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To Kiewit Shea Desalination Pipeline
6241 Yarrow Drive, Suite A
Carlsbad, CA 92011

Job No 12-685-03

Date 2/14/2014

Atten Dave Mixon

Project Melrose Lot Geotechnical Investigation
Carlsbad, CA

We Are Sending For: Your Use

Via: E-Mail

Date	Copies	Description
2/10/2014	1	Limited Geotechnical Investigation for Vacant Lot

Comment:

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GEOTECHNICAL CONSULTANTS

February 10, 2014

RMA Project No. 12-685-0/3

Kiewit Shea Desalination Pipeline
6241 Yarrow Drive, Suite A
Carlsbad, CA 92011

Attention: Mr. Dave Mixon

Subject: Limited Geotechnical Investigation for Vacant Lot
East Side of Melrose Drive
North of Cannon Road and South of Sunset Avenue
APN 169-180-27
Vista, CA

Dear Mr. Mixon:

In accordance with your request, a limited geotechnical investigation has been completed for the above-referenced project. The report addresses both engineering geologic and geotechnical conditions. The results of the investigation are presented in the accompanying report, which includes a description of site conditions, results of our field exploration and laboratory testing, conclusions, and recommendations. At this time there are no specific development plans for the lot and therefore this investigation is limited to address rough grading of the lot only and is not intended to provide finish grading or foundation recommendations which should be provided when plans are finalized.

We appreciate this opportunity to be of continued service to you. If you have any questions regarding this report, please do not hesitate to contact us at your convenience.

Respectfully submitted,

RMA Group

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GEOTECHNICAL CONSULTANTS

GEOTECHNICAL INVESTIGATION
FOR
VACANT LOT ON EAST SIDE OF MELROSE DRIVE, NORTH OF CANNON ROAD AND SOUTH OF SUNSET AVENUE
APN 169-180-27
VISTA, CA

For

Kiewit Shea Desalination Pipeline
6241 Yarrow Drive, Suite A
Carlsbad, CA 92011

February 10, 2014

12-685-0/03

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1.00 Introduction

1.01 Purpose

A limited geotechnical investigation has been completed for a vacant lot located on the east side of Melrose Drive, north of Cannon Road and south of Sunset Avenue in the City of Vista, California. The lot is identified as APN 169-180-27. The purpose of the investigation was to summarize geotechnical and geologic conditions at the site, and to provide general earthwork and rough grading recommendations so that excess fill soils generated during construction of the Poseidon Desalination Pipeline can be placed on the lot and compacted.

1.02 Scope of the Investigation

The general scope of this investigation included the following:

- Review of published and unpublished geologic, seismic, groundwater and geotechnical literature.
- Examination of aerial photographs.
- Contacting of underground service alert to locate onsite utility lines (performed by KSD personnel).
- Logging and sampling of 5 exploratory trenches excavated and backfilled with a backhoe.
- Laboratory testing of representative soil samples.
- Geotechnical evaluation of the compiled data.
- Preparation of this report presenting our findings, conclusions and recommendations.

Our scope of work did not include a preliminary site assessment for the potential of hazardous materials onsite.

1.03 Site Location and Description

The lot is located along the east side of Melrose Drive, north of Cannon Road and south of Sunset Avenue in the City of Vista, San Diego County, California (Figure 1). The site is identified as APN 169-180-27.

The site is bounded by Melrose Drive to the west, and developed rural residential/agricultural lots to the south, east and north. Its geographic position is approximately latitude 33.1752° and longitude -117.2527°.

The site is located on the east side of a hill that slopes to the east and south. There are existing 2:1 (horizontal to vertical) or flatter slopes located at the north and south portions of the site descending from Melrose Drive and slopes on the west, north and south sides of the site descend into a shallow drainage. Elevations at the site range from approximately 410 feet above mean sea level (msl) at the northwest corner to approximately 340 feet msl at the southeast corner.

Vegetation consists primarily of seasonal grasses and weeds with rows of trees along the south, east and north sides.

1.04 Current and Past Land Usage

The site is currently vacant and, based upon aerial photographs from as far back as 1938, does not appear to have been previously developed.

1.05 Planned Usage

It is our understanding that the final use of the property has not yet been determined, however the current proposed construction is limited to earthwork and rough grading to create a level pad in accordance with the current plan prepared by the City of Vista Engineering Department.

1.06 Investigation Methods

Our investigation consisted of office research, field exploration, laboratory testing, review of the compiled data, and preparation of this report. It has been performed in a manner consistent with generally accepted engineering and geologic principles and practices, and has incorporated applicable requirements of the California Building Code. Definitions of technical terms and symbols used in this report include those of the ASTM International, the California Building Code, and commonly used geologic nomenclature.

Technical supporting data are presented in the attached appendices. Appendix A presents a description of the methods and equipment used in performing the field exploration and logs of our subsurface exploration. Appendix B presents a description of our laboratory testing and the test results. Standard grading specifications and references are presented in Appendices C and D, respectively.

2.00 Findings

2.01 Geologic Setting

The property is located in the Peninsular Ranges geomorphic province. The Peninsular Ranges are one of the largest geologic units in the western United States, extending from Los Angeles to the tip of Baja California. Much of the Peninsular Ranges is composed intrusive, granitic rocks. Regional mapping by Kennedy and Tan, 2007, indicates the property is underlain by Tertiary aged sedimentary bedrock that was deposited on the western flank of the intrusive rocks. A regional geologic map of the area is presented as Figure 2.

2.02 Earth Materials

Our subsurface investigation encountered artificial fill, topsoil and Santiago Formation sedimentary bedrock.

- Artificial fill (Map Symbol af)

  Artificial fill is located along the western side of the site. The fill was reportedly placed during the development and construction of Melrose Drive (see References). The fill is composed generally of brown silty clay and sandy clay.

- Topsoil

  The site is overlain by a layer of topsoil consisting of dark brown clayey sand to sandy clay. The topsoil layer is dry to moist, with abundant roots and rodent burrow holes. The topsoil layer ranges from approximately 1 to 5-feet thick and is not suitable for support of additional fill or structures in its present condition. The topsoil layer will require removal and recompaction.

- Santiago Formation (Map Symbol Tsa)

  Sedimentary bedrock consisting of light gray silty sandstone and olive-brown siltstone and claystone underlies the site. The sandstone is generally fine to medium grained, moist, massive and dense. Interlayered within the sandstone are layers of siltstone and claystone that are generally poorly bedded and stiff. Regional geologic mapping indicates the bedrock generally dips to the west and southwest at about 3 to 10 degrees.

A Site Geologic Map showing the locations of our trenches and cross sections is presented as Figure 3.

The subsurface soils encountered in the exploratory trenches drilled at the site are described in greater detail on the logs contained in Appendix A.

2.03 Surface and Groundwater Conditions

No areas of ponding or standing water were present at the time of our study. Further, no springs or areas of natural seepage were found. An earthen drainage channel/creek bed extends along the north, east and south sides of the property, with portions of the channel lined with rock or concrete fragments. The channel ties into a concrete culvert and storm drain at the southwest corner of the property which appears to extend to the west under Melrose Drive.

Surface water was not observed to be flowing in the channel/creek bed at the time of our field investigation.

Groundwater was not encountered during our subsurface exploration. Based upon the shallow bedrock and terrain of the site, shallow groundwater is not expected to be encountered.

