5Y 8/3); very moist; dense; fine-grained sand; some brownish-yellow staining.		15 20 20	X		20.1	96.6	
		Silty Clay to Clayey Silt (CL/ML): Mottled olive-brown and light grayish brown; moist; very stiff; some fine sand; micaceous; (possible landslide debris derived from bedrock).							
20		Siltstone: Mottled light brownish gray and light olive brown (2.5Y 6/2 - 5/6); moist; soft; moderately to intensely fractured; highly weathered; landslide debris derived from bedrock.		15 22 25	X		26.8	94.3	
25				16 30 33	X		26.1	98.0	
		@ 26 Feet: Clay (CH): Gray (5Y 5/1); moist; 1/16" to 1/8" thick; small diameter roots; (Possible Rupture Surface). **BEDROCK - Niguel Formation (Tn)**.							

PLATE A-3

Petra Geotechnical

EXPLORATION LOG

Project: **Ferrocarril Landslide**		Test Pit No.: **SI-1**	
Location: **Mission Viejo, California**		Elevation: **466'**	
Job No.: **211-05**	Client: **City of Mission Viejo**	Date: **1/26/06**	
Excavation Method: **Limited Access Rig**	Driving Weight: **140 lbs / 30 in**	Logged By: **DO/DS**	

Depth (Feet)	Lithology	Material Description	Water	Samples: Blows	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Siltstone: Mottled light yellowish-brown and grayish brown (2.5Y 6/4 -5/2) with brownish-yellow staining (10YR 6/6); slightly moist; soft to moderately hard; very thinly bedded; moderately fractured; moderately weathered; micaceous; some fine sand.		50/ 6"	■		22.0	101.6	
35		@ 35 Feet: Unoxidized siltstone.							
40		Dark olive gray (5Y 3/2) to black (5Y 2.5/2); slightly moist; soft to moderately hard; unoxidized; micaceous; trace of shell fragments.		50/ 6"	■		22.5	100.9	
45									
50		Clayey Siltstone to Siltstone: Black (2.5Y N/2); slightly moist; soft to moderately hard; micaceous; unoxidized.		50/ 4"	■		27.4	93.6	
55									

EXPLORATION LOG - V3 211-05.GPJ PETRA.GDT 4/21/06

Petra Geotechnical

EXPLORATION LOG

Project: **Ferrocarril Landslide**		Test Pit No.: **SI-1**	
Location: **Mission Viejo, California**		Elevation: **466'**	
Job No.: **211-05**	Client: **City of Mission Viejo**	Date: **1/26/06**	
Excavation Method: **Limited Access Rig**	Driving Weight: **140 lbs / 30 in**	Logged By: **DO/DS**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Siltstone: Black (2.5Y N/2); slightly moist; soft to moderately hard; micaceous; unoxidized.		50/ 3"	■		23.5	96.0	

Notes

Total Depth = 68.7 Feet
No Caving
Very Minor Seepage @ 15 Feet +\-

Slope Inclinometer Installation

Installed 2.75" Diameter QC Inclinometer Casing.
Backfilled Annulus with Betonite - Cement Grout.
Bottom of Casing @ 68 Feet.
A-Axis S38W-N38E
Well Head - 30" x 8 5/8" Diameter Steel Casing.

EXPLORATION LOG

Project: **Ferrocarril Landslide**		Test Pit No.: **SI-2**	
Location: **Mission Viejo, California**		Elevation: **445'**	
Job No.: **211-05**	Client: **City of Mission Viejo**	Date: **1/27/06**	
Excavation Method: **Limited Access Rig**	Driving Weight: **140 lbs / 30 in**	Logged By: **DO/DS**	

Depth (Feet)	Lith-ology	Material Description	Water	Samples: Blows	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**LANDSLIDE DEBRIS (Qls)** Clayey Silt to Silty Clay (CL/ML): Mottled olive (5Y 5/3) to light gray (5Y 7/1); moist; firm; 15% fine sand.							MAX; #200
5		Silty Clay (CL): Olive gray (5Y 5/2); moist; very stiff; iron oxide stained.		9 13 17			28.5	92.7	
10		Clay (CH): Olive gray (5Y 5/2); moist; soft to firm; remolded; some white carbonate nodules; layer about 1/2" thick; few roots. **BEDROCK - Niguel Formation (Tn)** Sandy Siltstone: Olive (5Y 5/3); slightly moist to moist; soft to moderately hard; moderately to highly weathered; some iron oxide staining along fractures; laminated; micaceous; bioturbated.		22 40 60			25.4	99.9	
15		Siltstone: Olive gray (5Y 4/2); slightly moist to moist; soft to moderately hard; very thinly bedded; moderately weathered; micaceous; occasional fine sand laminae.		25 50			26.2	97.3	
20		Sandy Siltstone: Black (5Y 2.5/2); slightly moist to moist; soft to moderately hard; unoxidized; micaceous.		23 50/ 5"			24.9	97.6	

EXPLORATION LOG - V3 211-05.GPJ PETRA.GDT 4/21/06

Petra Geotechnical

EXPLORATION LOG

Project: Ferrocarril Landslide		Test Pit No.: SI-2
Location: Mission Viejo, California		Elevation: 445'
Job No.: 211-05	Client: City of Mission Viejo	Date: 1/27/06
Excavation Method: Limited Access Rig	Driving Weight: 140 lbs / 30 in	Logged By: DO/DS

Depth (Feet)	Lithology	Material Description	Water	Samples: Blows	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
		Notes Total Depth = 28.8 Feet No Caving No Seepage **Slope Inclinometer Installation** Installed 2.75" QC Inclinometer Casing. Backfilled Annulus with Bentonite Grout. Bottom of Casing @ 28.8 Feet. A-Axis S35W - N35E Well Head- 30" x 8 5/8" Diameter Steel Casing..							

APPENDIX B

FIELD AND LABORATORY TEST DATA

TABLE B-1

J.N. 211-05 — Laboratory Data Summary — May 31, 2006

Sample Number	Soil/Bedrock Description	Max. Dry Density [1] (pcf)	Optimum Moisture[1] (%)
1	Silty Clay	110.0	15.0

TABLE B-2
Field Density Test Results

Test No.	Date	Elevation (feet)	Field		Soil Type	Optimum Moisture (%)	Maximum Dry Density (pcf)	Relative Compaction (%)
			Moisture (%)	Unit Weight (pcf)				
1	01/11/06	458.0	24.8	97.2	1	15	110	88%
2	01/11/06	458.0	24.1	96.8	1	15	110	88%
3	01/12/06	459.0	20.7	100.2	1	15	110	91%
4	01/12/06	460.0	19.9	98.0	1	15	110	89%
5	01/17/06	460.0	17.6	98.2	1	15	110	89%
6	01/17/06	471.0	21.2	100.1	1	15	110	91%
7	01/18/06	462.0	19.3	97.8	1	15	110	89%
8	01/18/06	465.0	18.7	101.2	1	15	110	92%
9	01/19/06	468.0	20.4	100.0	1	15	110	91%
10	01/19/06	470.0	17.5	101.4	1	15	110	92%
11	01/20/06	474.0	19.3	100.1	1	15	110	91%
12	01/20/06	475.0	18.2	99.6	1	15	110	91%
13	01/21/06	474.0	17.7	101.6	1	15	110	92%
14	01/21/06	474.0	20.1	99.3	1	15	110	90%
15	01/23/06	478.0	17.6	101.2	1	15	110	92%
16	01/26/06	481.0	16.7	100.1	1	15	110	91%

LABORATORY TEST PROCEDURES

Soil Classification

Soils encountered within the exploratory borings were classified and described utilizing the visual-manual procedures of the Unified Soil Classification System, and in general accordance with Test Method ASTM D 2488-00. The assigned group symbols are presented on the Exploration Logs, Appendix A.

