GEOTECHNICAL DISCUSSION OF ROCK HARDNESS REMEDIAL EARTHWORK, AND EARTHWORK BALANCE FACTORS OCEAN BREEZE RANCH PLANNING AREAS, PA-1, PA-2, AND PA-3 BONSALL, SAN DIEGO COUNTY, CALIFORNIA

FOR

OCEAN BREEZE RANCH, LLC
5820 WEST LILAC ROAD
BONSALL, CALIFORNIA 92003

W.O. 6960-A-SC JUNE 16, 2016

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental

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June 16, 2016

W.O. 6960-A-SC

Ocean Breeze Ranch, LLC
5820 West Lilac Road
Bonsall, California 92003

Attention: Mr. Jim Conrad

Subject: Geotechnical Discussion of Rock Hardness, Remedial Earthwork, and Earthwork Balance Factors, Ocean Breeze Ranch Planning Areas, PA-1, PA-2, and PA-3, Bonsall, San Diego County, California

Reference: "Geotechnical Feasibility Evaluation, Vessels Stallion Ranch, Bonsall, San Diego County, California," W.O. 6688-A-SC, dated January 30, 2015, by GeoSoils, Inc.

Dear Mr. Conrad:

In accordance with your request, GeoSoils Inc. (GSI) has prepared this discussion of remedial earthwork, earthwork balance factors, and rock hardness with respect to rough grading of the Ocean Breeze Ranch site in the community of Bonsall, San Diego County, California. The scope of work performed in preparation of this preliminary report is part of a larger site evaluation in progress. Unless specifically superceded herein, the conclusions and recommendations presented in the reference report remain valid and applicable.

ROCK HARDNESS EVALUATION

A seismic refraction survey was performed in selected areas of deep cuts where the site is underlain with near surface granitic bedrock. To date, the survey consists of seven (7) seismic refraction lines, with four (4) completed within the vicinity of PA-1/2. A summary of methodology and procedures is presented in the referenced report.

Layer boundaries tend to mimic the surface topography, although variations are common depending upon the depth of weathering, fracturing, etc. In general, the survey indicated a near surface layer (Layer 1) thickness (i.e., undocumented fill, colluvium, weathered bedrock), ranging from about ±1 to ±7 feet. The average velocity of Layer 1 material is about ±1,000 fps, and is considered typical for such near surface material. The depth to the Layer 1/Layer 2 transition (bedrock) also ranges from about ±1 to ±7 feet below existing grades. The average velocity of Layer 2 is about ±2,900 fps, with some variability. Layer 3 is inferred at depths on the order of ±9 to possibly 38 feet, with average velocities in Layer 3 (relatively unweathered bedrock) likely greater than 4,700 fps. At depths where

velocities are greater than about 6,000 fps, rippability is ambiguous and blasting usually is required.

An evaluation has been made of the seismic refraction line data to estimate the approximate depth to non-rippable trenching (i.e., utility excavation) and to non-rippable bedrock. Approximate cut-off velocities of ±3,800 and ±6,000 fps are generally used as a basis for non-rippable trenching (assuming a Cat 235 Hoe [a large trackhoe], or equivalent), and non-rippable bedrock (assuming a D9L, or equivalent), respectively. It should be noted that a conventional rubber-tired backhoe can experience non-productive trenching at seismic velocities much less than ±2,000 to 2,500 fps.

Bedrock excavatability with respect to trenching shallower than the approximate ±3,800 fps cut-off depth is expected to vary from easy to very difficult and the necessity for localized areas requiring rock breaking, or blasting should be anticipated. Similarly, bedrock rippability shallower than the approximate ±6,000 fps cut-off depth is expected to vary from easy to very difficult, and the necessity for localized areas requiring rock breaking and/or blasting cannot be entirely precluded.

Variations should be expected. As such, bedrock excavations from the surface downward may generate oversize rock. Isolated "floaters" or corestones may also be encountered. The bulk of the materials derived from the weathered portion of the bedrock (up to and including the ±3,800 to 6,000 fps cut-off) are anticipated to disintegrate to approximately 12 to 24 inches and smaller constituents. Any oversize materials ($\geq$ 12 inches) generated would require special handling for use in fills, and may not be placed within 10 feet of finish grade or used as backfill in utility trenches. Oversize materials typically become commonplace during excavation into 5,000 fps materials, usually requiring specialized placement techniques during grading.