2.04 Faults

The site is not located within the boundaries of an Earthquake Fault Zone for fault-rupture hazard as defined by the Alquist-Priolo Earthquake Fault Zoning Act and no faults are known to pass through the property. The nearest earthquake fault zone is located about 18 miles to the northeast of the site along the Elsinore Fault Zone.

The nearest mapped fault is an unnamed fault located about 4 miles to the southwest. The nearest named fault is the Rose Canyon fault located approximately 7 miles to the southwest.

The accompanying regional Fault Map (Figure 4) illustrates the location of the site with respect to major faults in the region.

2.05 Historic Seismicity

The accompanying Regional Fault Map indicates the nearest historic earthquake was about 63 miles to the southeast in 1987 along the Coyote Creek fault.

Our research of regional geologic and seismic data did not reveal any known instances of ground failure within the site associated with regional seismic activity.

Seismic design parameters relative to the requirements of the 2013 California Building Code are presented in Section 3.09.

2.06 Flooding Potential

According to the City of Vista General Plan Environmental Impact Report (2010), the site is not located within a flood zone.

Control of surface runoff originating from within and outside of the site should, of course, be included in design of the project.

2.07 Landslides

Landslides were not encountered during the current subsurface investigation. Topographic landforms suggestive of landslides were not apparent in the field or on aerial photographs.

3.00 Conclusions and Recommendations

3.01 General Conclusions

Based on specific data and information contained in this report, our understanding of the project and our general experience in engineering geology and geotechnical engineering, it is our professional judgment that the proposed development is geologically and geotechnically feasible. This is provided that the recommendations presented below are fully implemented during design, grading and construction.

3.02 General Earthwork and Grading

All grading should be performed in accordance with the General Earthwork and Grading Specifications outlined in Appendix C, unless specifically revised or amended below. Recommendations contained in Appendix C are general specifications for typical grading projects and may not be entirely applicable to this project.

It is also recommended that all earthwork and grading be performed in accordance with Appendix J of the 2013 California Building Code and all applicable governmental agency requirements. In the event of conflicts between this report and Appendix J, this report shall govern.

3.03 Earthwork Shrinkage and Subsidence

Shrinkage is the decrease in volume of soil upon removal and recompaction expressed as a percentage of the original in-place volume. Subsidence occurs as natural ground is densified to receive fill. These factors account for changes in earth volumes that will occur during grading. Our estimates are as follows:

- Shrinkage factor = 10% to 15% for soil removed and replaced as compacted fill.
- Subsidence factor = 0.1 foot.

The degree to which fill soils are compacted and variations in the insitu density of existing soils will influence earth volume changes. Consequently, some adjustments in grades near the completion of grading could be required to balance the earthwork.

3.04 Removals and Overexcavation

All vegetation, trash and debris should be cleared from the grading area and removed from the site. Prior to placement of compacted fills, all topsoils, non-engineered fills and loose, porous, or compressible soils will need to be removed down to competent ground. Removal requirements will also apply to cut areas, if the depth of cut is not sufficient to reach competent ground. Removed and/or overexcavated soils may be moisture-conditioned and recompacted as engineered fill, except for soils containing detrimental amounts of organic material. The following additional recommendations are provided for earthwork for this site:

- Topsoil and/or loose, porous and compressible native soil ranging from 2 ½ to 4 feet deep was encountered and observed within the subject site. Complete removal of these native soils will need to be performed. If other non-engineered fills are encountered during grading, they will also need to be removed along with any underlying compressible native soils.

- It is expected that competent native soils will be encountered in cuts deeper than approximately 2 ½ feet below existing grade or the base of existing native topsoil or non-engineered fill. Provided competent soils are exposed, these cut surfaces should be scarified to a minimum depth of 12 inches, moisture conditioned and compacted to at least 90 percent of the maximum dry density.

- Prior to placement of fill, all removal bottoms in overexcavation areas and cut surfaces exposing competent native soils should be scarified to a minimum depth of 12-inches, moisture conditioned and compacted to at least 90 percent of the maximum dry density in accordance with ASTM D1557.

- Where fill material is to be placed on ground with slopes steeper than 5:1 (H:V) the sloping ground shall be benched. A fill key shall be constructed at the toe of fill slopes as shown on the detail included in Appendix C. The key shall be a minimum of 15 feet wide, shall extend a minimum of 2 feet into bedrock, and shall expose firm, native material as determined by the Geotechnical Consultant. Other benches shall be excavated to firm material as determined by the Geotechnical Consultant and shall have a minimum width of 4 feet.

- A back drain shall be installed in the bottom of the key, or at the lowest back cut practical to allow for drainage out of the face of the slope and at the mid-height of the slope for all slopes greater than 30-feet in height. The drain should consist of 4-inch diameter Schedule 40 perforated (perforations down) PVC pipe embedded in at least 3-cubic-feet per lineal foot of 3/4-inch crushed washed rock all wrapped in approved filter fabric (Mirafi 140N or equivalent). Solid pipe outlets, spaced at intervals of no more than 75-feet, should discharge at suitable locations. The actual location and placement of all back drains should be determined and observed during construction by the Geotechnical Consultant. Back drains should be "As-Built" for location and elevation by the project Civil Engineer. A typical drain detail is included in Appendix C.

The exposed soils beneath all overexcavation should be scarified an additional 12 inches, moisture conditioned to near optimum moisture content and compacted to a minimum of 90% relative compaction.

The above recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. Hence, overexcavation depths must be verified, and adjusted if necessary, at the time of grading. The overexcavated materials may be moisture-conditioned and re-compacted as engineered fill.

If any underground structures such as wells, septic tanks, leach fields, etc., are encountered during grading, they should be removed or abandoned in accordance with local codes and ordinances.

3.05 Rippability and Rock Disposal

Our exploratory trenches were advanced without difficulty and no oversize materials were encountered in our subsurface investigation. Accordingly we expect that earth materials will be rippable with conventional heavy duty grading equipment and oversized materials are not expected.

Our guidelines for rock disposal are presented in Appendix C. Implementation of our guidelines will require continuous testing and observation by a member of our staff. Oversized materials should not be placed within 10 feet of finish grade without the prior approval of the Geotechnical Consultant.

3.06 Subdrains

Ground water and surface water were not encountered during the course of our investigation and the proposed grading is not expected to fill any large canyons. Consequently, installation of canyon subdrains is not expected to be necessary.

Grading to construct the proposed fill slopes will require benching into the native ground and a toe of slope key. Installation of a subdrain at the toe of slope key and midway up the slope for slopes greater than 30-feet in height is recommended as described above.

3.07 Fill and Cut Slopes

New cut and fill slopes should be inclined no steeper than 2:1 (horizontal to vertical). New cut slopes should be mapped during construction by the Engineering Geologist. Fill slopes should be back rolled at maximum of 4-feet fill height intervals during construction and should be track walked upon completion.

Fill slopes reaching maximum heights of approximately 42 feet at inclinations of 2 horizontal to 1 vertical or flatter are expected to be grossly and surficially stable. This is provided that fill slopes constructed of material having a suitable strength characteristics (angle of internal friction and cohesion), are properly compacted and keyed into competent ground as recommended, as indicated in Appendix C. Import soils should be sampled and tested for compaction and strength characteristics prior to being imported to the site.

