GeoSoils, Inc.

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December 19, 2023 WO S8745

Long Beach Yacht Club
6201 E. Appian Way
Long Beach CA 90803

SUBJECT: Coastal Hazard and Sea Level Rise Discussion for Remodel, Pool Replacement, and New Accessory Structure at the Long Beach Yacht Club, Long Beach, California.

Dear Long Beach Yacht Club:

In accordance with the your request and authorization, GeoSoils, Inc. (GSI) is pleased to provide this discussion regarding the potential coastal hazards, including the impact of future sea level rise (SLR), on the remodeling of the existing Long Beach Yacht Club (LBYC) building, replacing the existing pool and pool deck, and building a new two story structure to service the pool area. The purpose of this report is to provide the hazard information for your permit application requested by the City of Long Beach and the California Coastal Commission (CCC). Our scope of work includes a review of the State of California Sea-Level Rise (SLR) Policy Guidance document (March 2018), CCC SLR Guidance (November 2018), a review of the proposed project plans, a site inspection, and preparation of this letter report.

INTRODUCTION

The proposed project is to remodel the existing clubhouse, replace the pool, and construct a new accessory structure to service the pool area. Figure 1, downloaded from Google Maps (Bird's Eye View), shows the site (building and pool), the public boardwalk (Naples Shoreline Path), the off site concrete bulkhead, the boat docks, and the navigation channel within Alamitos Bay. The lowest finished first floor (FF) elevation of the main building is about +11 feet NAVD88. The top of the public bulkhead is at about elevation 10 NAVD88 with the public boardwalk also at about elevation +10 feet NAVD88.

Figure 1. Subject LBYC site, adjacent properties, public boardwalk (Naples Shoreline Path), bulkhead, boat docks, and Alamitos Bay.

DATA & DATUM

The datum used in this report is NAVD88, which is about 2.62 feet below the mean tide level (MSL). The units of measurement in this report are feet (ft), pounds force (lbs), and seconds (sec). Site elevations and project preliminary plans were provided by and KAA, the project designer. A site reconnaissance was performed in December 2023. The visible portions of the offsite (city owned) bulkhead were observed to be in good condition.

HAZARD ANALYSIS

There are three different potential shoreline hazards identified at this site: shoreline movement/erosion, waves and wave runup, and flooding. For ease of review, each of these hazards will be analyzed and discussed separately, followed by a summary of the analysis including conclusions and recommendations, as necessary.

Shoreline Erosion Hazard

There is no actual shoreline fronting the site. The shoreline is essentially located at the City owned bulkhead. Shoreline erosion will not impact the proposed development over the life of the development.

Current Flooding Hazard

The National Oceanographic and Atmospheric (NOAA) National Ocean Survey tidal data station closest to the site with a long tidal record is located at Los Angeles Harbor (Station 94106600). The tidal datum elevations are as follows:

Mean High Water	4.55 feet
Mean Tide Level (MSL)	2.62 feet
Mean Low Water	0.74 feet
NAVD88	0.0 feet
Mean Lower Low Water	-0.2 feet

During storm conditions, the sea surface rises along the shoreline (super-elevation) and allows waves to break closer to the shoreline and runup on the beach. Super-elevation of the sea surface can be accounted for by: wave set-up, wind set-up and inverse barometer, wave group effects and El Niño sea level effects. For this analysis, the 1% Alamitos Bay water elevation is +7.2 feet NAVD88. The site is in the FEMA Shaded X zone with no base flood elevation (BFE). Figure 2 provides a portion of the FEMA map for the site.

Figure 2. Current FEMA map for the site.

Future Tide Levels Due to Sea Level Rise

The November 2018 California Coastal Commission (CCC) SLR Guidance Update document recommends that a project designer determine the range of SLR using the "best