Based upon our experience in this area, and the seismic refraction data obtained, the following table reflects our preliminary estimates of the rippability and trenchability at the locations of the seismic refraction survey lines; other interpretations are possible:

SEISMIC LINE NO.	GENERAL RIPPABILITY (ASSUMING A D9L DOZER OR CAT 235 HOE, OR EQUIVALENT)
ST-1	Rippable and trenchable to depths explored of 30 feet. Difficult trenching below depths of 2 to 4 feet. Localized blasting and/or rock breaking may not be precluded below depths of 10 feet.
ST-2	Rippable and trenchable to depths explored of 30 feet. Difficult trenching below depths of 2½ to 3 feet. Localized blasting and/or rock breaking may not be precluded below depths of 10 feet.
ST-3	Rippable and trenchable to depths explored of 30 feet. Moderate to difficult trenching below depths of 3½ feet. Localized blasting and/or rock breaking may not be precluded below depths of 30 feet.

SEISMIC LINE NO.	GENERAL RIPPABILITY (ASSUMING A D9L DOZER OR CAT 235 HOE, OR EQUIVALENT)
ST-4 (PA-2)	Rippable to depths explored of 30 feet. Not trenchable below depths of 3 to 4 feet. Localized blasting and/or rock breaking may not be precluded below depths of 10 feet. Oversize material is significant.
ST-101 (PA-2)	Rippable and trenchable to depths explored of ±30 feet. Difficult trenching below depths of 2½ to 5½ feet. Localized blasting and/or rock breaking may not be precluded below depths of 30 feet.
ST-102 (PA-2)	Rippable and trenchable to depths explored of ±30 feet. Difficult trenching below a depth of 2½ feet. Localized blasting and/or rock breaking may not be precluded below depths of 30 feet.
ST-103 (PA-2)	Rippable and trenchable to depths explored of ±38 feet. Difficult trenching below depths of 4½ to 7 feet. Localized blasting and/or rock breaking may not be precluded below depths of 30 feet.

Rock Hardness Summary

In general, utilizing the seismic data, it appears that the site area in the vicinity of our seismic lines may be characterized as being underlain by a surficial soils (fill, colluvium, weathered rock) to depths ranging from about ±1 to about ±7 feet in thickness, with less weather bedrock below those depths. At depths inferred to be approximately 30 feet or more, relatively fresh and very dense granitic bedrock likely exists. Based on all of the above, the need for overexcavation, blasting and/or line shooting would be anticipated on the site, should proposed cut grades exceed the depths indicated herein, in areas underlain with granitic bedrock (see Plate 1). It should be noted that a conventional rubber-tired backhoe will experience non-productive trenching at seismic velocities much less than ±2,000 to 2,500 fps. The seismic refraction data presented herein should be further reviewed in conjunction with final grading plans (when available). It should be noted that due to the variability of bedrock weathering, and the potential for local boulders, or less weathered bedrock, very difficult ripping, rock breaking, and/or blasting cannot be entirely precluded at shallower depths, even at or near the surface.

REMEDIAL EARTHWORK

Removals

A remedial removal exhibit was prepared by GSI (Attached as Plate 1). This exhibit indicates removal depths for the various areas of the site, based on the type of near surface material present. In general, this exhibit summarizes removals as follows:

Colluvium - A surficial soil layer with a thickness on the order of 2 to 3 feet where it is underlain by granitic bedrock, and 4 to 5 feet where it is underlain with older alluvium. Colluvium is present within all areas of the site, excluding PA-3.

Alluvium - A surficial soil deposit, predominately occurring within PA-3, and a portion of PA-2. Complete removals are anticipated within PA-2, and may be anticipated to vary from about 13 to 20 feet (see the reference report). Within PA-3, the depth of removal is limited by the depth to a shallow groundwater table. In general, the remedial removal excavations within PA-3 are anticipated to be completed to near the groundwater table, at depths on the order of 10 to 12 feet below existing grades, and be completed to at least 15 feet outside the improvement area.

Deposits of Older Alluvium and granitic bedrock are considered suitable bearing material, and removal is not required. It should be noted that the current limits of PA-3 are greater than indicated on Plate 1; however, this does not affect the anticipated removal depth in these areas.