3.08 Faulting

Since the site is not located within the boundaries of an Earthquake Fault Zone and no faults are known to pass through the property, surface fault rupture within the site is considered unlikely.

3.09 Seismic Design Parameters

Seismic design parameters have been developed in accordance with Section 1613 of the 2013 California Building Code (CBC) using the online U.S. Geological Survey Java Survey Seismic Design Maps Calculator (Version 3.1.0, ASCE 10 Standard) and a site location based on latitude and longitude. The calculator generates probabilistic and deterministic maximum considered earthquake spectral parameters represented by a 5-percent damped acceleration response spectrum having a 2-percent probability of exceedance in 50 years. The deterministic response accelerations are calculated as 150 percent of the largest median 5-percent damped spectral response acceleration computed on active faults within a region, where the deterministic values govern. The calculator does not, however, produce separate probabilistic and deterministic results. The parameters generated for the subject site are presented below:

2013 California Building Code (CBC) Seismic Parameters

Parameter	Value
Site Location	Latitude = 33.1752 degrees Longitude = -117.2527 degrees
Site Class	Site Class = C Soil Profile Name = Very dense soil and soft rock
Mapped Spectral Accelerations (Site Class B)	S_s (0.2- second period) = 1.037g S_1 (1-second period) = 0.405g
Site Coefficients (Site Class B)	F_a = 1.0 F_v = 1.4
Maximum Considered Earthquake Spectral Accelerations (Site Class B)	S_{MS} (0.2- second period) = 1.037g S_{M1} (1-second period) = 0.565g
Design Earthquake Spectral Accelerations (Site Class B)	S_{DS} (0.2- second period) = 0.691g S_{D1} (1-second period) = 0.376g

Peak earthquake ground acceleration adjusted for site class effects (PGA_M) has been determine in accordance with ASCE 7-10 Section 11.8.3 as follows: $PGA_M = F_{PGA} \times PGA = 1.010 \times 0.390 = 0.394g$.

3.10 Liquefaction and Secondary Earthquake Hazards

Potential secondary seismic hazards that can affect land development projects include liquefaction, tsunamis, seiches, seismically induced settlement, seismically induced flooding and seismically induced landsliding.

Liquefaction

Liquefaction is a phenomenon where earthquake- induced ground vibrations increase the pore pressure in saturated, granular soils until it is equal to the confining, overburden pressure. When this occurs, the soil can completely loose its shear strength and enter a liquefied state. The possibility of liquefaction is dependent upon grain size, relative density, confining pressure, saturation of the soils, and intensity and duration of ground shaking. In order for liquefaction to occur, three criteria must be met: underlying loose, coarse-grained (sandy) soils, a groundwater depth of less than about 50 feet, and a potential for seismic shaking from nearby large-magnitude earthquake.

According to the City of Vista General Plan Environmental Impact Report (2010) the site in not within a potential liquefaction hazard zone. Also, due to the shallow bedrock beneath the site, soil liquefaction at the site is unlikely and therefore, liquefaction calculations were not performed.

It should be noted that the California Geological Survey has not yet prepared a Seismic Hazard Zone Map of potential liquefaction hazards for the quadrangle in which the site is located.

Tsunamis and Seiches

Tsunamis are sea waves that are generated in response to large-magnitude earthquakes. When these waves reach shorelines, they sometimes produce coastal flooding. Seiches are the oscillation of large bodies of standing water, such as lakes, that can occur in response to ground shaking. Tsunamis and seiches do not pose hazards due to the inland

as lakes, that can occur in response to ground shaking. Tsunamis and seiches do not pose hazards due to the inland location of the site and lack of nearby bodies of standing water.

Seismically Induced Settlement

Seismically induced settlement occurs most frequently in areas underlain by loose, granular sediments. Damage as a result of seismically induced settlement is most dramatic when differential settlement occurs in areas with large variations in the thickness of underlying sediments. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement.

To provide support of fill, we recommend that loose surficial soils be removed down to dense alluvium or bedrock. The removal and recompaction of these loose soils will eliminate the potential for significant seismically induced settlement.

Seismically Induced Flooding

According to the City of Vista General Plan Environmental Impact Report (2010) the site is not located within a potential dam inundation area. In addition, there are no up gradient water reservoirs or dams located in close proximity of the site. Consequently seismically induced flooding at the site is unlikely.

Seismically Induced Landsliding

According to the City of Vista General Plan Environmental Impact Report (2010), the site is not within a landslide hazard zone. The potential for seismically induced landsliding of the proposed slopes is low provided the slopes are properly constructed following the recommendations contained with this report.

3.11 Utility Trench Backfill

The onsite fill soils will not be suitable for use as pipe bedding for buried utilities. All pipes should be bedded in a sand, gravel or crushed aggregate imported material complying with the requirements of the Standard Specifications for Public Works Construction Section 306-1.2.1. Crushed rock products that do not contain appreciable fines should not be utilized as pipe bedding and/or backfill. Bedding materials should be densified to at least 90% relative compaction (ASTM D1557) by mechanical methods. The Geotechnical Consultant should review and approve of proposed bedding materials prior to use.

The onsite soils are expected to be suitable as trench backfill provided they are screened of organic matter and cobbles over 12 inches in diameter. Trench backfill should be densified to at least 90% relative compaction (ASTM D1557). All utility trench backfill within street right of way, utility easements, under or adjacent to sidewalks, driveways, or building pads should be observed and tested by the Geotechnical Consultant to verify proper compaction.

Cal/OSHA construction safety orders should be observed during all underground work.

3.12 Plan Review

Once a formal grading plan is prepared for the subject property, this office should review the plans from a geotechnical viewpoint, comment on changes from the plan used during preparation of this report and revise the recommendations of this report where necessary.

3.13 Geotechnical Observation and Testing During Rough Grading

The geotechnical engineer should be contacted to provide observation and testing during the following stages of grading:

- During the clearing and grubbing of the site.
- During the demolition of any existing structures, buried utilities or other existing improvements.
- During excavation and overexcavation of compressible soils.
- During all phases of grading including ground preparation and filling operations.
- When any unusual conditions are encountered during grading.

A final geotechnical report summarizing conditions encountered during grading should be submitted upon completion of the rough grading operations.

