Attachment 3

Draft Preliminary Geotechnical Report

Preliminary Geotechnical Report
White Point Landslide
San Pedro District
Los Angeles, California
W.O. E1907483
Task Order Solicitation 11-087

January 6, 2012

DRAFT

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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TABLE OF CONTENTS

FIGURES

APPENDICES

PRELIMINARY GEOTECHNICAL REPORT
WHITE POINT LANDSLIDE
W.O. E1907483, TASK ORDER SOLICITATION NUMBER 11-087
SAN PEDRO DISTRICT, LOS ANGELES, CALIFORNIA

1.0 INTRODUCTION

This report presents preliminary geotechnical information for the White Point Landslide located in the San Pedro District of Los Angeles. The site is located as shown in the Vicinity Map, Figure 1. The preliminary report summarizes our field explorations which occurred between November 25 and December 23, 2011 and our preliminary conclusions based on data collected to date. Note that additional tasks for this project, including post-landslide aerial topographic survey, laboratory testing, geologic cross sections, and stability analyses are either in progress or have not started. These tasks will be presented in our final geotechnical report for the project, anticipated to be released in April 2012. Our final geotechnical report will supersede this preliminary geotechnical report in its entirety.

The White Point Landslide and surrounding area is shown on the Site and Exploration Plan, Figure 2. Movement of the landslide was first reported by City of Los Angeles (City) representatives in June of 2011. Small cracks were observed in the pavement of the Paseo Del Mar roadway, which trends east and west along the top of a steep, approximately 120-foot-high, south-facing bluff overlooking the Pacific Ocean. These cracks became wider and more extensive and were accompanied by vertical displacement of the roadway surface and adjacent areas toward the beach over a period of five months. On November 20, 2011, a large section of the sea cliff rapidly failed, destroying an approximately 600-foot-long section of Paseo Del Mar and associated utilities aligned along the roadway.

2.0 SCOPE OF SERVICES

Our scope of services is based on the Task Order Solicitation (TOS) No. 11-087, dated November 16, 2011, and our proposal dated December 12 2011. The preliminary report presents a compilation of deliverables from Subtasks 1, 2, and 4 through 7 of the TOS. This is largely a data report, as it does not present conclusions and recommendations beyond our current assessment of landslide movement. Our conclusions and recommendations will be presented in our final geotechnical report upon completion of our tasks described in our proposal and TOS. Recommendations, if any, will be related to additional studies we believe should be performed. This preliminary report includes:

- Literature research,
- Geologic mapping and air photo review results,
- Field exploration plan,
- Health and safety plan,
- Boring logs, borehole instrumentation construction logs, borehole geophysical logs,
- Instrumentation monitoring results to date,
- Instrumentation monitoring plan,
- Geotechnical and analytical laboratory test results, and
- Preliminary geologic cross sections.

3.0 RESEARCH DATA AND FIELD MAPPING

3.1 Literature Research

The results of our literature search are included in the reference section at the end of this report. The Geology of the Palos Verdes Peninsula has been studied in detail for the last 80 years due to its location, the potential for oil bearing sediments, and the propensity for large slope failures. The White Point Landslide is not a unique failure or occurrence for this area. Other large landslides include the nearby Point Fermin landslide, the Portuguese Bend landslide, the Flying Triangle landslide, the Klondike Canyon landslide, the South Shores landslide, the Abalone Cove landslide, and the recent Trump National Golf Club landslide. Most, if not all of these landslides have occurred in the Monterey Formation, which is the same formation that underlies the White Point area. The regional geology are depicted on Figure 3.

3.2 Geologic Mapping and Air Photo Review Results

We have reviewed stereo photo pairs for the area including the 1928 Fairchild photographs and the 1953 United States Department of Agriculture photographs. The aerial photographs reviewed were chosen in part because of their time frame. The 1928 photographs was the earliest set of aerial photographs that were completed for Los Angeles County and typically predate most of the wide spread development that is present today. The 1953 photographs were chosen because they were closest to the construction date of the nearby Nike Missile Base. Review of the photographs did not indicate or reveal any pre-existing features that would be indicative of landsliding in the area upslope of the recent White Point Landslide.