Transitions/Overexcavation

In order to reduce the potential for differential settlement and facilitate trenching for foundations underground utilities, etc., the entire cut portion of the building pad(s), areas with planned fills less than 4 feet thick, and areas where the as-built fill thickness would be less than 4 feet after remedial removals have been performed should be overexcavated to a minimum depth of 4 feet below finish grade or 2 feet below the lowest foundation element (whichever is greater) and be replaced with compacted fill. The overexcavation subgrade bottom should be inclined to drain away from the structure(s), and into the street. Prior to fill placement, the overexcavation subgrade should be scarified at least 8 inches in depth, moisture conditioned as necessary, and be recompacted to at least 90 percent of the laboratory standard (ASTM D 1557). Overexcavation should be completed to a minimum lateral distance of 5 feet outside the outermost exterior foundation. Overexcavation for underground utilities may be completed to at least 1 foot below the lowest utility invert and be replaced with compacted fill. The undercut transition should not create a minimum to maximum of fill thickness variation of more than 3:1 (maximum to minimum) across any lot.

Miscellaneous

Other type of remedial earthwork, such as stabilization fill, buttresses, etc. are not anticipated at this time, but may not be entirely precluded, as conditions are exposed in the field during grading.

EMBANKMENT FACTORS

Excavation into onsite earth materials, such as existing fills, colluvium, alluvium, and older alluvium, will generally generate mixtures of silty sand, sand and gravelly sand, with minor amounts of clayey sand, and produce good to fair quality fill material. Excavations within the underlying granitic bedrock will generally produce good quality material near the surface, with poor quality fill material consisting of angular gravel to cobble to boulder size rock fragments becoming more abundant with depth of excavation.

Embankment factors (shrinkage/bulking) for the site have been estimated based upon our experience with other sites in the general vicinity, as well as data obtained from ongoing site exploration. It is apparent that shrinkage would vary with depth and with areal extent over the site. The refraction data indicates variability between depths of about 4 feet to 20 feet b.e.g., in addition to other variables, including vegetation, weed control, discing, and previous filling or exporting, etc. All these factors are difficult to define in a three-dimensional fashion, and the contractors compactive efforts may also contribute some variance. Therefore, the information presented below represents average shrinkage and bulking values, using the following assumptions.

Colluvium . . . . . 10-15% Shrinkage
Alluvium . . . . . 10-15% Shrinkage
Older Alluvium . . . . . 2-5% Shrinkage
Existing Fill . . . . . 2-5% Shrinkage
Bedrock (from Church, 1981)
- 25% Rock/75% Earth (about 2½ to 4 feet b.e.g.) . . . . . 8% Shrinkage
- 50% Rock/50% Earth (about 4 to 18 feet b.e.g.) . . . . . 5% Shrinkage
- 75% Rock/25% Earth (about 18 to 30 feet b.e.g.) . . . . . 12% Bulk
- 100% Rock (> ±30 feet b.e.g.) . . . . . 12-33% Bulk

Please note that the depths assigned to the various bedrock zones are measured below existing grades (b.e.g.). We emphasize that the seismic refraction data obtained does not indicate the actual depth to 100% rock, but infers that it exists below a depth that ranges from about 10 to 38 feet (b.e.g.). Prior to grading and finalization of grading plans, additional rock hardness evaluation with an air track rig should be considered in this regard.

PLAN REVIEW

Final project plans (grading, precise grading, foundation, retaining wall, landscaping, etc.), should be reviewed by this office prior to construction, so that construction is in accordance with the conclusions and recommendations of this report. Based on our review, supplemental recommendations and/or further geotechnical studies may be warranted.

LIMITATIONS

The materials encountered on the project site and utilized for our analysis are believed representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during mass grading. Site conditions may vary due to seasonal changes or other factors.