4.00 Closure

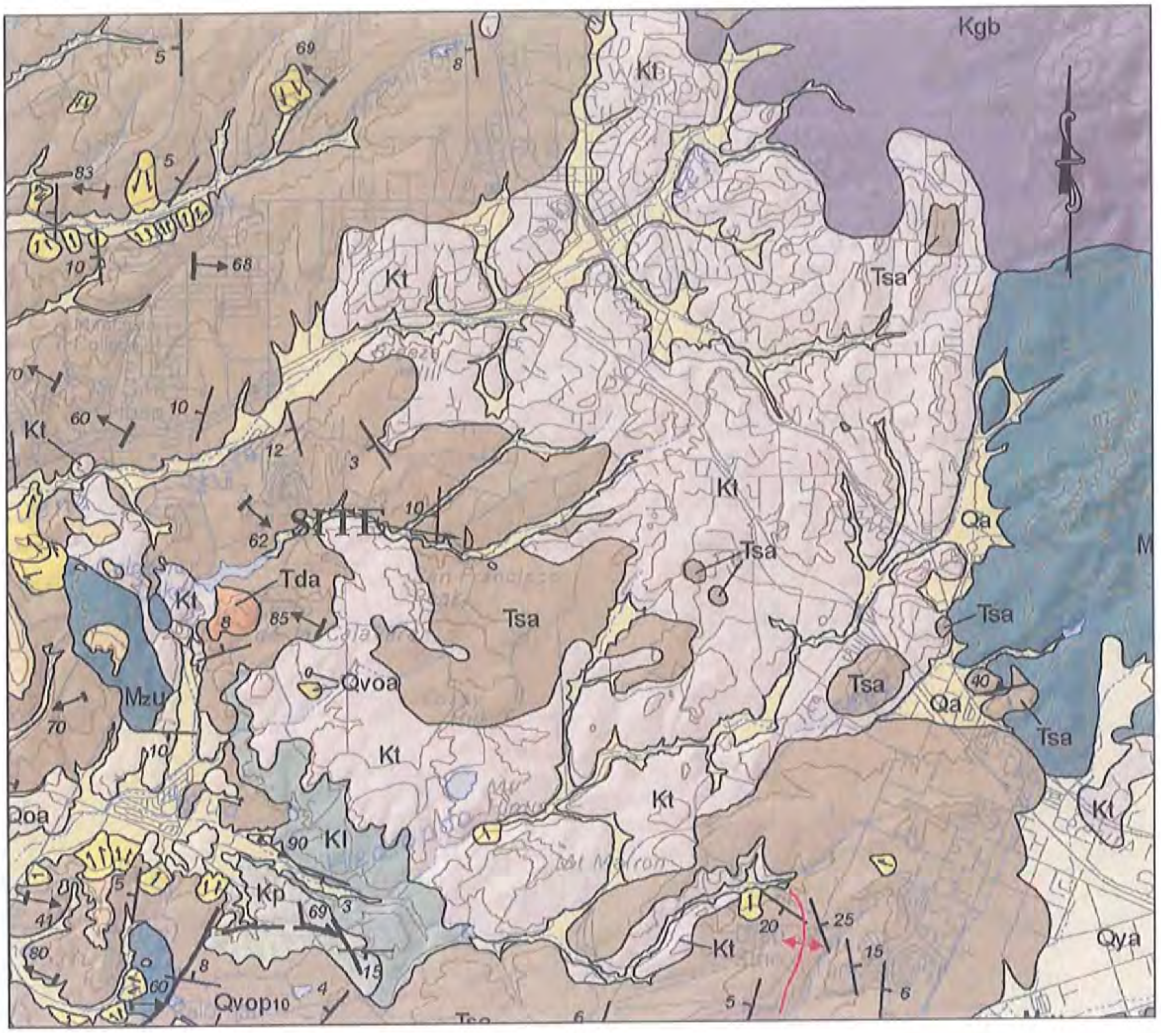
The findings, conclusions and recommendations in this report were prepared in accordance with generally accepted engineering and geologic principles and practices. No other warranty, either express or implied, is made. This report has been prepared for the client to be used solely for design purposes. Anyone using this report for any other purpose must draw their own conclusions regarding required construction procedures and subsurface conditions.

The geotechnical and geologic consultant should be retained during the earthwork and foundation phases of construction to monitor compliance with the design concepts and recommendations and to provide additional recommendations as needed. Should subsurface conditions be encountered during construction that are different from those described in this report, this office should be notified immediately so that our recommendations may be re-evaluated.

FIGURES

SITE LOCATION MAP
Scale: 1" = 2,000'

Base Map: U.S. Geological Survey, 2012, San Luis Rey Quadrangle



REGIONAL GEOLOGIC MAP

Scale: 1" ~ 6,000'

Partial Legend

Qa - Alluvium (late Holocene)
Qya - Alluvium (Holocene and late Pleistocene)
Qoa - Older Alluvium (late to middle Pleistocene)
Tsa - Santiago Formation (middle Eocene)
Kl - Lusardi Formation (upper Cretaceous)
Kgb - Gabbro, individed (middle Cretaceous)
Mzu - Metasedimentary and metavolcanic rocks, undivided (Mesozoic)

Source: Kennedy, K.P. and Tan, S.S., 2007, Geologic Map of the Oceanside 30' x 60' Quadrangle, California, California Geological Survey Regional Map Series, Map Number 2.

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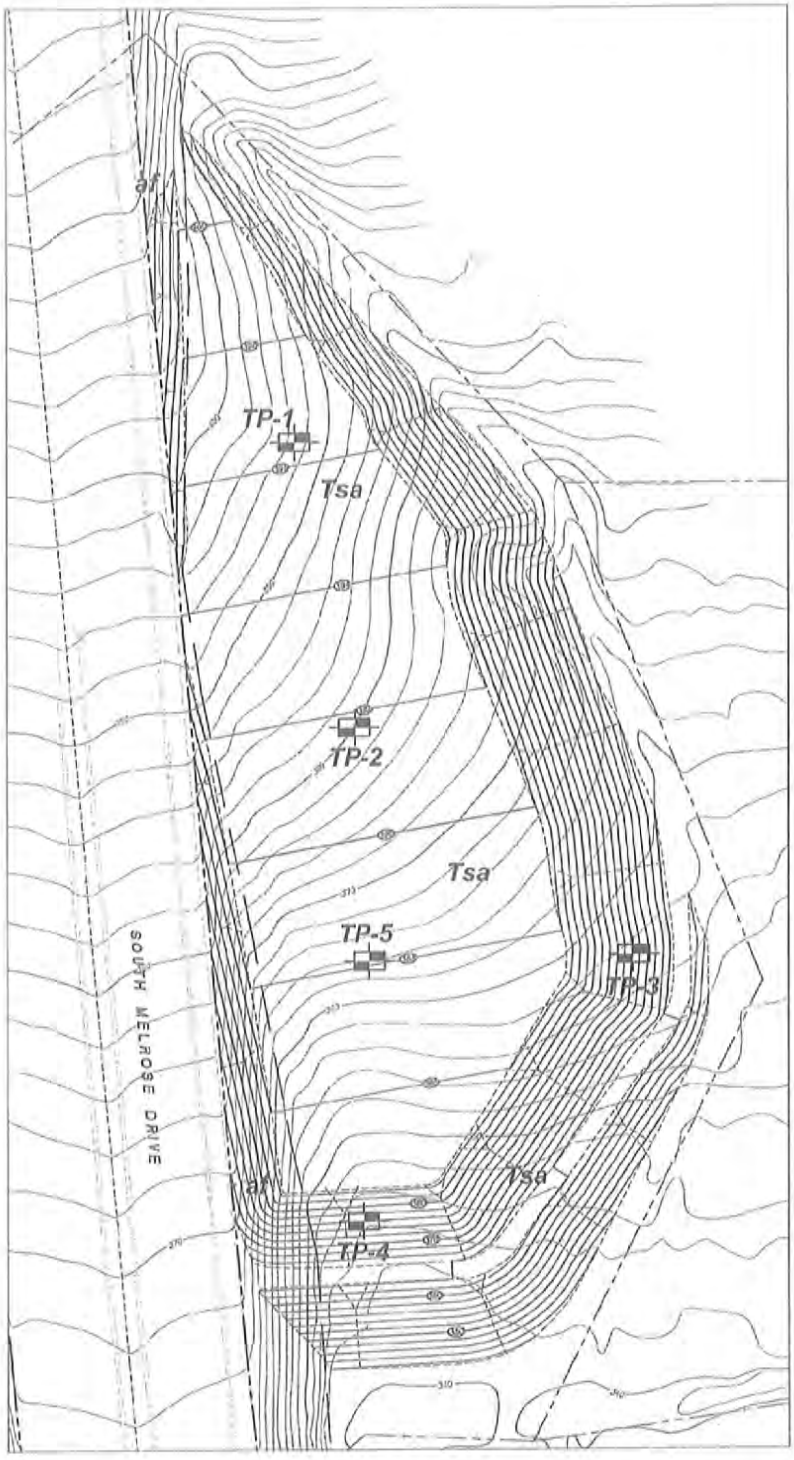
LEGEND