In Situ Moisture and Density

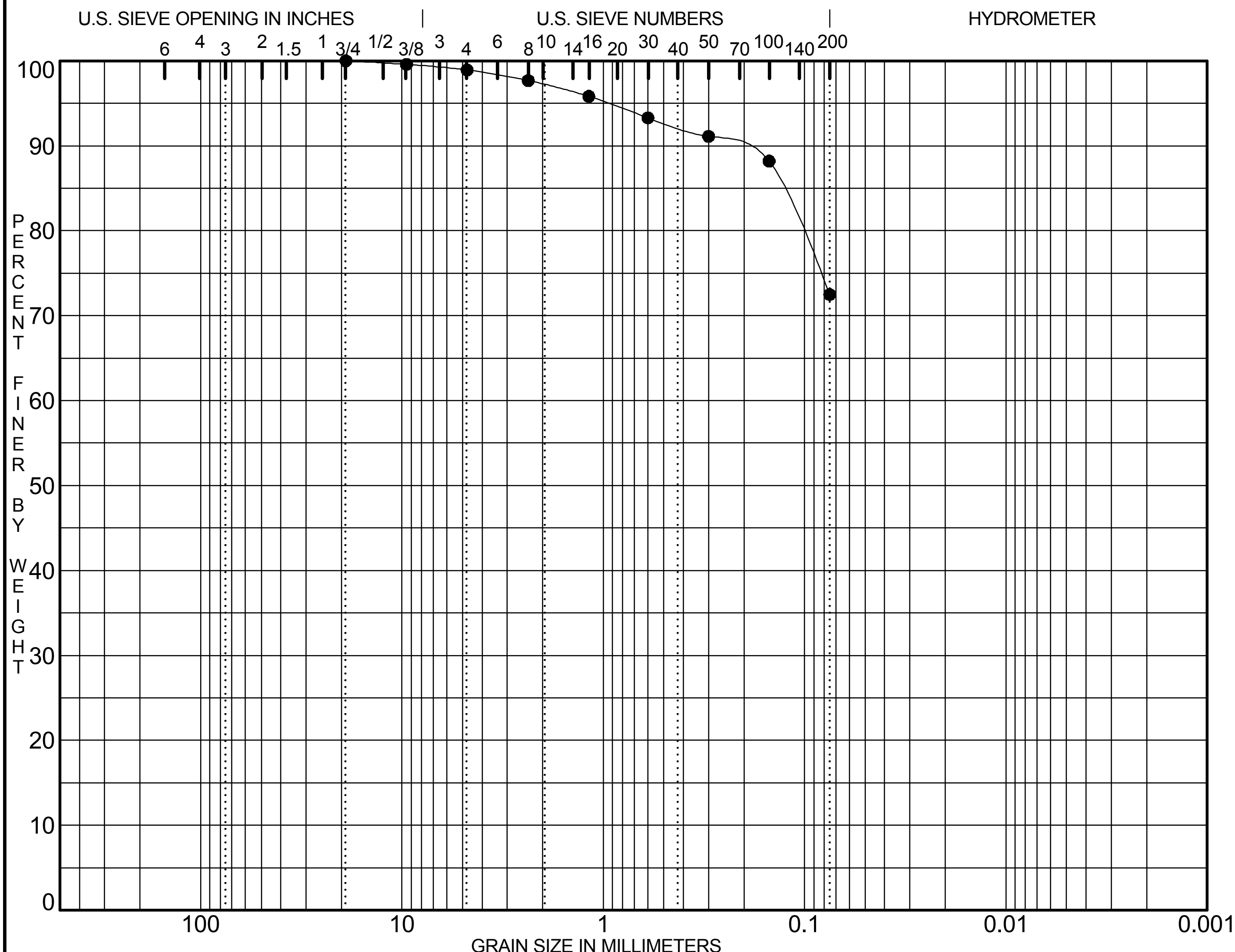
Moisture content and dry density of the in place soils were determined in representative strata in accordance with test method ASTM D 2216-98. Test data are presented in the Exploration Logs, Appendix A.

Laboratory Maximum Dry Density/Optimum Moisture

The maximum dry density and optimum moisture content of the near-surface soil materials were determined for a selected sample in accordance with Test Method A of ASTM D 1557-02. The results of this test are presented on Plate B-1.

Grain-Size Analysis

Grain-size analyses were performed on selected samples. These tests were performed in general accordance with ASTM Test Method D 422-90. Test results are presented on Plates B-2 and 3.



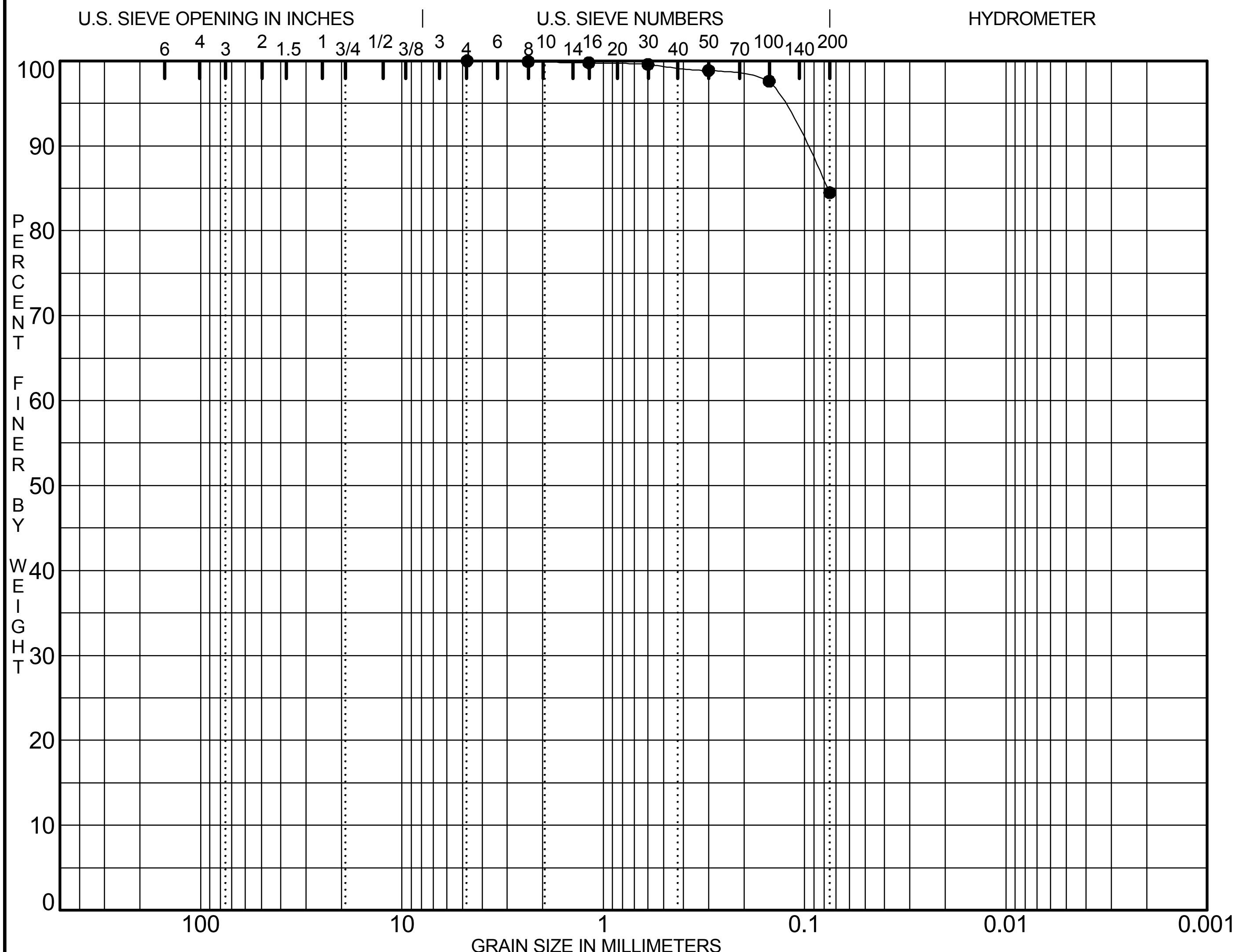
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	SI-1	0.0	Silty Clay/Clayey Silt (CL-ML)						