Inasmuch as our study is based upon our review and engineering analyses and laboratory data, the conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. GSI assumes no responsibility or liability for work or testing performed by others, or their inaction; or work performed when GSI is not requested to be onsite, to evaluate if our recommendations have been properly implemented. Use of this report constitutes an agreement and consent by the user to all the limitations outlined above, notwithstanding any other agreements that may be in place. In addition, this report may be subject to review by the controlling authorities. Thus, this report brings to completion our scope of services for this portion of the project. All samples will be disposed of after 30 days, unless specifically requested by the Client, in writing.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

Robert G. Crisman
Engineering Geologist, CEG 1934

John P. Franklin
Engineering Geologist, CEG 1340

David W. Skelly
Civil Engineer, RCE 47857

RGC/DWS/JPF/jh

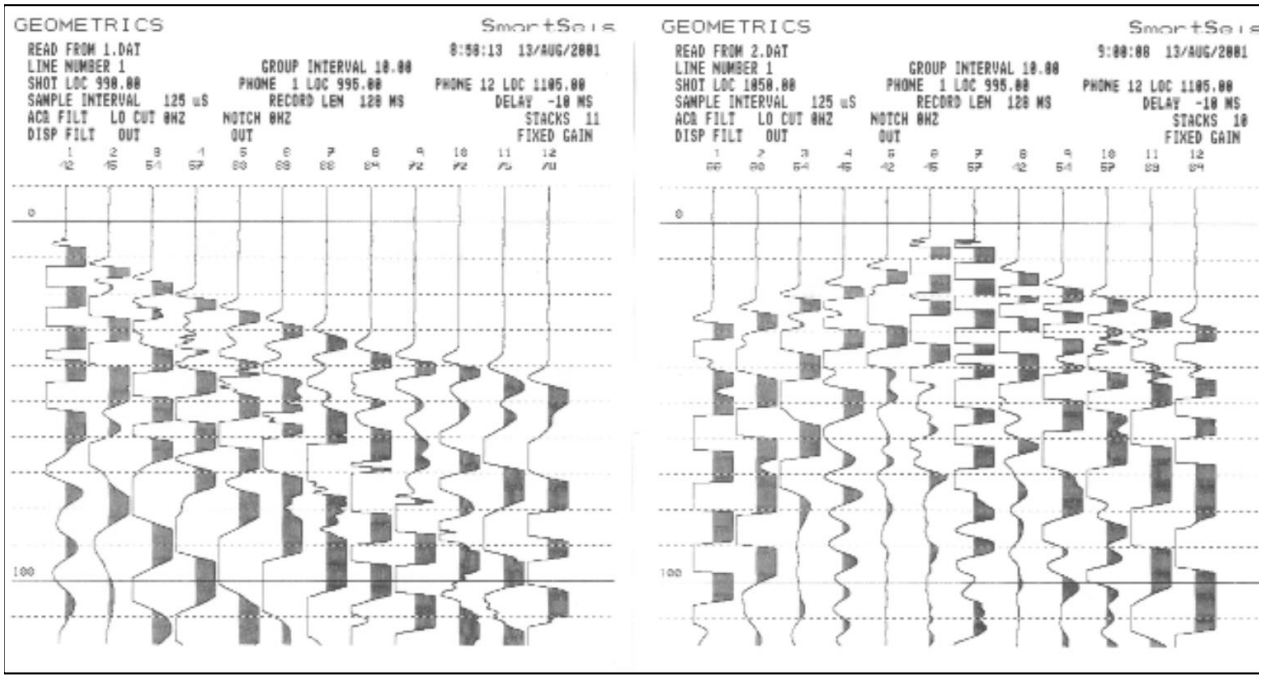
Attachments: Appendix - Seismic Refraction Data
Plate 1 - Geotechnical Map - Remedial Removal Exhibit

Distribution: (1) Addressee (electronic copy)
(1) Helios Property Solutions, Attn: Mr. Pete Fagrell
(1) Project Design Consultants, Attn: Ms. Debbie Reece

