APPENDIX E4

GEOTECHNICAL REPORT UPDATE TO THE EIR LEVEL GEOTECHNICAL FEASIBILITY INVESTIGATION

October 20, 2022

Lewis Management Corporation
1156 North Mountain Avenue
Upland, California 91786

Project No. 33318C.11

Attention: Ms. Waen Messner

Subject: Geotechnical Report Update to the EIR Level Geotechnical Feasibility Investigation, Gateway at Grand Terrace Specific Plan and Homecoming Project, City of Grand Terrace, San Bernardino County, California (Project No. 33318C.1).

As requested by you, we are providing this letter to update our previous EIR Level Geotechnical Feasiblity Investigation Report, Project No. 33318C.1, dated July 31, 2018 (LOR, 2018.)

PROJECT CONSIDERATIONS

It is our understanding that the proposed development is similar to that described in our previous geotechnical report (LOR, 2018) and that minor changes to the limits of the project site have been made. On October 10, 2022, a representative from this firm conducted a site reconnaissance and found the site to generally be in a similar condition as previously reported (LOR, 2018).

Minor disturbances to local areas of the site are apparent locally. These are largely surficial in nature, consisting mostly of disturbed surface soils, scattered debris, and a few soil stockpiles, and are not considered to pose significant impacts to the site from the geotechnical perspective.

It is the opinion of this firm that our previous preliminary geotechnical investigation conducted for the property, combined with the information provided below, is considered appropriate for the design and construction of the currently proposed project. Supplemental geotechnical investigation within selected areas where heavier structures might be proposed or where additional site area information is needed could be required. In order to evaluate the need for additional geotechnical investigation, project plans should be reviewed by this office as they are developed.

SOILS AND SEISMIC DESIGN CRITERIA (California Building Code 2019)

Design requirements for structures can be found within Chapter 16 of the 2019 California Building Code (CBC) based on building type, use, and/or occupancy. The classification of use and occupancy of all proposed structures at the site, shall be the responsibility of the building official.

Chapter 20 of the ASCE 7-16 defines six possible site classes for earth materials that underlie any given site. Bedrock is assigned one of three of these six site classes and these are: A, B, or C. Soil is assigned as C, D, E, or F. Per ASCE 7-16, Site Class A and Site Class B shall be measured on-site or estimated by a geotechnical engineer, engineering geologist or seismologist for competent rock with moderate fracturing and weathering. Site Class A and Site Class B shall not be used if more than 10 feet of soil is between the rock surface and bottom of the spread footing or mat foundation. Site Class C can be used for very dense soil and soft rock with Ñ values greater than 50 blows per foot. Site Class D can be used for stiff soil with Ñ values ranging from 15 to 50 blows per foot. Site Class E is for soft clay soils with Ñ values less than 15 blows per foot. Our previous investigation, mapping by others, and our experience in the site region indicates that the materials beneath the site are considered Site Class D stiff soils.

Earthquake design criteria have been formulated in accordance with the 2019 CBC and ASCE 7-16 for the site based on the results of our investigation to determine the Site Class and an assumed Risk Category II. However, these values should be reviewed and the final design should be performed by a qualified structural engineer familiar with the region. In addition, the building official should confirm the Risk Category utilized in our design (Risk Category II). Our design values are attached.

CEQA CONSIDERATIONS

Although the following information may not be required at this time, our recent work with you on related projects indicates that it may be needed in the future. The following table defines and answers checklist questions as presented within CEQA Appendix G for Geology and Soils. Our rankings of the anticipated impacts that the proposed project will have on considerations related to geology and soils are presented below.

VII. GEOLOGY AND SOILS. Would the project

a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

i)Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map, issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42. - *Response - No Impact*

ii) Strong seismic ground shaking?
Response - Less Than Significant with Mitigation Incorporated

iii) Seismic-related ground failure, including liquefaction?
Response - No Impact

iv) Landslides?
Response - No Impact

b) Result in substantial soil erosion or the loss of topsoil?
Response - Less Than Significant with Mitigation Incorporated

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
Response - Less Than Significant Impact

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?
Response - No Impact

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?
Response - No Impact

f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?
Response - No Impact

CLOSURE

We trust this information is as desired at this time, if you have any questions please contact this firm at your convenience.