	Specimen Identification		D100	D60	D30	D50	%Gravel	%Sand	%Silt	%Clay
●	SI-1	0.0	19.00				1.1	26.4	72.5	

GRAIN SIZE - V1 211-05.GPJ PETRA.GDT 4/21/06

J.N. 211-05	**GRAIN SIZE ANALYSIS**	**April, 2006**
PETRA GEOTECHNICAL, INC.		**PLATE B-2**



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	SI-2	0.0	Silty Clay/Clayey Silt (CL-ML)						

	Specimen Identification		D100	D60	D30	D50	%Gravel	%Sand	%Silt	%Clay
●	SI-2	0.0	4.75				0.0	15.5	84.5	

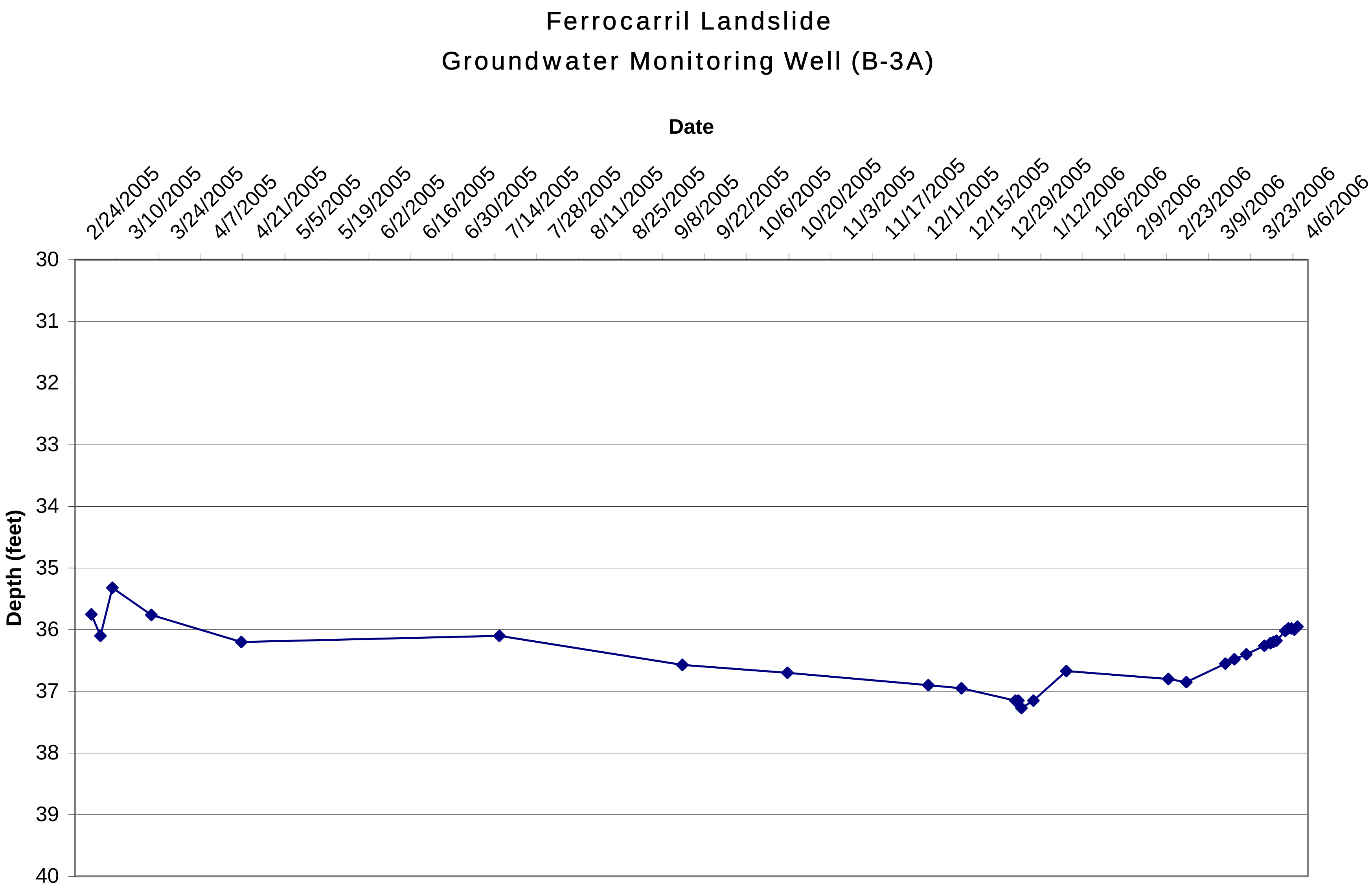
GRAIN SIZE - V1 211-05.GPJ PETRA.GDT 4/21/06