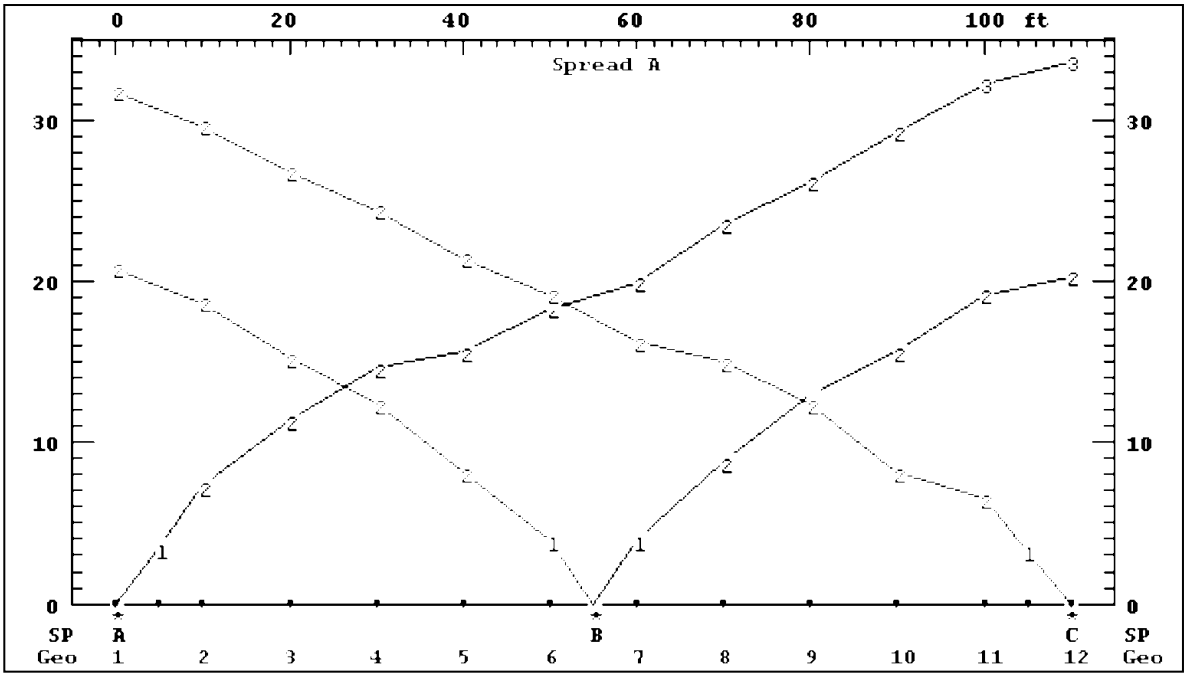
APPENDIX

SEISMIC REFRACTION DATA

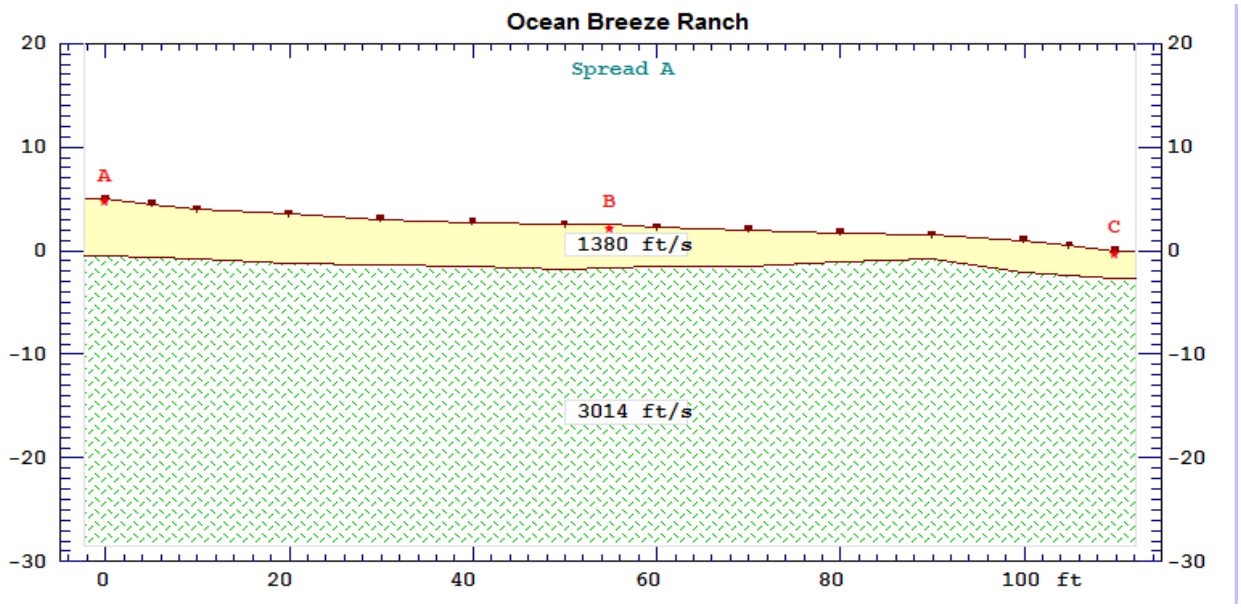
Example
Raw Seismic Data



Example
Seismic Line



Seismic Line
ST-101