Respectfully submitted,
LOR Geotechnical Group, Inc.

John P. Leuer, GE 2030
President

RMM:AAT:JPL:ss

Attachments: Seismic Design Spectra, CEQA

Distribution: Addressee (2) and via email waen.messner@lewismc.com

REFERENCES

American Society of Civil Engineers, 2016, Minimum Design Load for Buildings and Other Structures, ASCE 7-16.

California Building Standards Commission, 2019 California Building Code.

CEQA, 2019, Appendix G, Section VII, Geology and Soils.

LOR Geotechnical Group, Inc., 2018, EIR Level Geotechnical Feasibility Investigation, Gateway at Grand Terrace Specific Plan and Homecoming Project, City of Grand Terrace, San Bernardino County, California, Project No. 3318C.1, dated July 31, 2018.

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

Project: Gateway at Grand Terrace Specific Plan
Project Number: 33318C.1
Client: Lewis Management Corporation
Site Lat/Long: 34.0258/-117.3299
Controlling Seismic Source: San Jacinto

REFERENCE	NOTATION	VALUE
Site Class	C, D, D default, or E	D measured
Site Class D - Table 11.4-1	F_a	1.0
Site Class D - 21.3(ii)	F_v	2.5
$0.2*(S_{D1}/S_{DS})$	T_0	0.196
S_{D1}/S_{DS}	T_S	0.981
Fundamental Period (12.8.2)	T	Period
Seismic Design Maps or Fig 22-14	T_L	8
Equation 11.4-4 - $2/3*S_{M1}$	S_{D1}	1.1767
Equation 11.4-2 - F_V*S_1 [1]	S_{M1}	1.7650

[1] - F_V as determined by Section 21.3

REFERENCE	NOTATION	VALUE
Fv (Table 11.4-2)[Used for General Spectrum]	F_v	1.7
Design Maps	S_s	1.800
Design Maps	S_1	0.706
Equation 11.4-1 - F_A*S_S	S_{MS}	1.800*
Equation 11.4-3 - $2/3*S_{MS}$	S_{DS}	1.20*
Design Maps	PGA	0.761
Table 11.8-1	F_{PGA}	1.1
Equation 11.8-1 - $F_{PGA}*PGA$	PGA_M	0.837*
Section 21.5.3	80% of PGA_M	0.670
Design Maps	C_{RS}	0.922
Design Maps	C_{R1}	0.897

REFERENCE	NOTATION	VALUE
$0.2*(S_{D1}/S_{DS})$	T_0	0.133*
S_{D1}/S_{DS}	T_S	0.667*
Equation 11.4-4 - $2/3*S_{M1}$	S_{D1}	0.8001*
Equation 11.4-2 - F_V*S_1	S_{M1}	1.2002*

RISK COEFFICIENT

Cr - At Perods <=0.2, Cr=C_{RS}	C_{RS}	0.922
Cr - At Periods >=1.0, Cr=C_{R1}	C_{R1}	0.897

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

Period	Cr
0.200	0.922
0.300	0.919
0.400	0.916
0.500	0.913
0.600	0.910
0.680	0.907
1.000	0.897