J.N. 211-05	**GRAIN SIZE ANALYSIS**	**April, 2006**
PETRA GEOTECHNICAL, INC.		**PLATE B-3**

APPENDIX C

GROUNDWATER MONITORING AND RAINFALL DATA

PETRA

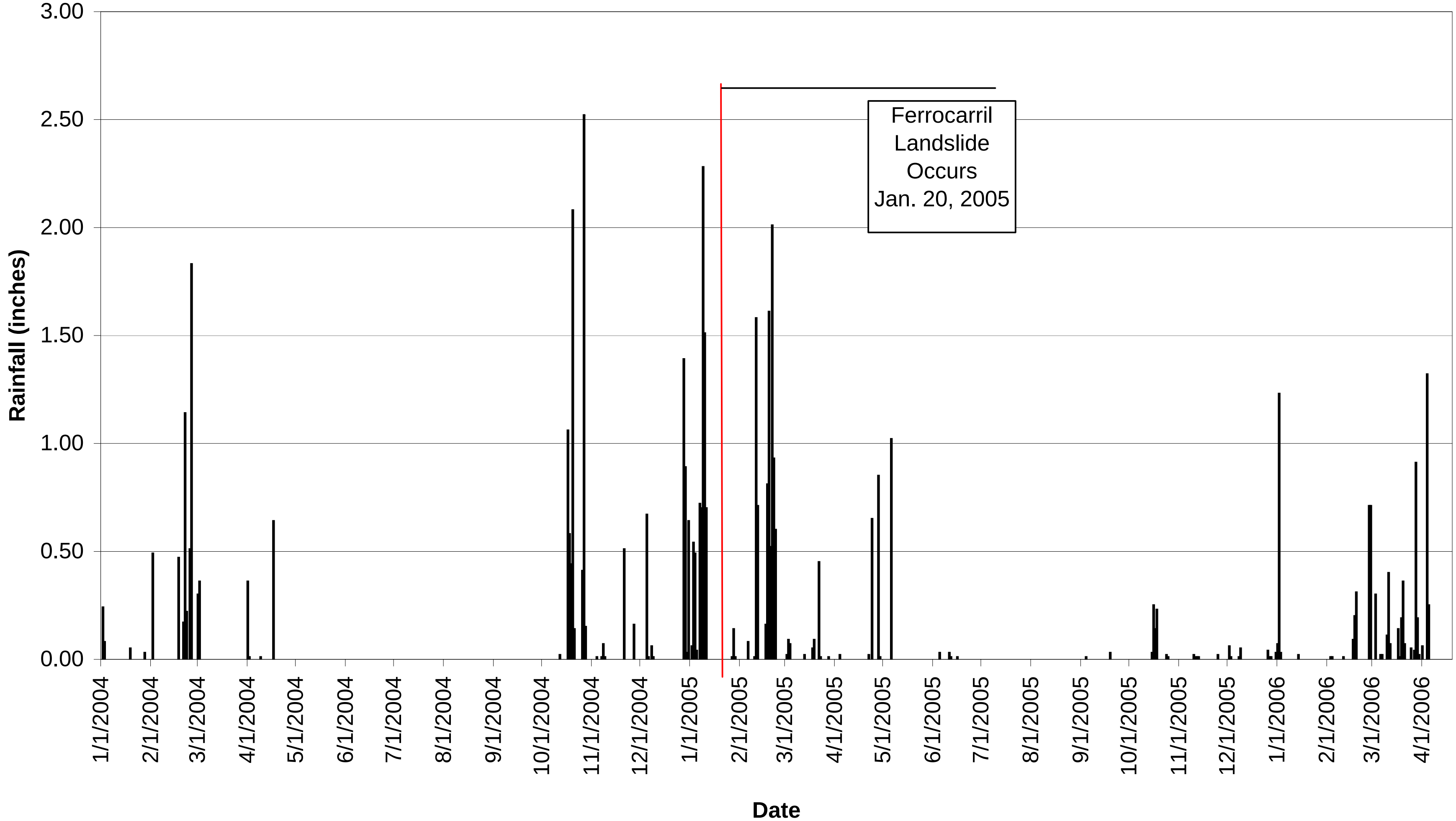


PETRA GEOTECHNICAL, INC.
J.N. 211-05

FERROCARRIL LANDSLIDE
GROUNDWATER MONITORING DATA
BORING B-3A

Date	Depth (ft)	Elevation (ft)	Change from Initial (ft)
02/24/05			Installed
03/01/05	35.75	473.25	Initial
03/04/05	36.10	472.90	-0.40
03/08/05	35.32	473.68	0.38
03/21/05	35.76	473.24	-0.06
04/20/05	36.20	472.80	-0.50
07/15/05	36.10	472.90	-0.40
09/14/05	36.57	472.43	-0.87
10/19/05	36.70	472.30	-1.00
12/05/05	36.90	472.10	-1.20
12/16/05	36.95	472.05	-1.25
01/03/06	37.15	471.85	-1.45
01/04/06	37.15	471.85	-1.45
01/05/06	37.27	471.73	-1.57
01/09/06	37.15	471.85	-1.45
01/20/06	36.67	472.33	-0.97
02/23/06	36.80	472.20	-1.10
03/01/06	36.85	472.15	-1.15
03/14/06	36.55	472.45	-0.85
03/17/06	36.48	472.52	-0.78
03/21/06	36.40	472.60	-0.70
03/27/06	36.26	472.74	-0.56
03/29/06	36.22	472.78	-0.52
03/30/06	36.20	472.80	-0.50
03/31/06	36.18	472.82	-0.48
04/03/06	36.02	472.98	-0.32
04/04/06	35.98	473.02	-0.28
04/05/06	35.98	473.02	-0.28
04/06/06	36.00	473.00	-0.30
04/07/06	35.95	473.05	-0.25

RAINFALL
LAKE MISSION VIEJO
2004 - 2006



PETRA GEOTECHNICAL, INC.
J.N. 211-05

RAINFALL DATA
LAKE MISSION VIEJO
2004 - 2006

2004	
Date	Rainfall (in)
01/02/04	0.24
01/03/04	0.08
01/19/04	0.05
01/28/04	0.03
02/02/04	0.49
02/18/04	0.47
02/21/04	0.17
02/22/04	1.14
02/23/04	0.22
02/25/04	0.51
02/26/04	1.83
03/01/04	0.30
03/02/04	0.36
04/01/04	0.36
04/02/04	0.01
04/09/04	0.01
04/17/04	0.64
10/12/04	0.02
10/17/04	1.06
10/18/04	0.58
10/19/04	0.44
10/20/04	2.08
10/21/04	0.14
10/26/04	0.41
10/27/04	2.52
10/28/04	0.15
11/04/04	0.01
11/07/04	0.01
11/08/04	0.07
11/09/04	0.01
11/21/04	0.51
11/27/04	0.16
12/05/04	0.67
12/06/04	0.01
12/08/04	0.06
12/09/04	0.01
12/28/04	1.39
12/29/04	0.89
12/30/04	0.03
12/31/04	0.64