South North

Ocean Breeze Ranch
Bonsall, California

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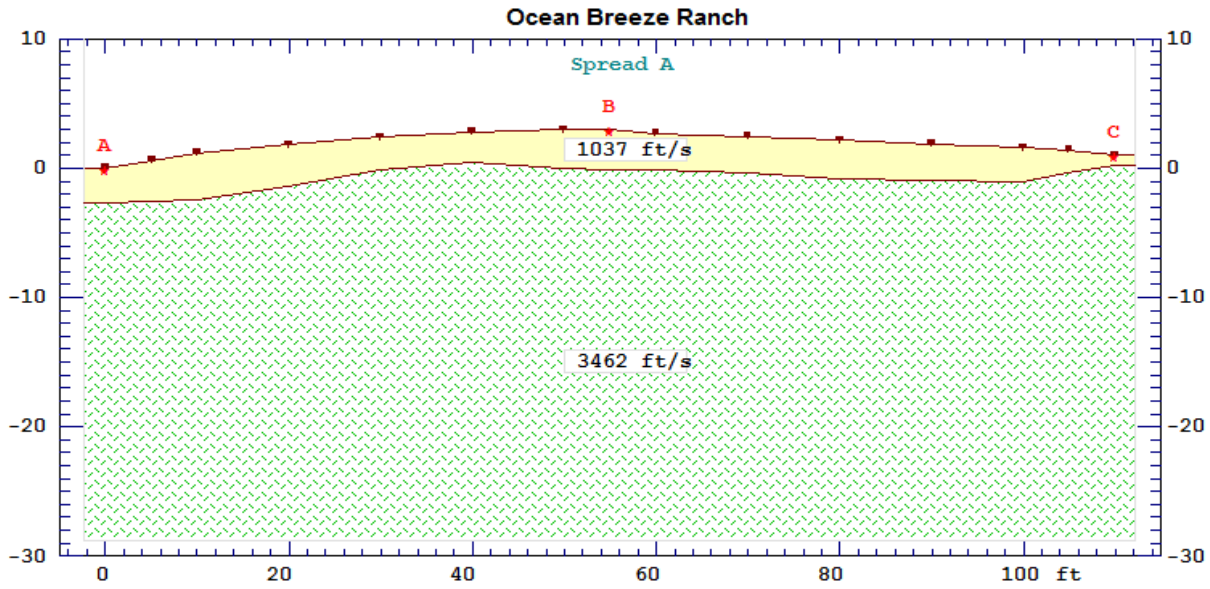
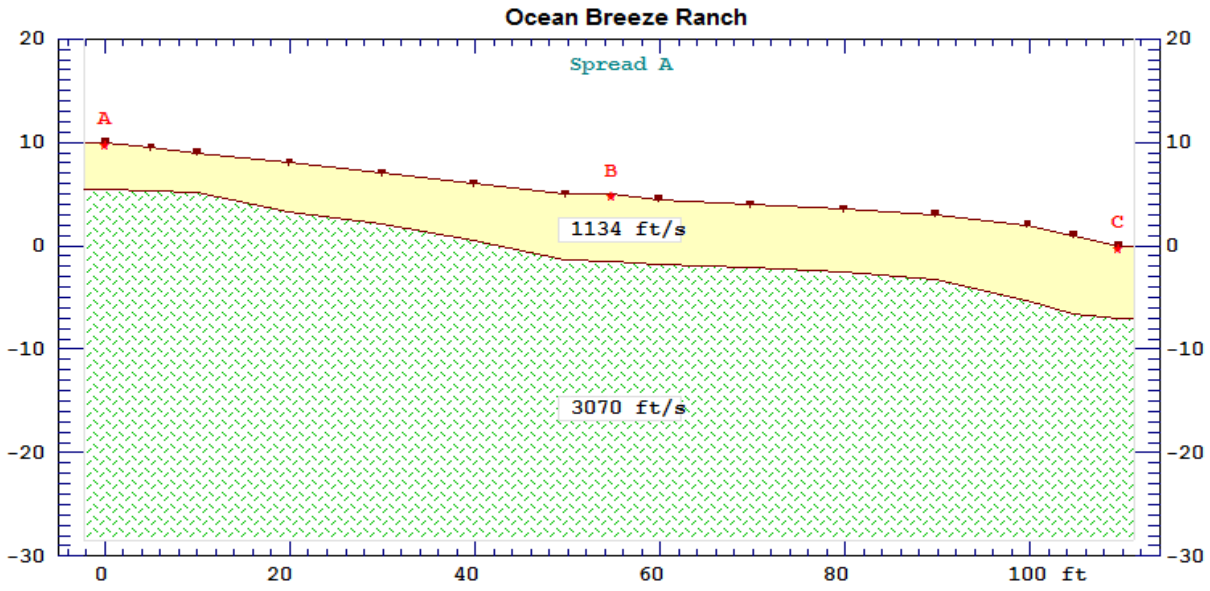
Plate A-3