Geologic mapping was completed of the surrounding slopes and along the beach below the landslide by Shannon & Wilson engineering geologists. Data was collected along outcrops below the existing landslide and within bedrock exposures in the surf zone. Additional mapping was also completed on the slopes north of the landslide area. The geologic data collected during the mapping along the beach is included in the Site and Exploration Plan, Figure 2. We have also included a Preliminary Geologic Cross Section, Figure 4, located through the central portion of the site, with our preliminary geologic interpretation of the underlying geologic structure below the site. This includes some of the data collected from the exploration program as well as interpretation from nearby bedrock outcrop.

3.3 Groundwater Review

We reviewed groundwater well data recorded by the Los Angeles County Department of Public Works. The nearest ground water well, 322S, is located approximately 8.5 miles northeast of White Point Landslide near the intersection of Figueroa Street and West "C" Street in San Pedro. No other water well or monitoring well records for the immediate area have been located to date. Review of the State of California GeoTracker website did not indicate any monitoring wells for the immediate area. The closest mapped monitoring wells were located at the northeast corner of Western Avenue and 25th Street, approximately 2800 feet north of the White Point Landslide.

4.0 FIELD EXPLORATIONS

4.1 General

The field exploration program for the White Point Landslide includes nine borings and a geologic mapping program of the surrounding area. Following completion of the field work, minor clean-up work including well development and well completion occurred between December 26 and 30.

The techniques used to advance and sample the borings are described below. At the time this report was being prepared, the final surveyed information for the well completions was not yet available. Also at the time this report was being prepared, the updated topographic map for the site was in the process of being completed. Locations of the borings are shown in Figure 2. The approximate locations are shown for completed borings where survey data is not yet available. Preliminary boring locations, depth, elevation, and general exploration data are presented on the Well and Inclinometer Summary, Table G-1, Appendix G.

4.2 Drilling

Drilling operations were accomplished by multiple drilling subcontractors. Jet Drilling, Inc. of Signal Hill, California, provided and operated a truck-mounted CME 75 rotary drill rig to complete boring B-1 between November 25, 2011 and November 26, 2011 between November 25, 2011 and November 29, 2011. Roy Bros of Malibu, California, provided and operated one truck-mounted EZ-Bore 24-inch Bucket Auger drill rig to complete borings B-2, B-3, B-4 and B-

5 between November 30, 2011 and December 15, 2011. Gregg Drilling & Testing, Inc. of Signal Hill, California, provided and operated a truck-mounted CME 75 rotary drill rig to complete borings B-7 and B-9 between December 13, 2011 and December 20, 2011. Boart Longyear of Upland, California, provided and operated a track-mounted sonic drill rig to complete borings B-6 and B-8 between December 12, 2011 and December 18, 2011.

A Shannon & Wilson certified engineering geologist supervised the field exploration program, and our field geologists and engineering staff members located the borings, observed the exploratory drilling, collected samples, and logged the borings. Our field activity reports during the drilling are included in Appendix A. The original boring locations as identified by the City were modified slightly in conjunction with the Palos Verdes Land Conservancy (Conservancy) to reduce potential impacts to the flora. Our biologist worked with Conservancy representatives to facilitate the equipment route and final locations of the explorations.

4.3 Health and Safety Plan

A Health and Safety Plan was prepared prior to initiation of the drilling and geologic mapping program. The plan attempted to identify the known hazards at the site as well as possible hazards related to subsurface structures and utilities. The plan was submitted to City representatives for their review and approval. The field program was completed with no reportable injuries from Shannon & Wilson personnel or subcontractors. A copy of the Health & Safety Plan is included in Appendix B.

4.4 Bucket Augers and Downhole Logging

The subsurface conditions were explored by drilling four borings using 24-inch-diameter, bucket-type drilling equipment. The borings were drilled to maximum depths of 120 feet below the existing grade. Caving and raveling of the boring walls occurred as indicated on the boring logs; however, casing or drilling mud was not used to extend the boring to the depths drilled.