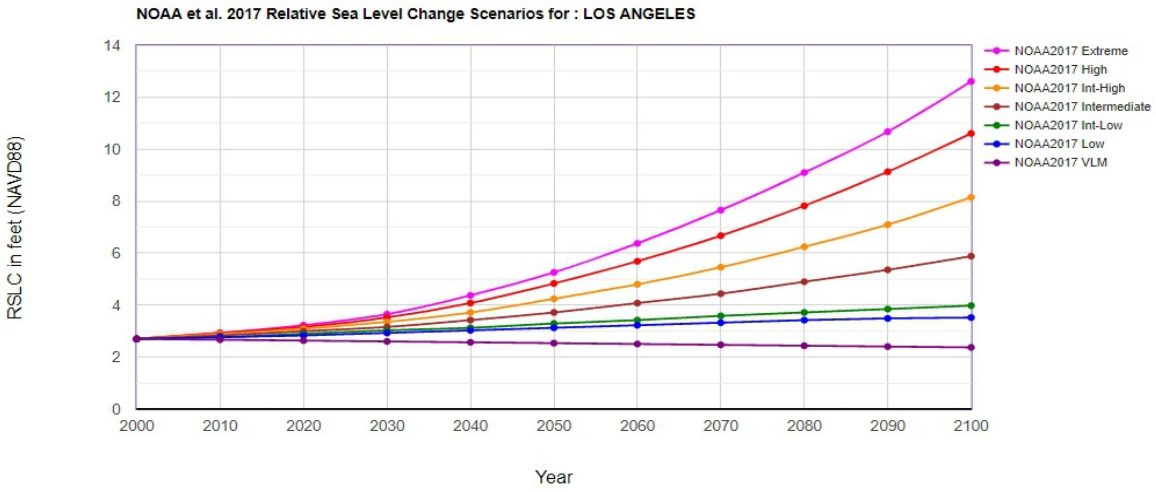
available science." The California Ocean Protection Council (COPC) adopted an update to the State's Sea-Level Rise Guidance in March 2018 which the CCC has adopted in November 2018. These estimates are based upon a 2014 report entitled "Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites" (Kopp el at, 2014). This update included SLR estimates and probabilities for Los Angeles Harbor, the closest SLR estimates to Alamitos Bay. The report provides SLR estimates based upon various carbon emission scenarios known as a "representative concentration pathway" or RCP. Figure 3 provides the March 2018 COPC data (from the Kopp et al 2014 report) with the CCC SLR adopted estimates (in feet) and the probabilities of those estimate to meet or exceed the 1991-2009 mean.

		Probabilistic Projections (in feet) (based on Kopp et al. 2014)					*H++ scenario (Sweet et al. 2017) *Single scenario*
		MEDIAN	**LIKELY RANGE**		**1-IN-20 CHANCE**	**1-IN-200 CHANCE**	
		50% probability sea-level rise meets or exceeds...	*66% probability sea-level rise is between...*		*5% probability sea-level rise meets or exceeds...*	*0.5% probability sea-level rise meets or exceeds...*	
				Low Risk Aversion		**Medium - High Risk Aversion**	**Extreme Risk Aversion**
High emissions	2030	0.3	0.2 -	0.5	0.6	0.7	1.0
	2040	0.5	0.4 -	0.7	0.9	1.2	1.7
	2050	0.7	0.5 -	1.0	1.2	1.8	2.6
Low emissions	2060	0.8	0.5 -	1.1	1.4	2.2	
High emissions	2060	1.0	0.7 -	1.3	1.7	2.5	3.7
Low emissions	2070	0.9	0.6 -	1.3	1.8	2.9	
High emissions	2070	1.2	0.8 -	1.7	2.2	3.3	5.0
Low emissions	2080	1.0	0.6 -	1.6	2.1	3.6	
High emissions	2080	1.5	1.0 -	2.2	2.8	4.3	6.4
Low emissions	2090	1.2	0.7 -	1.8	2.5	4.5	
High emissions	2090	1.8	1.2 -	2.7	3.4	5.3	8.0
Low emissions	2100	1.3	0.7 -	2.1	3.0	5.4	
High emissions	2100	2.2	1.3 -	3.2	4.1	6.7	9.9
Low emissions	2110*	1.4	0.9 -	2.2	3.1	6.0	
High emissions	2110*	2.3	1.6 -	3.3	4.3	7.1	11.5

Figure 3. Table from Kopp et al (2014) and COPC 2018, providing current SLR estimates and probabilities for the Los Angeles Harbor tide station.

The CCC SLR Guidance (CCCSLRG) is based upon the COPC update to the State's Sea-Level Rise Guidance in March 2018. These COPC estimates are based upon a 2014 report by Kopp, et al., 2014. The Kopp et al. paper used 2009 to 2012 SLR modeling by climate scientists for the probability analysis, which means the "best available science" used by the CCC is over 10 years old. The SLR models used as the basis for the COPC and CCCSLRG have been in place for a couple decades. The accuracy of any model can be determined by comparing the measured SLR (real data) to the model predicted SLR (model prediction). If the model cannot predict, with any accuracy, what will happen in the past, it is very unlikely that the model will increase in accuracy when predicting SLR over the next 75 years or the life of the project. Simply put, if the model is not accurate now, it will be even less accurate in the future.

NOAA, and NASA, currently provides the “best available” SLR science (NOAA, 2022). NOAA has been measuring SLR globally and at Los Angeles Harbor. The NOAA Los Angeles Harbor SLR rate is 1.03 mm/yr. The rate can be used to calculate a sea level rise of 30.9 mm (0.1 ft) over the last 23 years and next 7 years (Jan 2000 to Jan 2030), a period of 30 years. NOAA also provides the latest SLR model curves and tables for the Los Angeles Harbor NOAA Station. Figure 4 provides the SLR model curves and tables for Los Angeles Harbor.