Seismic Line
ST-102

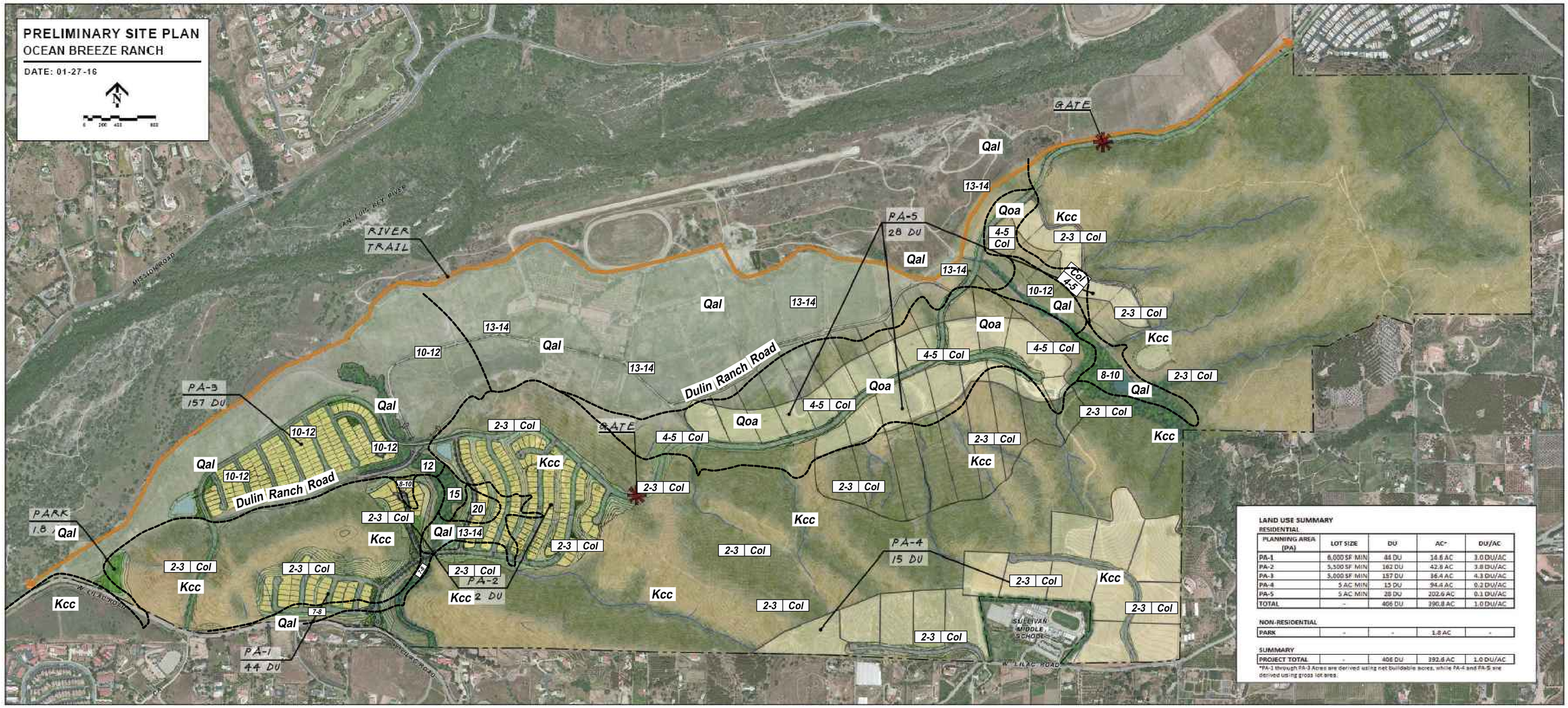


North South

Seismic Line
ST-103



East West



LAND USE SUMMARY

RESIDENTIAL

PLANNING AREA (PA)	LOT SIZE	DU	AC*	DU/AC
PA-1	6,000 SF MIN	44 DU	14.6 AC	3.0 DU/AC
PA-2	5,500 SF MIN	162 DU	42.8 AC	3.8 DU/AC
PA-3	5,000 SF MIN	157 DU	36.4 AC	4.3 DU/AC
PA-4	5 AC MIN	15 DU	94.4 AC	0.2 DU/AC
PA-5	5 AC MIN	28 DU	202.6 AC	0.1 DU/AC
TOTAL	-	406 DU	390.8 AC	1.0 DU/AC

NON-RESIDENTIAL

PARK	"	"	1.8 AC	"

SUMMARY

PROJECT TOTAL	-	406 DU	392.6 AC	1.0 DU/AC

*PA-1 through PA-3 Acres are derived using net buildable acres, while PA-4 and PA-5 are derived using gross lot area.

TABLE A

PRELIMINARY SHRINKAGE/BULKING VALUES

COLLUVIUM	10%-15%	SHRINKAGE				
ALLUVIUM	10%-15%	SHRINKAGE				
OLDER ALLUVIUM	2%-5%	SHRINKAGE				
BEDROCK						
25% ROCK/75% EARTH,	8%	SHRINKAGE FROM	-3	TO -6	FEET bg	
50% ROCK/50% EARTH,	5%	SHRINKAGE FROM	-6	TO -12	FEET bg	
75% ROCK/25% EARTH,	12%	BULK, FROM	-12	TO -20	FEET bg	
100% ROCK,	33%	BULK, BELOW		-20	FEET bg	

ALL DEPTHS WILL HAVE VARIABILITY

NOTES