The soils and bedrock encountered were down-hole logged by our engineering geologists, and discrete and bulk samples were obtained for laboratory review and testing. The preliminary log of the borings is presented in Appendix C; the depths at which samples were obtained are also indicated on the logs. The number of blows required to drive a Modified California Sampler 12 inches and the Kelly bar weight and drop are indicated on the log.

4.5 Rotary Core

Continuous HQ-wireline coring was used in borings B-1, B-7, and B-9 to sample and advance through rock. Preliminary boring logs are provided in Appendix C. Core samples were visually classified and described in the field, then boxed for transport to our laboratory and storage facility for further examination. Photographs of the core are provided in Appendix D. The rock core recovery was calculated by dividing the length of core recovered in the barrel by the length of the total drilled run. This ratio is expressed as a percent.

The rock quality designation (RQD), also presented graphically on the boring logs, is a modified core recovery percentage including only the total length of the specimens of intact rock more than 4 inches in length, divided by the total length of the core run. The smaller pieces are considered to be the result of close jointing, fracturing, or weathering in the rock mass and are excluded from the determination. Difficulties such as distinguishing natural fractures in the rock core from mechanical breaks due to drilling operations restrict the use of the RQD in evaluating in situ rock properties. However, it does provide a subjective estimate of rock mass quality and a comparison of rock quality in the borings.

4.6 Sonic Drilling

The field exploration program included two sonic borings at B-6 and B-8. Preliminary boring logs are provided in Appendix C. These borings were extended approximately 110 feet below ground surface, into the Monterey Formation. Sonic drilling uses a combination of rotation, down-pressure, and high-frequency vibration to penetrate the subsurface with a 4 inch inside-diameter core barrel. The core barrel was then over-cased with a larger 6 inch diameter casing, and withdrawn through the larger casing to retrieve a continuous 4 inch diameter core sample. Water was occasionally introduced into the hole for lubrication and cooling.

The sonic drilling yielded continuous core samples 4 inches in diameter, generally in 5 foot. Unlike rotary core drilling methods the samples are typically composed of broken chips or pieces and are collected in tubular bags or plastic (Lexan) sleeves. The advantage to this method is that the core is still retained in a stratigraphic interval and disposal costs have been reduced due to the minimalization of drilling fluids. For this project, we used the Lexan sleeves in the lower portion of the borings from about 70 to 110 feet bgs, targeting areas where we anticipated potential slip surfaces. For the borings core runs within the terrace unit and Monterey Formation were labeled, boxed, and transported to a storage facility for higher quality photography and further examination.

4.7 Acoustic & Optical Televiewer

4.7.1 Acoustic Televiewer Survey

GEOVision of Corona, California provided borehole Televiewer surveys using a RG Borehole Televiewer, or equivalent. The Borehole Acoustic Televiewer utilizes acoustic waves to image the internal surface of the borehole. Because it is acoustic, and not optical, it does not require clear water to operate. The resulting images can be laid out vertically almost like a physical core. The instrument has a built-in fluxgate magnetometer to maintain orientation accuracy throughout the measurement. Because of this, fractures that pass through the "core" can not only be mapped, but oriented in space to provide an orientation angle relative to north, and a dip angle at a measured depth. This analysis is done after the data collection using specialized software tools. The amount of time required to process the data will depend on the complexity of the rock (number of fractures). The acoustic televiewer requires a stable, fluid filled, uncased borehole between 67 and 150mm diameter.

4.7.2 Optical Televiewer Survey

Similar to the acoustic televiewer but using visible light optics, the OPTV probe provides a continuous, detailed and orientated 360º true color image of the borehole walls using a unique optical imaging system. This can be rapidly interpreted, using data from the internal orientation module, to obtain a complete feature analysis that includes dip, strike, frequency and fracture aperture.

Optical televiewer logging was conducted on borings B-1 and B-7. Acoustic televiewer logging was completed in the lower portion of B-1, below approximately 60 feet. The mix of logging techniques was used because of the fractured nature of the bedrock and the difficulty in retaining drilling mud or fluids, which are required the acoustic televiewer method. The optical and acoustic televiewer logs are included in Appendix E.