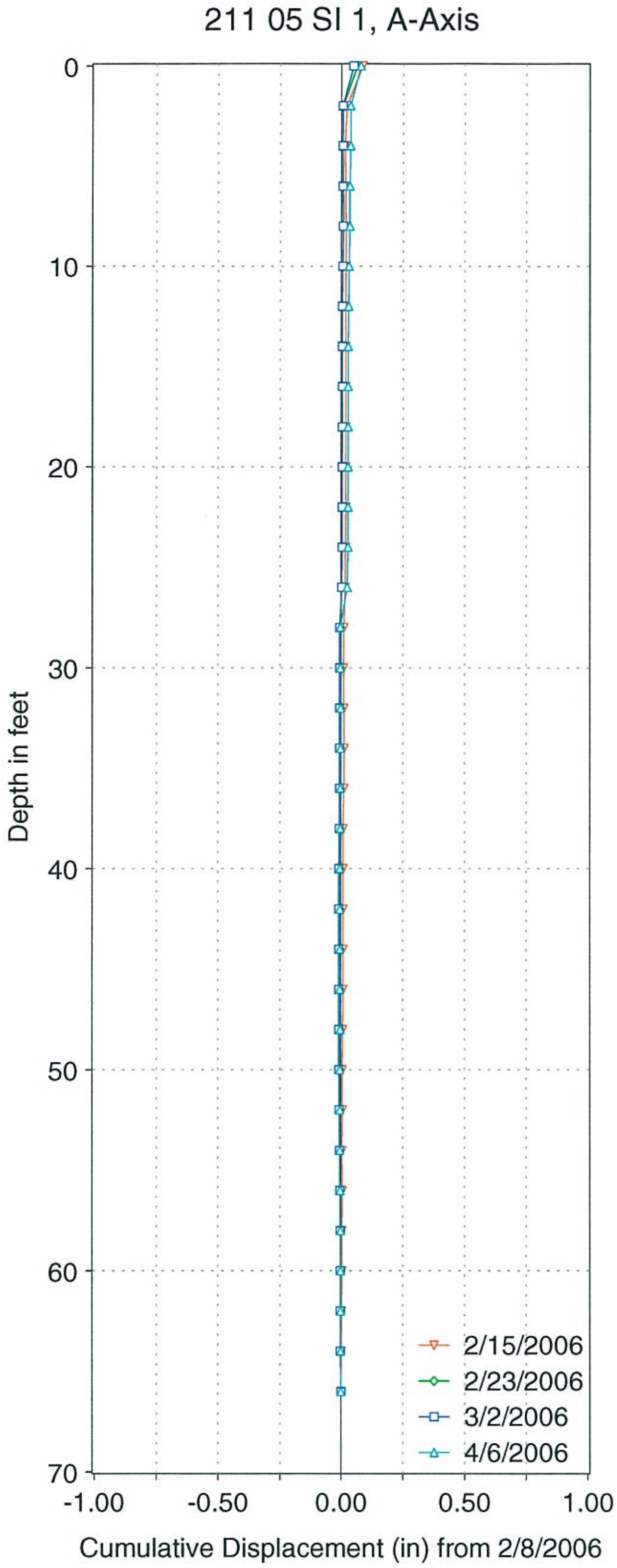
2005			
Date	Rainfall (in)	Date	Rainfall (in)
01/02/05	0.06	06/12/05	0.01
01/03/05	0.54	06/16/05	0.01
01/04/05	0.49	09/04/05	0.01
01/05/05	0.04	09/19/05	0.03
01/07/05	0.72	10/15/05	0.03
01/08/05	0.70	10/16/05	0.25
01/09/05	2.28	10/17/05	0.14
01/10/05	1.51	10/18/05	0.23
01/11/05	0.70	10/24/05	0.02
01/27/05	0.01	10/25/05	0.01
01/28/05	0.14	11/10/05	0.02
01/29/05	0.01	11/11/05	0.01
02/06/05	0.08	11/12/05	0.01
02/10/05	0.01	11/13/05	0.01
02/11/05	1.58	11/25/05	0.02
02/12/05	0.71	12/02/05	0.06
02/17/05	0.16	12/03/05	0.01
02/18/05	0.81	12/08/05	0.01
02/19/05	1.61	12/09/05	0.05
02/20/05	0.52	12/26/05	0.04
02/21/05	2.01	12/27/05	0.01
02/22/05	0.93	12/28/05	0.01
02/23/05	0.60	12/31/05	0.03
03/02/05	0.02		
03/03/05	0.09		
03/04/05	0.07		
03/13/05	0.02		
03/18/05	0.05		
03/19/05	0.09		
03/22/05	0.45		
03/23/05	0.01		
03/28/05	0.01		
04/04/05	0.02		
04/22/05	0.02		
04/24/05	0.65		
04/28/05	0.85		
04/29/05	0.01		
05/06/05	1.02		
06/05/05	0.03		
06/11/05	0.03		

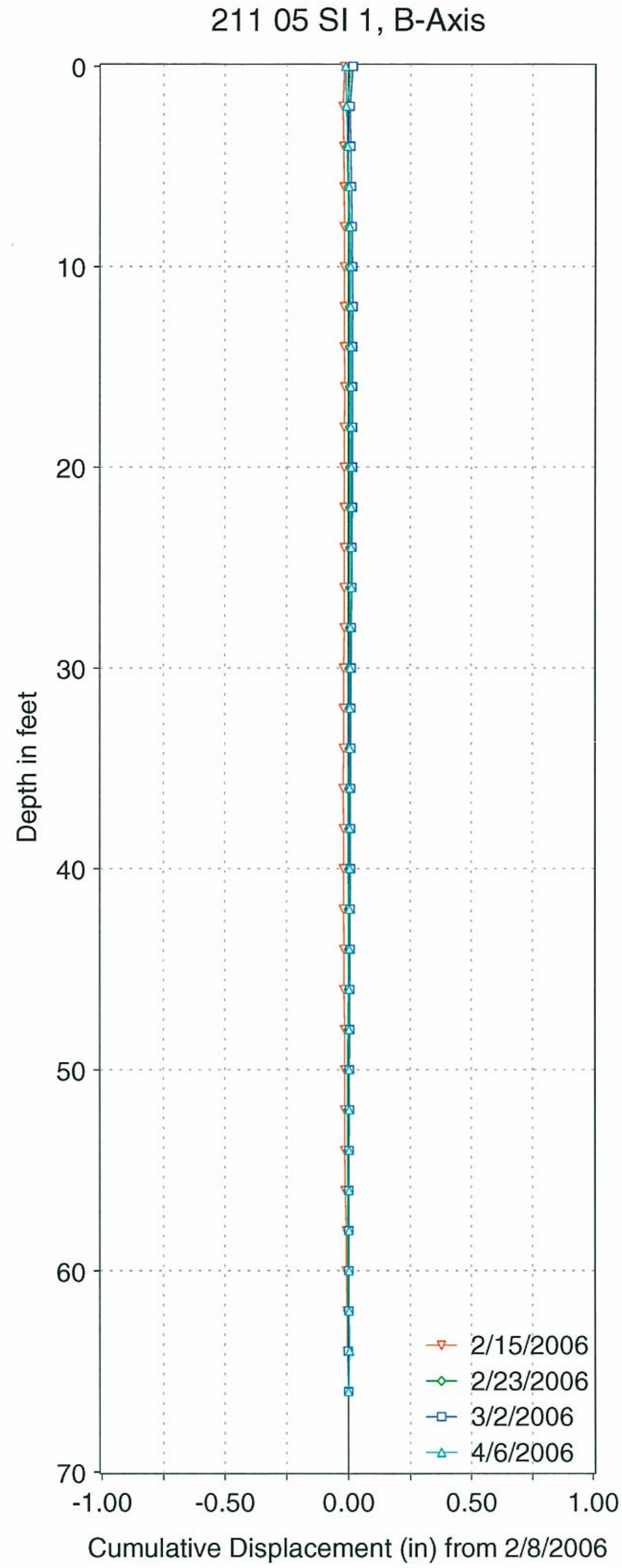
2006	
Date	Rainfall (in)
01/01/06	0.07
01/02/06	1.23
01/03/06	0.03
01/14/06	0.02
02/03/06	0.01
02/04/06	0.01
02/11/06	0.01
02/17/06	0.09
02/18/06	0.20
02/19/06	0.31
02/27/06	0.71
02/28/06	0.71
03/03/06	0.30
03/06/06	0.02
03/07/06	0.02
03/10/06	0.11
03/11/06	0.40
03/12/06	0.07
03/17/06	0.14
03/18/06	0.01
03/19/06	0.19
03/20/06	0.36
03/21/06	0.07
03/25/06	0.05
03/27/06	0.04
03/28/06	0.91
03/29/06	0.19
03/30/06	0.02
04/01/06	0.06
04/04/06	1.32
04/05/06	0.25