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

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

PROBABILISTIC SPECTRA[1]
2% in 50 year Exceedence

Project No: 33318C.1

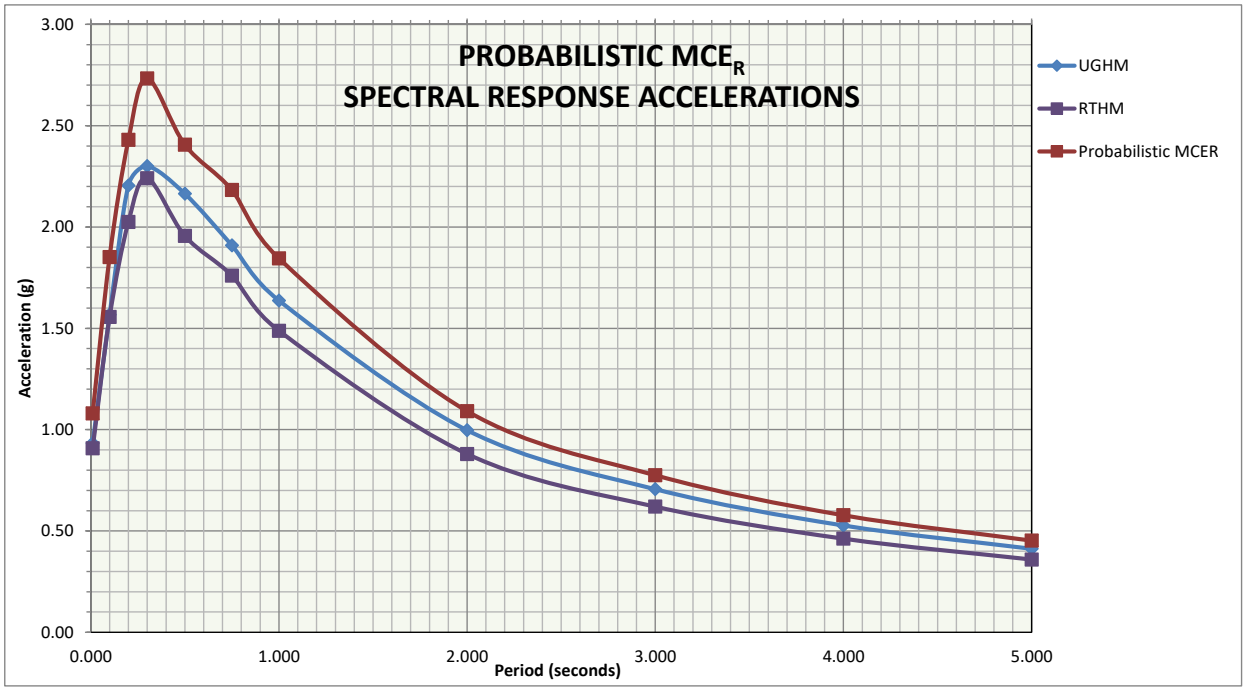
Period	UGHM	RTGM	Max Directional Scale Factor[2]	Probabilistic MCE
0.010	0.933	0.908	1.19	1.081
0.100	1.567	1.556	1.19	1.852
0.200	2.205	2.025	1.20	2.430
0.300	2.300	2.240	1.22	2.733
0.500	2.164	1.956	1.23	2.406
0.750	1.909	1.760	1.24	2.182
1.000	1.637	1.488	1.24	1.845
2.000	0.997	0.880	1.24	1.091
3.000	0.706	0.620	1.25	0.775
4.000	0.527	0.462	1.25	0.578
5.000	0.412	0.359	1.26	0.452

Probabilistic PGA: 0.933

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

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

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



DETERMINISTIC SPECTRUM

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

Controlling Source: San Jacinto

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

Period	Deterministic PSa Median + 1.σ for 5% Damping	Max Directional Scale Factor[2]	Deterministic MCE	Section 21.2.2 Scaling Factor Applied
0.010	0.874	1.19	1.040	1.040
0.020	0.880	1.19	1.047	1.047
0.030	0.892	1.19	1.061	1.061
0.050	0.937	1.19	1.115	1.115
0.075	1.107	1.19	1.317	1.317
0.100	1.301	1.19	1.549	1.549
0.150	1.582	1.20	1.898	1.898
0.200	1.773	1.20	2.127	2.127
0.250	1.929	1.21	2.334	2.334
0.300	2.021	1.22	2.465	2.465
0.400	2.081	1.23	2.560	2.560
0.500	2.039	1.23	2.508	2.508
0.750	1.700	1.24	2.108	2.108
1.000	1.450	1.24	1.798	1.798
1.500	1.045	1.24	1.296	1.296
2.000	0.795	1.24	0.986	0.986
3.000	0.542	1.25	0.677	0.677
4.000	0.371	1.25	0.463	0.463
5.000	0.271	1.26	0.341	0.341