4.8 Instrumentation

4.8.1 General

Instrumentation, including monitoring wells, inclinometers, and vibrating wire piezometers, were installed as shown in Table G-1 and Figure 2, based on the TOS and discussions with City representatives during exploration activities. Details are presented in the following sections.

4.8.2 Observation Wells

Two 2-inch diameter PVC well casings were installed in borings B-6 and B-8, and one 8-inch PVC well casing was installed in the completed bucket auger boring B-3. The monitoring well locations are shown on Figure 2.

Sonic boreholes in which wells were installed were done so through the drill string outer pipe casing with the inner core barrel removed, which leaves a borehole annulus of approximately 6 inches in diameter. The bottom 5 foot of the hole was filled with 8/12 graded silica filter pack sand. The 0.020-inch machined-slotted well screen and blank threaded Schedule 40 PVC riser pipe were then placed within the outer pipe casing and filter pack sand was placed around the well pipe by pouring it from the surface. Depth of the sand placed inside the casing was continuously sounded using a weighted fiberglass tape measure. Sand was placed until it rose 1 to 2 feet inside the casing. Then the casing was retracted, being careful not to bring the bottom of the casing above the top of the sand. This was repeated until the sand had reached a depth of 5 feet above the top of the well screen. The remainder of the hole was backfilled with 10 feet of poured medium bentonite chips and then high solids sodium bentonite grout placed through a tremie pipe. A watertight locking cap was placed on the top of the well casing, and a flush-surface traffic-rated monument cover was placed in concrete over the top of the well.

The construction of the 8-inch well was completed in a 24 inch bucket auger hole, B-3. The bottom 5 foot of the hole was filled with Monterey #3 graded silica filter pack sand. The 0.020-inch machined-slotted well screen and blank threaded Schedule 80 PVC riser pipe were then placed between 110 and 40 below ground surface. The Monterey #3 filter pack sand was placed around the well pipe by pouring it from the surface. Depth of the sand placed inside the casing was continuously sounded using a weighted fiberglass tape measure. This was repeated until the sand had reached a depth of 5 feet above the top of the well screen. The remainder of the hole was backfilled with 5 feet of poured medium bentonite chips, which were then hydrated. A high solids sodium bentonite grout was placed through a tremie pipe to approximately 2 feet below ground surface. A watertight locking cap was placed on the top of the well casing, and a flush-surface traffic-rated monument cover was placed in concrete over the top of the well.

4.8.3 Vibrating Wire Piezometers

The vibrating wire piezometer converts water pressure to a frequency signal via a diaphragm, a tensioned steel wire, and an electromagnetic coil. The piezometer is designed so that a change in pressure on the diaphragm causes a change in tension of the wire. When excited by the electromagnetic coil, the wire vibrates at its natural frequency. The vibration of the wire in the proximity of the coil generates a frequency signal that is transmitted to the readout device. The readout device processes the signal, applies calibration factors, and displays a reading in the required engineering unit.

Vibrating wire piezometers were placed in borings B-1, B-5, B-7 and B-9 thus allowing water level readings at each location. In conjunction with the monitoring well locations at borings B-3, B-6 and B-8, it will allow a total of seven points water level monitoring points throughout the site. Additional details of the vibrating wire piezometers are presented in Appendix F.

4.8.4 Inclinometers

Inclinometers are devices for monitoring deformation normal to the axis of a pipe by means of a portable probe passing through the pipe. The inside of the pipe contains two sets of grooves at 90 degrees to each other so that the probe can track up and down the casing without rotating. The casing is usually installed so that one set of grooves is aligned in the down-slope direction. The probe contains a gravity sensing transducer designed to measure inclination with respect to the vertical. One high-impact, 2.75-inch O.D. and two 3.34-inch ABS plastic inclinometer pipes, or casings, manufactured by the Durham Geo Slope Indicator Company were installed in vertical boreholes. The 2.75-inch O.D. casing was installed in boring B-1, and the 3.34 inch O.D. casing was installed in Borings B-5, B-7 and B-9.