APPENDIX D

SLOPE INCLINOMETER SURVEYS

PETRA

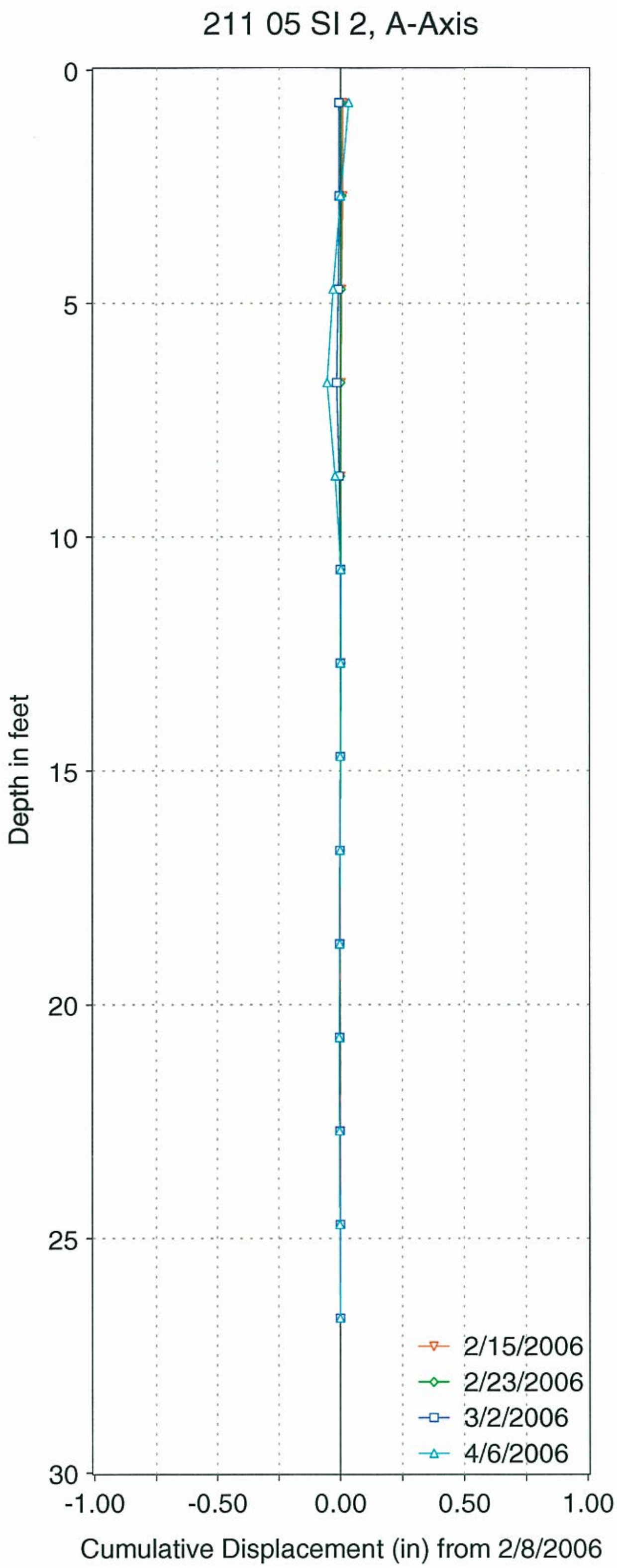


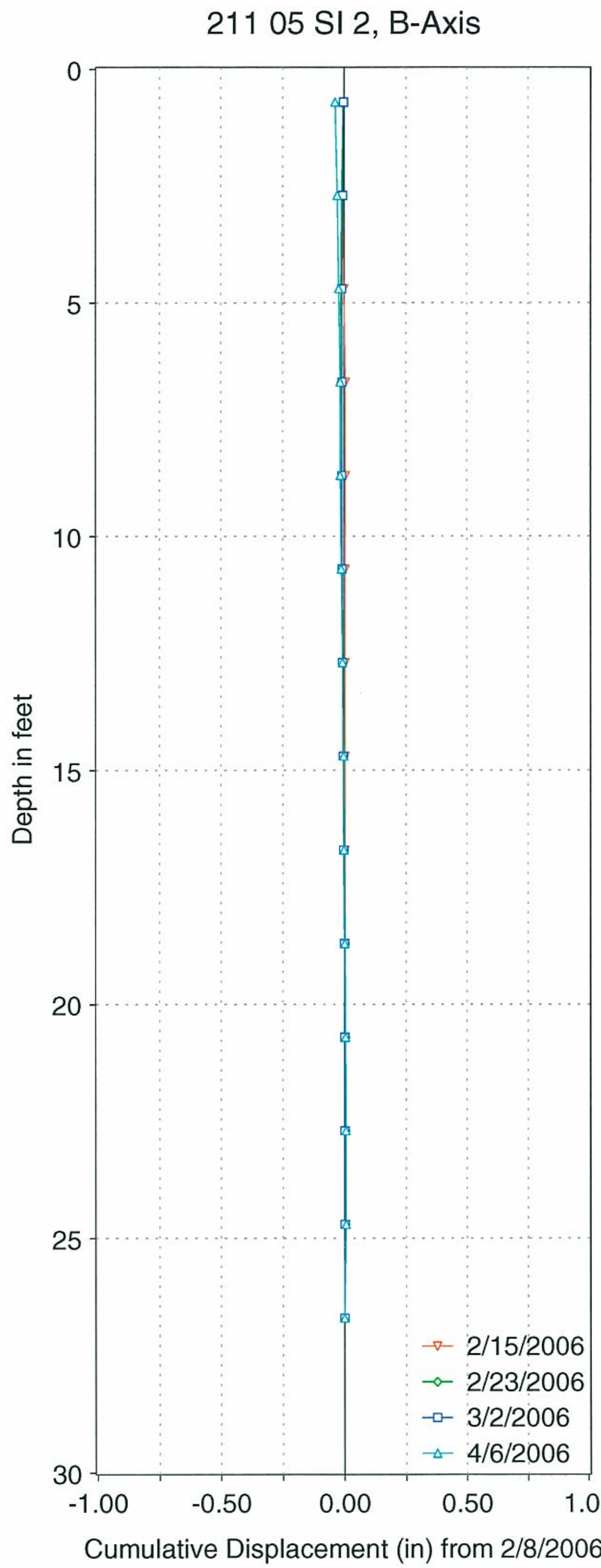


PETRA

FERROCARRIL LANDSLIDE
INCLINOMETER SI-1
MISSION VIEJO, CA

J.N. 211-05



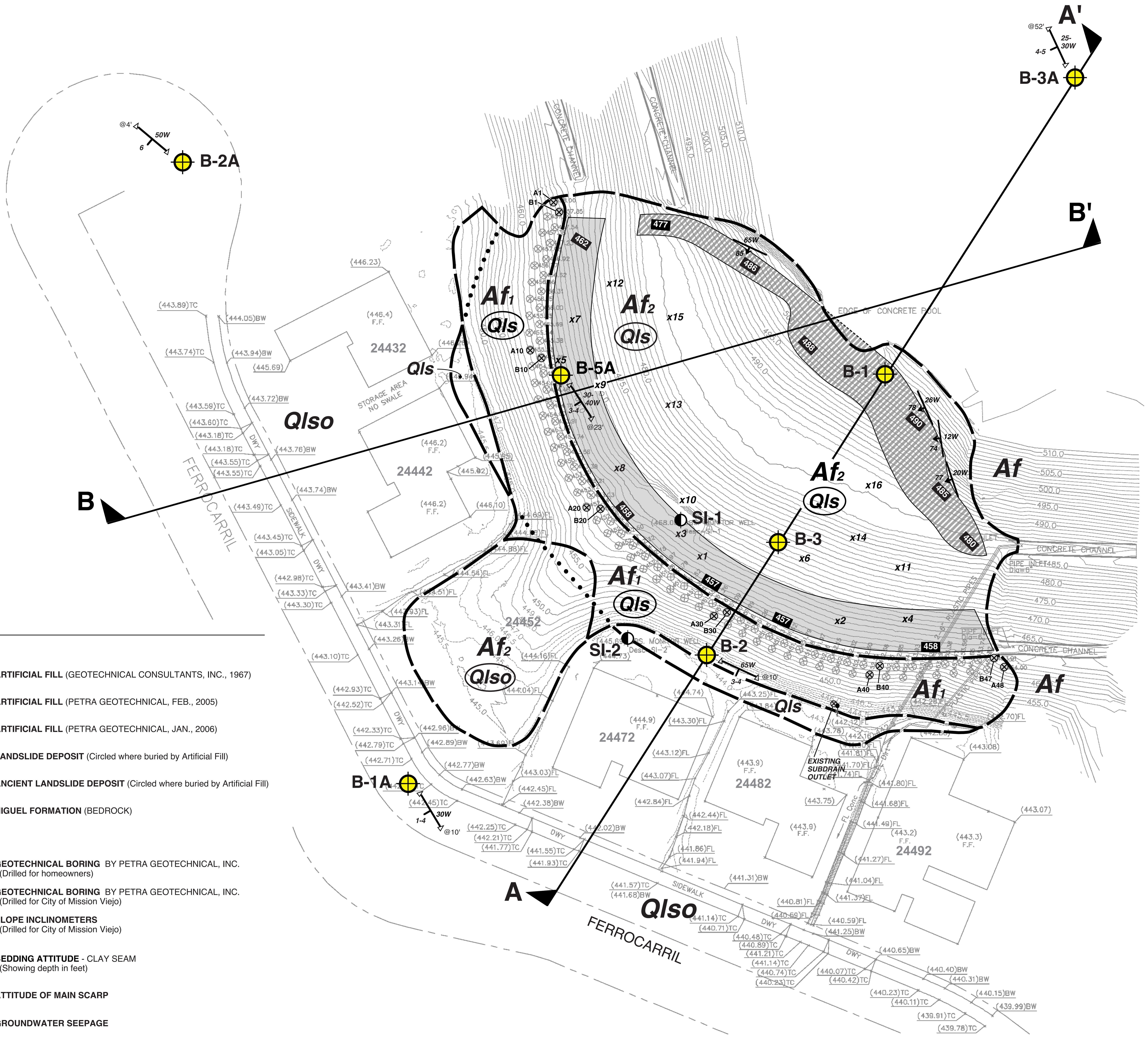


PETRA

FERROCARRIL LANDSLIDE
INCLINOMETER SI-2
MISSION VIEJO, CA

J.N. 211-05

TOPOGRAPHIC SURVEY FERROCARRIL SLOPE CITY OF MISSION VIEJO AS OF FEB. 23, 2006



LEGEND

BW	BACK OF WALK
CONC.	CONCRETE
Dia.	DIAMETER
DWY	DRIVEWAY
FF	FINISHED FLOOR
FL	FLOWLINE
TC	TOP OF CURB
⊗453.03	INDICATES PILE WITH DESIGN TOP ELEVATION
⊗ A48 ⊗ B47	PILE ROW AND NUMBER

SURVEYOR'S CERTIFICATE:

THIS SURVEY WAS PERFORMED BY ME OR UNDER MY SUPERVISION.

ROGER A. FRANK P.L.S. 4215

GRAPHIC SCALE

(IN FEET)
1 inch = 20 ft.

EXPLANATION

GEOLOGIC UNITS

Af	**ARTIFICIAL FILL** (GEOTECHNICAL CONSULTANTS, INC., 1967)
Af1	**ARTIFICIAL FILL** (PETRA GEOTECHNICAL, FEB., 2005)