af - Artificial fill
Tsa - Topsoil over Santiago Formation

Geologic Contact

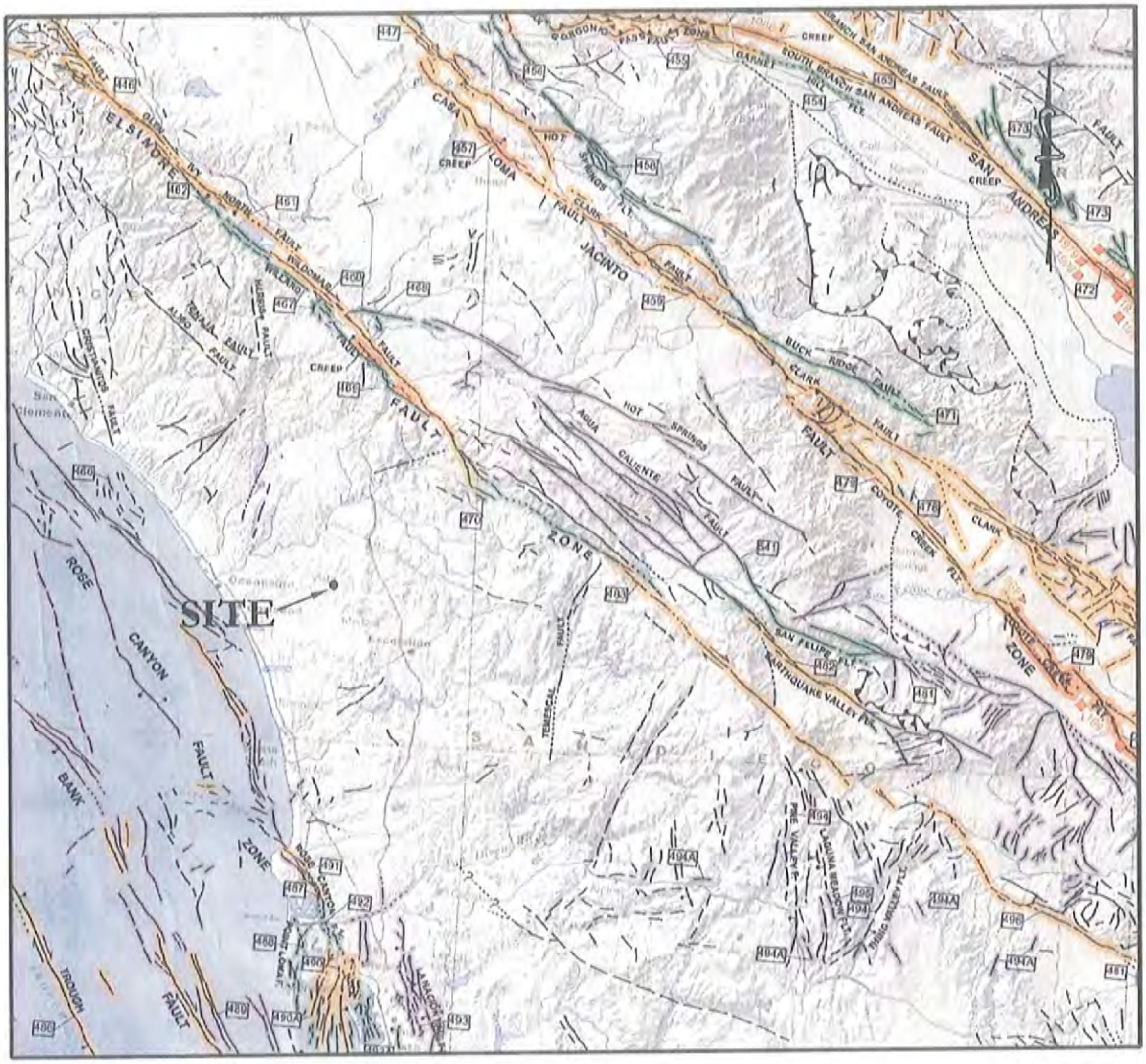
TP-5 - Exploratory Trench Location



SITE GEOLOGIC MAP

Base map: from City of Vista

Scale: 1" ~ 100'



REGIONAL FAULT MAP

Scale: 1" ~ 15 miles

Partial Legend

Orange - Holocene fault displacement
Green - Late Quaternary fault displacement
Purple - Quaternary fault (age undifferentiated)
440 - Numbers refer to annotations accompanying Map No. 6

Base Map: California Geological Survey Fault Activity Map of California, Map No. 6, 2010

APPENDIX A

FIELD INVESTIGATION

APPENDIX A

FIELD INVESTIGATION

A-1.00 FIELD EXPLORATION

A-1.01 Number of Trenches

Our subsurface investigation consisted of 5 trenches excavated with a backhoe using a 24-inch bucket.

A-1.02 Location of Borings

A Geologic Map showing the approximate locations of the trenches is presented as Figure 3.

A-1.03 Trench Logs

Logs of trenches were prepared by RMA staff and are attached in this appendix. The logs contain factual information and interpretation of subsurface conditions between samples. The strata indicated on these logs represent the approximate boundary between earth units and the transition may be gradual. The logs show subsurface conditions at the dates and locations indicated, and may not be representative of subsurface conditions at other locations and times.

Identification of the soils encountered during the subsurface exploration was made using the field identification procedure of the Unified Soils Classification System (ASTM D2488). A legend indicating the symbols and definitions used in this classification system and a legend defining the terms used in describing the relative compaction, consistency or firmness of the soil are attached in this appendix. Bag samples of the major earth units were obtained for laboratory inspection and testing, and the in-place density of the various strata encountered in the exploration was determined.

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravel, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravel or gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amt of fines)	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			Pt	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

UNIFIED SOIL CLASSIFICATION SYSTEM

I. SOIL STRENGTH/DENSITY

BASED ON STANDARD PENETRATION TESTS

Compactness of sand		Consistency of clay	
Penetration Resistance N (blows/Ft)	Compactness	Penetration Resistance N (blows/ft)	Consistency
0-4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium Dense	4-8	Medium Stiff
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

N = Number of blows of 140 lb. weight falling 30 in. to drive 2-in OD sampler 1 ft.