The purpose of the inclinometer casings is to permit periodic monitoring of the slope to detect hillside movements. The inclinometer measurements can define the location of deforming zone(s) and allow an evaluation of that zone as time progresses. Baseline (or “initial”) readings from each inclinometer are taken in the casings and then subsequent readings are taken at intervals and compared to the initial readings. Deviations from the initial readings may indicate slope movement.

Each reading consists of two sets of data. Data Set “A” measures deviation from the initial reading in the down-slope direction, referred to as the “A axis.” Data set B measures deviation from the initial reading at 90 degrees to the down-slope direction, the “B axis.” The initial readings were taken on December 21, 2010; note these are considered the “baseline” readings and are typically not plotted. The subsequent data sets can be plotted as incremental or cumulative change. Additional details of the inclinometer installation and plots of the incremental change are shown in Appendix G.

5.0 LABORATORY TESTING

5.1 Geotechnical Testing

Included below is the table with the requested sampling schedule. We are in the process of assigning testing to samples collected to the exploration program.

Number of Tests	Geotechnical Laboratory Tests
40	In-Place Density and Field Moisture (ASTM D2216 and D2937)
5	Atterberg Limits (ASTM D4318)
4	Sieve Analysis, 3-inch to No. 200 Sieve (ASTM D422)
4	Percent Passing No. 200 Sieve (ASTM D1140)
3	Sieve plus Hydrometer (ASTM D422)
4	Three-Point Direct Shear Test (ASTM D3080)
4	Repeat Residual Shear
2	Consolidation
2	Chemical Tests for corrosion potential (CA DOT Method)
3	Unconfined compression
2	Specific Gravity
5	Point Load

5.2 Environmental Testing

Samples of the surficial soil from the terrace deposits were collected from borings B-3, B-4 and B-5 and tested per ASTM Test Methods 8260 and 8270 as requested by the City. The laboratory results for the samples are included in Appendix H. Based on the results, the targeted analytes were reported as "Not Detected."

6.0 CONCLUSIONS

Based on our studies completed to date, it is our opinion that the risk of landslide movement beyond the current chainlink fence placed along the nature preserve trail and perimeter of the White Point landslide is low. From data collected by the inclinometers, there appears to be no significant movement at these locations (borings B-1, B-5, B-7, and B-9). This suggests that the adjacent properties and recent storm drain improvements are not subject to movement related to the current landslide limits from the time of our readings.

Visual observation of the existing cracks adjacent to the main head scarp suggests that the material immediately adjacent to the scarp is moving or rotating into the graben area. We expect to see periodic calving of this material throughout the upcoming winter months. It is also likely that the main landslide mass will continue to move ocean-ward and likely accelerate during periods of heavy precipitation.

Signs should be placed on the beach on the east and west limits of the landslide to warn individuals of the potential hazards related to additional slope failure and possible collapse.

7.0 LIMITATIONS

This report was prepared for the exclusive use of the City of Los Angeles for specific application to this project.

The preliminary analyses, conclusions, and recommendations contained in this report are based on site conditions as they presently exist and are subject to change as our services on this project progresses. We assume that the explorations made for this project are representative of the subsurface conditions throughout the project area (i.e., the subsurface conditions everywhere at the site are not significantly different from those disclosed by the explorations).

Within the limitations of the scope, schedule, and budget, the preliminary analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practices in this area at the time this report was prepared. We make no other warranty, either express or implied. These conclusions and recommendations were based on our understanding of the project as described in this report and the site conditions as interpreted from the current explorations.

Shannon & Wilson, Inc. has prepared the document, "Important Information About Your Geotechnical/Environmental Report," in Appendix I to assist you and others in understanding the use and limitations of this report.

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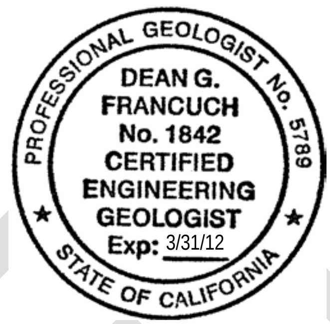

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8.0 REFERENCES

Anderson, J. L., 1987, Deformation in the Coastal Portion of the Abalone Cove Landslide, a Natural Laboratory for the study of Tectonics in Miniature, in Fisher, P. J, Geology of the Palos Verdes Peninsula and San Pedro Bay: Society of Economic Paleontologists and Mineralogists & American Association of Petroleum Geologists, p. 57.