Af2	**ARTIFICIAL FILL** (PETRA GEOTECHNICAL, JAN., 2006)
Qls	**LANDSLIDE DEPOSIT** (Circled where buried by Artificial Fill)
Qlso	**ANCIENT LANDSLIDE DEPOSIT** (Circled where buried by Artificial Fill)
Tn	**NIGUEL FORMATION** (BEDROCK)

SYMBOLS

B-3	**GEOTECHNICAL BORING** BY PETRA GEOTECHNICAL, INC. (Drilled for homeowners)
B-5A	**GEOTECHNICAL BORING** BY PETRA GEOTECHNICAL, INC. (Drilled for City of Mission Viejo)
SI-2	**SLOPE INCLINOMETERS** (Drilled for City of Mission Viejo)
@4' 6 50W	**BEDDING ATTITUDE** - CLAY SEAM (Showing depth in feet)
78 26W	**ATTITUDE OF MAIN SCARP**
	GROUNDWATER SEEPAGE
Af1 Qls	**APPROXIMATE LIMITS OF ACTIVE LANDSLIDE**
	GEOLOGIC CONTACT (Dashed Where Approximate)
B B'	**GEOLOGIC CROSS-SECTION**
x16	**APPROXIMATE LOCATION OF FIELD DENSITY TEST**

SYMBOLS (cont.)

	APPROXIMATE LOCATION OF KEY (2006)
	APPROXIMATE LIMITS OF UPPER REMOVAL AREA (2006)
458	**APPROXIMATE ELEVATION OF BOTTOM OF REMEDIAL EXCAVATION** (Feet)