BASED ON RELATIVE COMPACTION

Compactness of sand		Consistency of clay	
% Compaction	Compactness	% Compaction	Consistency
<75	Loose	<80	Soft
75-83	Medium Dense	80-85	Medium Stiff
83-90	Dense	85-90	Stiff
>90	Very Dense	>90	Very Stiff

II. SOIL MOISTURE

Moisture of sands		Moisture of clays	
% Moisture	Description	% Moisture	Description
<5%	Dry	<12%	Dry
5-12%	Moist	12-20%	Moist
>12%	Very Moist	>20%	Very Moist, wet

SOIL DESCRIPTION LEGEND

REFERENCE TRENCH LOGS

RMA Group

Exploratory Trench Log

Trench No. TP-1

Location: See Plot Plan

Logged By: Ashleigh Love

Equipment: CAT 420E Backhoe 24-inch bucket

Date Excavated: 01/21/2014

Depth (ft)	Bulk Sample	Moisture Content (%)	Dry Density (pcf)		USCS	Graphic Symbol	Material Description
							This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.
					CL		Alluvium (Qal) Sandy Clay – Dark brown, fine-grained sand, moist, organics including grass and rootlets upper 6 inches, soft in upper 6 inches, stiff below 6 inches
					Bdrx		Santiago Fm (Tsa) Claystone – Olive gray, highly weathered from 2.5 – 3.5 feet, moist, stiff to very stiff
5							Total Depth 4.5 feet Groundwater not encountered Trench backfilled
10							
15							

Exploratory Trench Log

Trench No. TP-2

Location: See Plot Plan

Logged By: Ashleigh Love

Equipment: CAT 420E Backhoe 24-inch bucket

Date Excavated: 01/21/2014

Depth (ft)	Bulk Sample	Moisture Content (%)	Dry Density (pcf)		USCS	Graphic Symbol	Material Description
							This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.
					CL		Alluvium (Qal) Sandy Clay – Dark brown, fine-grained sand, moist, organics including grass and rootlets upper 6 inches, soft in upper 6 inches, stiff below 6 inches
					Bdrx		Santiago Fm (Tsa) Sandy Siltstone – Light gray, fine to medium-grained sand, moist, slightly friable, dense, trace of clay
5							Total Depth 4.5 feet Groundwater not encountered Trench backfilled
10							
15							

RMA Group

Exploratory Trench Log

Location: See Plot Plan

Logged By: Ashleigh Love

Equipment: CAT 420E Backhoe 24-inch bucket

Trench No. TP-3

Date Excavated: 01/21/2014

Depth (ft)	Bulk Sample	Moisture Content (%)	Dry Density (pcf)		USCS	Graphic Symbol	Material Description
							This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.
					CL		Alluvium (Qal) Clay – Brown, trace of fine-grained sand, moist, organics including grass and rootlets upper 6 inches, soft in upper 6 inches, stiff below 6 inches
					Bdrx		Santiago Fm (Tsa) Claystone – Olive gray, highly weathered from 2.5 – 4.5 feet, moist, stiff to very stiff
5							@4.5 feet...hard, finely jointed
							Total Depth 6.0 feet Groundwater not encountered Trench backfilled
10							
15							

Exploratory Trench Log

Location: See Plot Plan

Logged By: Ashleigh Love

Equipment: CAT 420E Backhoe 24-inch bucket

Trench No. TP-4

Date Excavated: 01/21/2014

Depth (ft)	Bulk Sample	Moisture Content (%)	Dry Density (pcf)		USCS	Graphic Symbol	Material Description
							This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.
					CL		Alluvium (Qal) Sandy Clay – Brown, fine to medium-grained sand, moist, soft, organics including grass and rootlets upper 6 inches, soft in upper 6 inches, stiff below 6 inches
5					Bdrx		Santiago Fm (Tsa) Claystone – Dark olive brown, trace of fine-grained sand, weathered from 4.0-7.0 feet, moist, hard
							@ 7 feet...finely jointed
							Total Depth 8.5 feet Groundwater not encountered Trench backfilled
10							
15							

RMA Group

Exploratory Trench Log

Location: See Plot Plan

Logged By: Ashleigh Love

Equipment: CAT 420E Backhoe 24-inch bucket

Trench No. TP-5

Date Excavated: 01/21/2014

Depth (ft)	Bulk Sample	Moisture Content (%)	Dry Density (pcf)		USCS	Graphic Symbol	Material Description
							This log contains factual information and interpretation of the subsurface conditions between the samples. The stratum indicated on this log represent the approximate boundary between earth units and the transition may be gradual. The log show subsurface conditions at the date and location indicated, and may not be representative of subsurface conditions at other locations and times.
					CL		Alluvium (Qal) Clayey Sand – Dark brown, trace of fine-grained sand, moist, organics including grass and rootlets upper 6 inches, soft in upper 6 inches, stiff to very stiff below 6 inches
					Bdrx		Santiago Fm (Tsa) Siltstone – Olive gray, moist, finely jointed, slight trace of carbonates, massive, stiff
5							Total Depth 6.0 feet Groundwater not encountered Trench backfilled
10							
15							

RMA Job No. 12-685-0/03

APPENDIX B

LABORATORY TESTS

APPENDIX B

LABORATORY TESTS

B-1.00 LABORATORY TESTS

B-1.01 Maximum Density

Maximum density - optimum moisture relationships for the major soil types encountered during the field exploration were performed in the laboratory using the standard procedures of ASTM D1557.

B-1.02 Test Results

Test results for all laboratory tests performed on the subject project are presented below.

MAXIMUM DENSITY - OPTIMUM MOISTURE
(Test Method: ASTM D1557)

Sample Location	Optimum Moisture (percent)	Maximum Density (lbs/ft^3)
TP-1 @ 1'-2'	14.0	117.7

APPENDIX C

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

APPENDIX C

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

C-1.00 GENERAL DESCRIPTION

C-1.01 Introduction

These specifications present our general recommendations for earthwork and grading as shown on the approved grading plans for the subject project. These specifications shall cover all clearing and grubbing, removal of existing structures, preparation of land to be filled, filling of the land, spreading, compaction and control of the fill, and all subsidiary work necessary to complete the grading of the filled areas to conform with the lines, grades and slopes as shown on the approved plans.

The recommendations contained in the geotechnical report of which these general specifications are a part of shall supersede the provisions contained hereinafter in case of conflict.

C-1.02 Laboratory Standard and Field Test Methods

The laboratory standard used to establish the maximum density and optimum moisture shall be ASTM D1557.

The insitu density of earth materials (field compaction tests) shall be determined by the sand cone method (ASTM D1556), direct transmission nuclear method (ASTM D2922) or other test methods as considered appropriate by the geotechnical consultant.

Relative compaction is defined, for purposes of these specifications, as the ratio of the in-place density to the maximum density as determined in the previously mentioned laboratory standard.

C-2.00 CLEARING

C-2.01 Surface Clearing

All structures marked for removal, timber, logs, trees, brush and other rubbish shall be removed and disposed of off the site. Any trees to be removed shall be pulled in such a manner so as to remove as much of the root system as possible.

C-2.02 Subsurface Removals

A thorough search should be made for possible underground storage tanks and/or septic tanks and cesspools. If found, tanks should be removed and cesspools pumped dry.

Any concrete irrigation lines shall be crushed in place and all metal underground lines shall be removed from the site.

C-2.03 Backfill of Cavities

All cavities created or exposed during clearing and grubbing operations or by previous use of the site shall be cleared of deleterious material and backfilled with native soils or other materials approved by the soil engineer. Said backfill shall be compacted to a minimum of 90% relative compaction.