1. REMOVAL DEPTH DATA OBTAINED FROM:

"GEOTECHNICAL FEASIBILITY EVALUATION, VESSELS STALLION RANCH, BONSALL, SAN DIEGO COUNTY, CALIFORNIA", W.O. #6688-A-SC, DATED: JANUARY 30, 2015, BY GEOSOILS, INC.

2. ANY SHRINKAGE/BULKING ASSOCIATED WITH "CUT" EXCAVATION BELOW THE REMOVAL DEPTH INDICATED AS SHOWN IN TABLE A.

GSI LEGEND

- **Col** – COLLUVIUM
- **Qal** – QUATERNARY ALLUVIUM
- **Qoa** – QUATERNARY OLDER ALLUVIAL FLOOD PLAIN DEPOSITS
- **Kcc** – CRETACEOUS-AGE GRANITIC BEDROCK (TONALITE OF COUSER CANYON)
- – APPROXIMATE BOUNDARY FOR SPECIFIC REMOVAL DEPTH, AND/OR SOIL TYPE
- **13-14** – APPROXIMATE REMOVAL DEPTH, IN FEET
- **4-5 Col** – APPROXIMATE THICKNESS (REMOVAL DEPTH) OF COLLUVIUM OVERLAYING OLDER ALLUVIUM OR BEDROCK

N

GRAPHIC SCALE

400 0 200 400 800 1600

1" = 400'

ALL LOCATIONS ARE APPROXIMATE

This document or efile is not a part of the Construction Documents and should not be relied upon as being an accurate depiction of design.

GeoSoils, Inc.

GEOTECHNICAL MAP
REMEDIAL REMOVALS EXHIBIT
Plate 1

W.O. 6960-A-SC	DATE: 06/16	SCALE:1" = 400'