Anderson, J. L., 1987, The Flying Triangle Landslide: Geologic, Geomorphologic, and Tectonic Factors, in Fisher, P. J, Geology of the Palos Verdes Peninsula and San Pedro Bay: Society of Economic Paleontologists and Mineralogists & American Association of Petroleum Geologists, p. 2-1 to 2-6.

County of Los Angeles, 1975, Engineering Geologic and Seismic Report, White's Point Military Reservation; prepared by County of Los Angeles, Department of County Engineer Design Division, report dated August 26, 1975.

Ehlig, P. L., 1987, The Portuguese Bend Landslide Stabilization Project, in Fisher, P. J, Geology of the Palos Verdes Peninsula and San Pedro Bay: Society of Economic Paleontologists and Mineralogists & American Association of Petroleum Geologists, p. 2-17 to 2-24.

Haydon, W.D., 2007, Overview of the landslides of the Palos Verdes Peninsula, in Brown, A.R., Shlemon, R.J., and Cooper, J.D., eds., Geology and Paleontology of Palos Verdes Hills, California: A 60th Anniversary Revisit to Commemorate the 1946 Publication of U.S. Geological Survey Professional Paper 207: Pacific Section, Society for Sedimentary Geology (SEPM), book 103, p. 259-270.

Hill, C. A., Douglas, R.G.; and Hammond, D.E., 2007, A hydrological assessment of groundwater sources in the Portuguese Bend and Abalone Cove Landslide areas, California: implications for landslide movement, in Brown, A.R., Shlemon, R.J., and Cooper, J.D., eds., Geology and Paleontology of Palos Verdes Hills, California: A 60th Anniversary Revisit to Commemorate the 1946 Publication of U.S. Geological Survey Professional Paper 207: Pacific Section, Society for Sedimentary Geology (SEPM), book 103, p. 271-292.

Lass, G. L. and Eagen, J. T., 1986, Introduction to the Ancient Albalone Cove Landslides, *in* Pipkin, B. and others, Geology and Landslides of Palos Verdes Hills California: National Association of Geology Teachers, p. 40-46.

Linden, K. V., 1988, The Portuguese Bend Landslide, *in* Johnson, A. M. and others, Engineering Geology: Elsevier Science Publishers B. V., v 27, no. 1-4, p. 301-374.

Linden, K. V. and Lindvall, C. E. ,1986, The Portuguese Bend Landslide, *in* Pipkin, B. and others, Geology and Landslides of Palos Verdes Hills California: National Association of Geology Teachers, p. 32-39.

Pipkin, B. W., Ehlig, P., and Bryan, M. E., 1986, Geology and Landslides of Palos Verdes Hills California: National Association of Geology Teachers, p. 4-6.

Scullin, M., 1987, Point Fermin Landslide, *in* Fisher, P. J, Geology of the Palos Verdes Peninsula and San Pedro Bay: Society of Economic Paleontologists and Mineralogists & American Association of Petroleum Geologists, p. 2-25 to 2-36.

Slosson, J. E. and Havens, G. W., 1987, Mitigation Rather than Litigation of the Abalone Cove Landslide, *in* Fisher, P. J, Geology of the Palos Verdes Peninsula and San Pedro Bay: Society of Economic Paleontologists and Mineralogists & American Association of Petroleum Geologists, p. 2-13 to 2-16.

State of California, 2012, State Water Resources Control Board GeoTracker; http://geotracker.waterboards.ca.gov/

Woodring, W. P., Bramlette, M. N., Kew W. S., 1946, Geology and Paleontology of Palos Verdes Hills, California, *in* Ickes, H. L. and Wrather, W. E., United State Department of the Interior (USDI): U. S. Government Printing Office, p. 16-33, 39-40, 112.