C-3.00 Original Ground Preparation

C-3.01 Stripping of Vegetation

After the site has been properly cleared, all vegetation and topsoil containing the root systems of former vegetation shall be stripped from areas to be graded. Materials removed in this stripping process may be used as fill in areas designated by the soil engineer, provided the vegetation is mixed with a sufficient amount of soil to assure that no appreciable settlement or other detriment will occur due to decaying of the organic matter. Soil materials containing more than 3% organics shall not be used as structural fill.

C-3.02 Removals of Non-Engineered Fills

Any non-engineered fills encountered during grading shall be completely removed and the underlying ground shall be prepared in accordance to the recommendations for original ground preparation contained in this section. After cleansing of any organic matter the fill material may be used for engineered fill.

C-3.03 Overexcavation of Fill Areas

The existing ground in all areas determined to be satisfactory for the support of fills shall be scarified to a minimum depth of 6 inches. Scarification shall continue until the soils are broken down and free from lumps or clods and until the scarified zone is uniform. The moisture content of the scarified zone shall be adjusted to within 2% of optimum moisture. The scarified zone shall then be uniformly compacted to 90% relative compaction.

Where fill material is to be placed on ground with slopes steeper than 5:1 (H:V) the sloping ground shall be benched. The lowermost bench shall be a minimum of 15 feet wide, shall be a minimum of 2 feet deep, and shall expose firm material as determined by the geotechnical consultant. Other benches shall be excavated to firm material as determined by the geotechnical consultant and shall have a minimum width of 4 feet.

Existing ground that is determined to be unsatisfactory for the support of fills shall be overexcavated in accordance to the recommendations contained in the geotechnical report of which these general specifications are a part.

C-4.00 Fill Materials

C-4.01 General

Materials for the fill shall be free from vegetable matter and other deleterious substances, shall not contain rocks or lumps of a greater dimension than is recommended by the geotechnical consultant, and shall be approved by the geotechnical consultant. Soils of poor gradation, expansion, or strength properties shall be placed in areas designated by the geotechnical consultant or shall be mixed with other soils providing satisfactory fill material.

C-4.02 Oversize Material

Oversize material, rock or other irreducible material with a maximum dimension greater than 12 inches shall not be placed in fills, unless the location, materials, and disposal methods are specifically approved by the geotechnical consultant. Oversize material shall be placed in such a manner that nesting of oversize material does not occur and in such a manner that the oversize material is completely surrounded by fill material compacted to a minimum of 90% relative compaction. Oversize material shall not be placed within 10 feet of finished grade without the approval of the geotechnical consultant.

C-4.03 Import

Material imported to the site shall conform to the requirements of Section 4.01 of these specifications. Potential import material shall be approved by the geotechnical consultant prior to importation to the subject site.

C-5.00 Placing and Spreading of Fill

C-5.01 Fill Lifts

The selected fill material shall be placed in nearly horizontal layers which when compacted will not exceed approximately 6 inches in thickness. Thicker lifts may be placed if testing indicates the compaction procedures are such that the required compaction is being achieved and the geotechnical consultant approves their use.
Each layer shall be spread evenly and shall be thoroughly blade mixed during the spreading to insure uniformity of material in each layer.

C-5.02 Fill Moisture

When the moisture content of the fill material is below that recommended by the soils engineer, water shall then be added until he moisture content is as specified to assure thorough bonding during the compacting process.

When the moisture content of the fill material is above that recommended by the soils engineer, the fill material shall be aerated by blading or other satisfactory methods until the moisture content is as specified.

C-5.03 Fill Compaction

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted to not less than 90% relative compaction. Compaction shall be by sheepsfoot rollers, multiple-wheel pneumatic tired rollers, or other types approved by the soil engineer.

Rolling shall be accomplished while the fill material is at the specified moisture content. Rolling of each layer shall be continuous over its entire area and the roller shall make sufficient trips to insure that the desired density has been obtained.

C-5.04 Fill Slopes

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compacting of the slopes may be done progressively in increments of 3 to 4 feet in fill height. At the completion of grading, the slope face shall be compacted to a minimum of 90% relative compaction. This may require track rolling or rolling with a grid roller attached to a tractor mounted side-boom.

Slopes may be over filled and cut back in such a manner that the exposed slope faces are compacted to a minimum of 90% relative compaction.

The fill operation shall be continued in six inch (6") compacted layers, or as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

C-5.05 Compaction Testing

Field density tests shall be made by the geotechnical consultant of the compaction of each layer of fill. Density tests shall be made at locations selected by the geotechnical consultant.

Frequency of field density tests shall be not less than one test for each 2.0 feet of fill height and at least every one thousand cubic yards of fill. Where fill slopes exceed four feet in height their finished faces shall be tested at a frequency of one test for each 1000 square feet of slope face.

Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density reading shall be taken in the compacted material below the disturbed surface. When these readings indicate that the density of any layer of fill or portion thereof is below the required density, the particular layer or portion shall be reworked until the required density has been obtained.

C-6.00 SUBDRAINS

C-6.01 Subdrain Material

Subdrains shall be constructed of a minimum 4-inch diameter pipe encased in a suitable filter material. The subdrain pipe shall be Schedule 40 Acrylonitrile Butadiene Styrene (ABS) or Schedule 40 Polyvinyl Chloride Plastic (PVC) pipe or approved equivalent. Subdrain pipe shall be installed with perforations down. Filter material shall consist of 3/4" to 1 1/2" clean gravel wrapped in an envelope of filter fabric consisting of Mirafi 140N or approved equivalent.

C-6.02 Subdrain Installation

Subdrain systems, if required, shall be installed in approved ground to conform the approximate alignment and details shown on the plans or herein. The subdrain locations shall not be changed or modified without the approval of the geotechnical consultant. The geotechnical consultant may recommend and direct changes in the subdrain line, grade or material upon approval by the design civil engineer and the appropriate governmental agencies.

C-7.00 EXCAVATIONS

C-7.01 General

Excavations and cut slopes shall be examined by the geotechnical consultant. If determined necessary by the geotechnical consultant, further excavation or overexcavation and refilling of overexcavated areas shall be performed, and/or remedial grading of cut slopes shall be performed.

C-7.02 Fill-Over-Cut Slopes

Where fill-over-cut slopes are to be graded the cut portion of the slope shall be made and approved by the geotechnical consultant prior to placement of materials for construction of the fill portion of the slope.

C-8.00 TRENCH BACKFILL

C-8.01 General

Trench backfill within street right of ways shall be compacted to 90% relative compaction as determined by the ASTM D1557 test method. Backfill may be jetted as a means of initial compaction; however, mechanical compaction will be required to obtain the required percentage of relative compaction. If trenches are jetted, there must be a suitable delay for drainage of excess water before mechanical compaction is applied.

C-9.00 SEASONAL LIMITS

C-9.01 General

No fill material shall be placed, spread or rolled while it is frozen or thawing or during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the soils engineer indicate that the moisture content and density of the fill are as previously specified.