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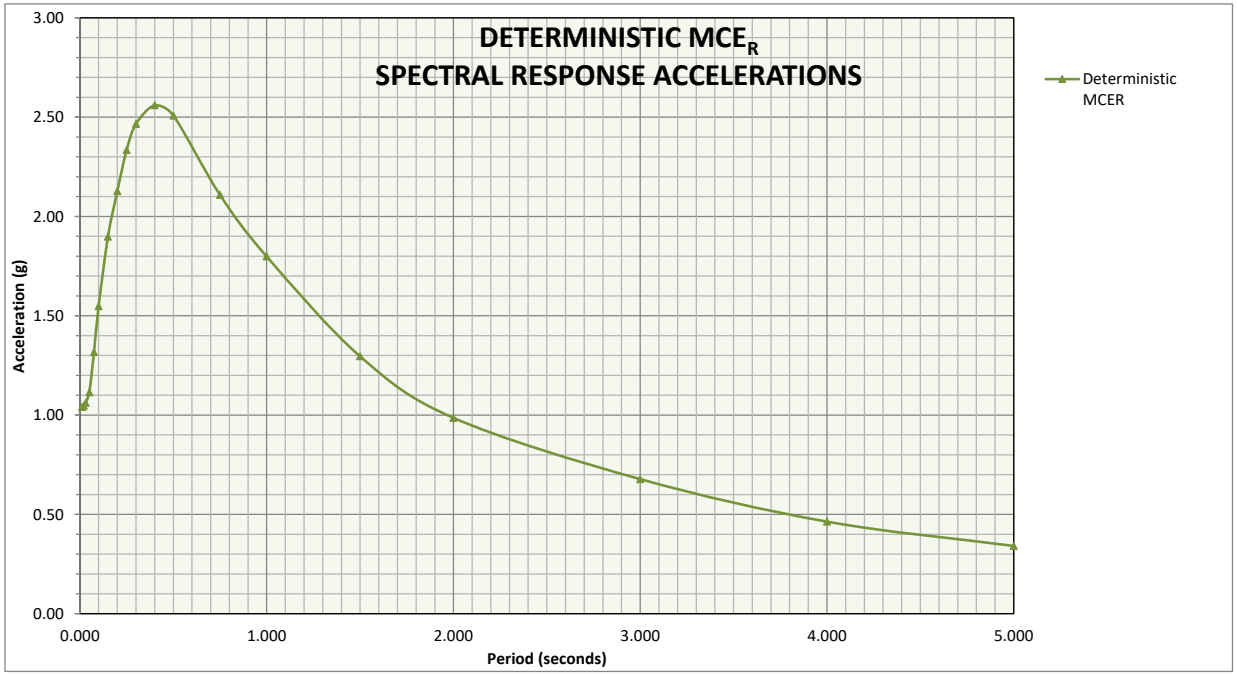
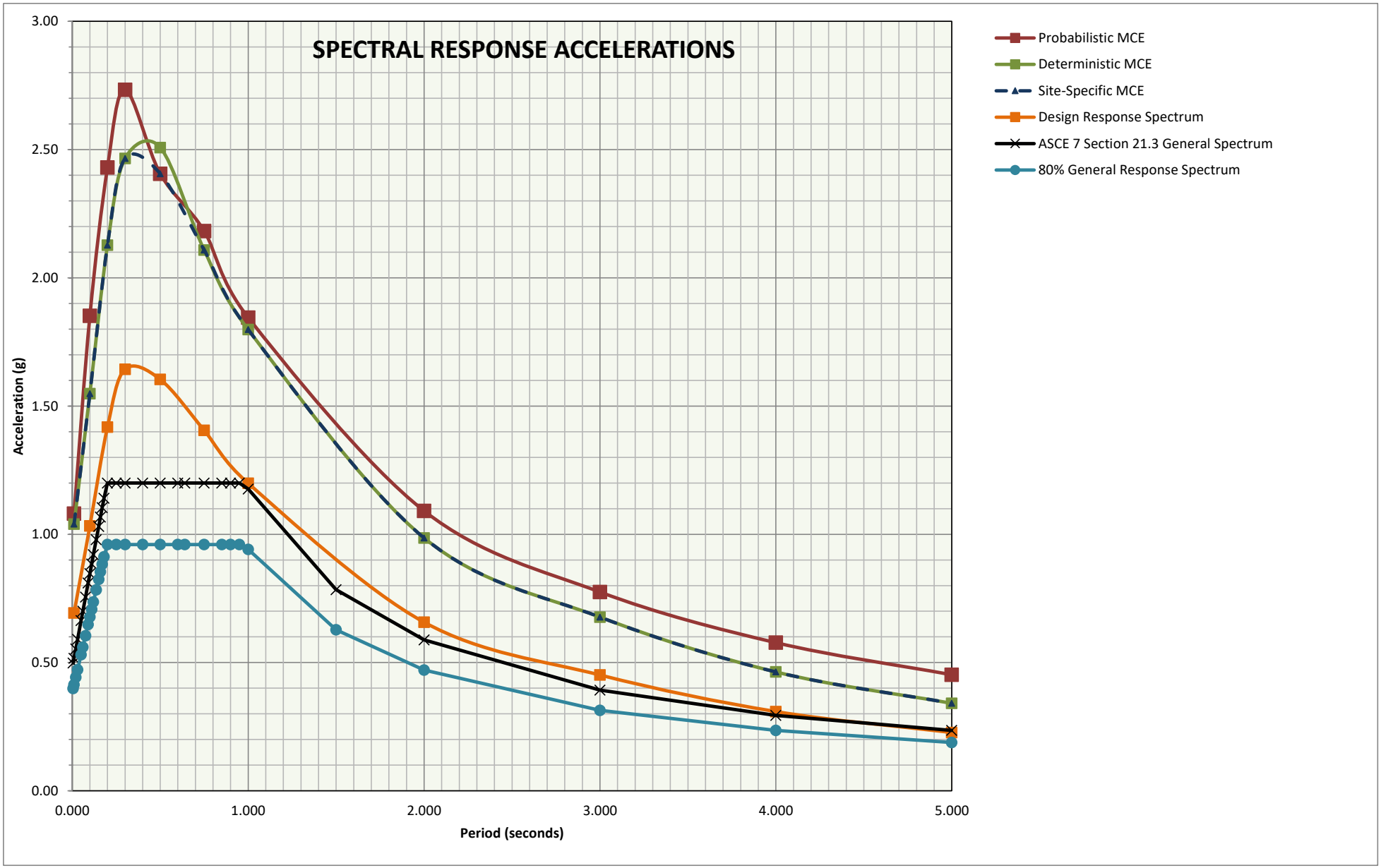
Is Determinstic $Sa_{(max)}$<1.5*Fa?	NO
Section 21.2.2 Scaling Factor:	N/A
Deterministic PGA:	0.874
Is Deterministic PGA >=F_{PGA}*0.5?	YES