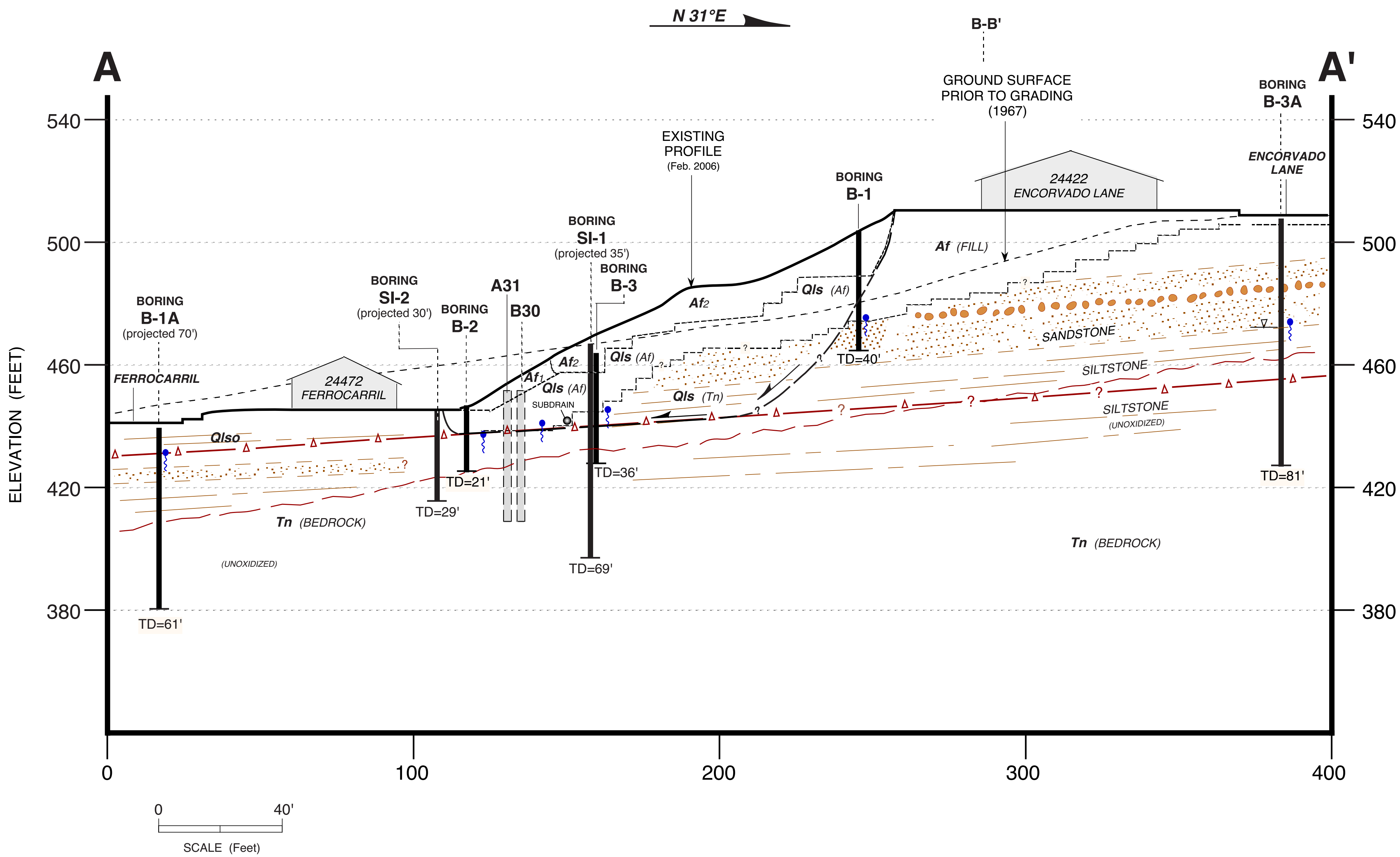
PETRA GEOTECHNICAL, INC.

JN 211-05	MAY, 2006
GEOTECHNICAL MAP	PLATE 1

JOHNSON-FRANK & ASSOC., INC.
LAND SURVEYING - MAPPING
5150 E. HUNTER AVENUE
ANAHEIM, CALIFORNIA 92807-2049
(714) 777-8877 FAX (714) 777-1641

DATE MAR. 7, 2006 SHEET 1 OF 1

SECTION A - A'

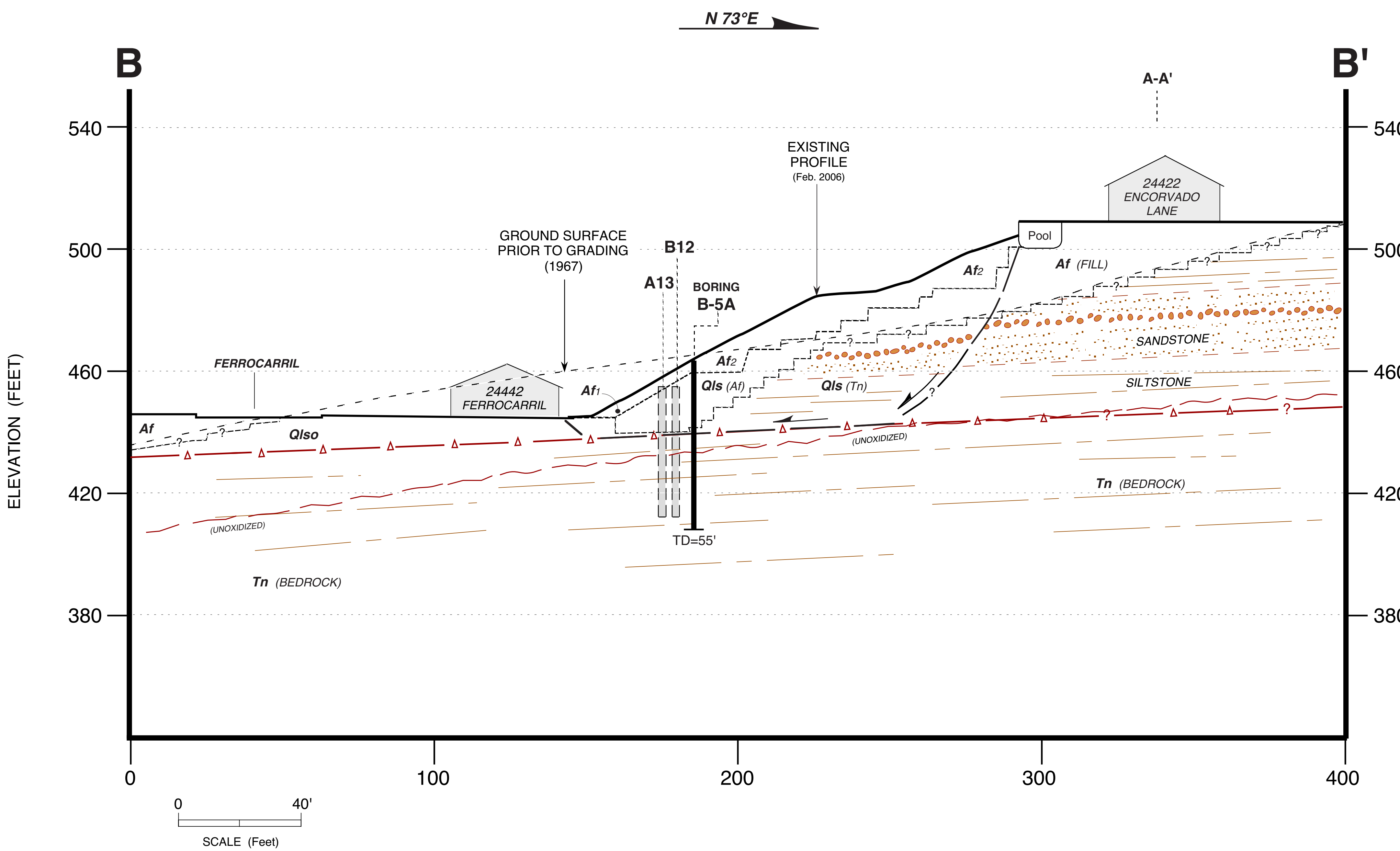


PETRA GEOTECHNICAL, INC.

JN 211-05 MAY, 2006

PLATE 2

SECTION B - B'



PETRA GEOTECHNICAL, INC.

JN 211-05 MAY, 2006

PLATE 3