C-10.00 SUPERVISION

C-10.01 Prior to Grading

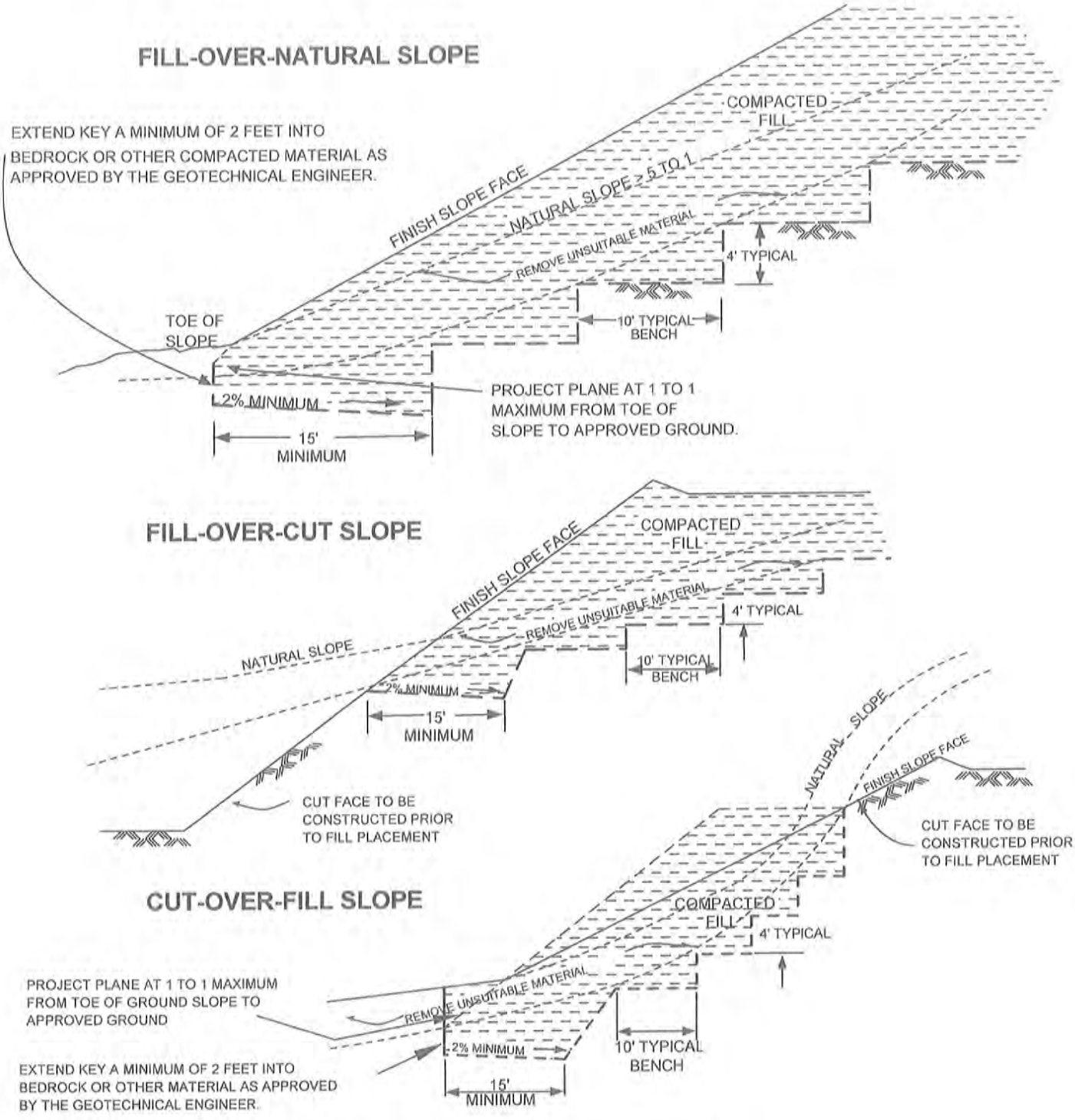
The site shall be observed by the geotechnical consultant upon completion of clearing and grubbing, prior to the preparation of any original ground for preparation of fill.

The supervisor of the grading contractor and the field representative of the geotechnical consultant shall have a meeting and discuss the geotechnical aspects of the earthwork prior to commencement of grading.

C-10.02 During Grading

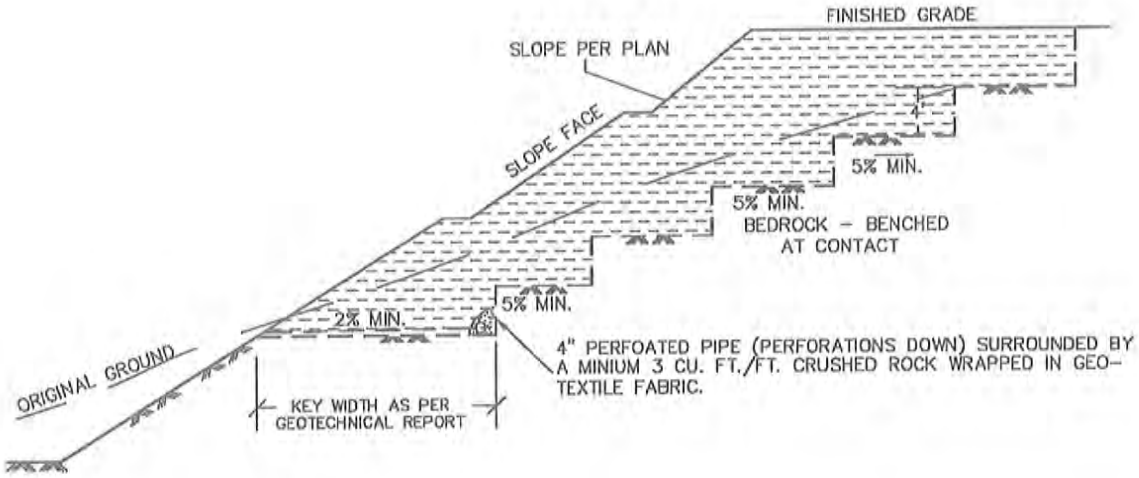
Site preparation of all areas to receive fill shall be tested and approved by the geotechnical consultant prior to the placement of any fill.

The geotechnical consultant or his representative shall observe the fill and compaction operations so that he can provide an opinion regarding the conformance of the work to the recommendations contained in this report.



KEY AND BENCHING DETAIL

BACKDRAINAGE DETAIL FOR FILL OVER CUT SLOPES



SPECIFICATION FOR CRUSHED ROCK

PUBLIC WORK CONSTRUCTION SECTION 200–1.2

SIEVE SIZE	% PASSING
1"	100
3/4"	90–100
1/2"	30–60
3/8"	0–20
#4	0–5

SPECIFICATIONS FOR PIPE

SCHEDULE 40 PVC OR CARBON VYLAN "2" PVC–SDR 335 OR EQUIVALENT.

FILTER FABRIC – MIRAFI 140N, SUPAC 5NP OR APPROVED EQUIVALENT.

APPENDIX D

REFERENCES

APPENDIX D

REFERENCES

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To Kiewit Shea Desalination Plant
6241 Yarrow Drive, Suite A
Carlsbad, CA 92011

Job No 12-685-03

Date 2/13/2014

Atten Dave Mixon

Project Poseidon - Carlsbad Desalination Plant
, CA

We Are Sending For: Your Use

Via: Mail

Date	Copies	Description
2/10/2014	3	Limited Geotechnical Investigation for Vacant Lot

Comment:

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5050 Avenida Encinas, Suite 370
Carlsbad, CA 92008

Job No 12-685-03

Date 2/13/2014

Atten Dave Mixon

Project Poseidon - Carlsbad Desalination Plant
, CA

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