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

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





Project No: 33318C.1

SITE SPECIFIC SPECTRA

Period	Probabilistic MCE	Deterministic MCE	Site-Specific MCE	Design Response Spectrum (Sa)
0.010	1.081	1.040	1.040	0.693
0.100	1.852	1.549	1.549	1.032
0.200	2.430	2.127	2.127	1.418
0.300	2.733	2.465	2.465	1.644
0.500	2.406	2.508	2.406	1.604
0.750	2.182	2.108	2.108	1.405
1.000	1.845	1.798	1.798	1.199
2.000	1.091	0.986	0.986	0.657
3.000	0.775	0.677	0.677	0.451
4.000	0.578	0.463	0.463	0.309
5.000	0.452	0.341	0.341	0.227

ASCE 7-16: Section 21.4
Site Specific

	Calculated Value	Design Value
SDS:	1.479	1.479
SD1:	1.354	1.354
SMS:	2.219	2.219
SM1:	2.032	2.032
Site Specific PGAm:	0.874	0.874
Site Class:	D measured	

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

Period	ASCE 7 SECTION 21.3 General Spectrum	80% General Response Spectrum
0.005	0.498	0.399
0.010	0.517	0.413
0.020	0.553	0.443
0.030	0.590	0.472
0.050	0.664	0.531
0.060	0.700	0.560
0.075	0.755	0.604
0.090	0.810	0.648
0.100	0.847	0.678
0.110	0.884	0.707
0.120	0.921	0.736
0.136	0.979	0.783
0.150	1.031	0.825
0.160	1.067	0.854
0.170	1.104	0.883
0.180	1.141	0.913
0.200	1.200	0.960
0.250	1.200	0.960
0.300	1.200	0.960
0.400	1.200	0.960
0.500	1.200	0.960
0.600	1.200	0.960
0.640	1.200	0.960
0.750	1.200	0.960
0.850	1.200	0.960
0.900	1.200	0.960
0.950	1.200	0.960
1.000	1.177	0.941
1.500	0.784	0.628
2.000	0.588	0.471
3.000	0.392	0.314
4.000	0.294	0.235
5.000	0.235	0.188

Project No: 33318C.1