Huntington Harbour
Scenarios for LOS ANGELES
NOAA2017 VLM: -0.00328 feet/yr
All values are expressed in feet

Year	NOAA2017 VLM	NOAA2017 Low	NOAA2017 Int-Low	NOAA2017 Intermediate	NOAA2017 Int-High	NOAA2017 High	NOAA2017 Extreme
2000	2.70	2.70	2.70	2.70	2.70	2.70	2.70
2010	2.67	2.77	2.77	2.83	2.90	2.93	2.93
2020	2.63	2.83	2.90	3.00	3.09	3.16	3.23
2030	2.60	2.93	3.03	3.16	3.36	3.52	3.65
2040	2.57	3.03	3.13	3.42	3.72	4.08	4.37
2050	2.54	3.13	3.29	3.72	4.24	4.83	5.26
2060	2.50	3.23	3.42	4.08	4.80	5.69	6.37
2070	2.47	3.32	3.59	4.44	5.46	6.67	7.65
2080	2.44	3.42	3.72	4.90	6.24	7.82	9.10
2090	2.40	3.49	3.85	5.36	7.10	9.13	10.67
2100	2.37	3.52	3.98	5.88	8.15	10.61	12.61

Figure 4. Taken from the USACOE SLR curve calculator program.

Looking at the table in Figure 4, the SLR base value in the year 2000 is 2.70 feet. Adding 0.1 feet to the base SLR value yields the value 2.8 for the year 2030. The model that most closely predicts the currently measured SLR is the NOAA 2017 Low Model. This NOAA model predicts about 1.5 feet of SLR in the year 2100. Examining Figure 3 for the year 2030 and 0.1 feet of SLR, the closest probability category is the lower limits of the “Likely Range.”

The CCCSLRG document recommends that a project designer determine the range of SLR using the “best available science.” The NOAA information provided above, and in NOAA 2022, is more current than the CCCSLRG. The NOAA information provides the

"best available science" for SLR prediction and is required to be used. Currently, the SLR model that the CCC is "requiring" to be used for development is incorrect by a factor of about 4 as to the amount of the SLR in Los Angeles.

The design life of a commercial use development is typically about 50- to 75-years. Figure 3 illustrates that SLR in the year 2100 for the Likely Range, and considering the most onerous RCP (8.5), is 1.3 feet to 3.2 feet above the 1991-2009 mean. In addition, based upon this 2018 COPC SLR report, the 5% probability SLR for the project is estimated to be less than 4.1 feet and a 0.5% probability that SLR will be between 5 feet and 6 feet in the year 2098. This 0.5% SLR is based upon the interpolation of the low estimates and the high estimates for 2090 and 2100, recognizing that the interpolation is exponential and not linear((4.5 + 5.4)/2 = ~5 and (5.3 + 6.7)/2 = ~6 feet)). The design 1% water elevation for Alamitos Bay is about elevation +7.2 feet NAVD88. This actual high water record period includes the 1982-83 severe El Niño, and the 1997 El Niño events, and is therefore consistent with the methodology outlined in the CCCSLRG document.

The "likely" sea level rise range for the proposed project is 1.3 feet to 3.2 feet with a lower probability (~5%) of SLR of about 4.0 feet. The likely SLR range would account for future extreme bay water levels in the range of 8.5 feet NAVD88 (7.2 feet NAVD88 + 1.3 feet SLR) and 10.4 feet NAVD88 (7.2 feet NAVD88 + 3.2 feet SLR). There is a 0.5% probability that bay water will meet or exceed ~14 feet NAVD88 (7.2 feet NAVD88 + 6.7 feet SLR). The top of the City owned bulkhead next to the public walkway is about elevation 10 feet NAVD88. As stated before, the present maximum historical water elevation at the site, including El Niño effects, is ~+7.2 feet NAVD88. Based upon the elevation of the bulkhead (+10 feet NAVD88), the extreme Alamitos Bay water level will exceed the height of the bulkhead when SLR is 2.8 feet or greater. For the likely COPC SLR estimate range (high emissions) the bulkhead is safe from overtopping beyond the year 2090. For SLR greater than 2.3 feet the height of the continuous public bulkhead can be increased. For the 0.5% probability SLR case this may occur after the year 2070. The bulkhead can be increased in height to adapt to SLR. It should be noted that simply increasing the height of the bulkhead at only this site will not mitigate site flooding. The entire bulkhead around Alamitos Bay would need to be raised in elevation to mitigate SLR related flooding. If the bay water is higher than the bulkhead, flooding will not occur constantly but rather only a few times a month, at the full moon and new moon, for a period of about 1 hour.

The NASA "best available science" is based upon the Intergovernmental Panel for Climate Change (IPCC) AR6 update. IPCC is the globally recognized panel of experts on SLR science and modeling. Figure 5 provides the NASA 2023 IPCC AR6 models with the SLR estimates (in meters) for the Los Angeles NOAA station, and the model probabilities of those estimate to meet or exceed the 1995-2014 baseline. The likely IPCC AR6 SLR in the year 2100 (SSP3-7.0) is 0.54 meters (1.77 feet) and the unlikely (very low probability ~0.5%) in the year 2100 (SSP5-8.5) is 0.76 meter (about 2.5 feet). The NOAA and NASA IPCC AR 6 data/models are the currently best available science and are required by the CCCSLRG to be considered for flood hazard determination.

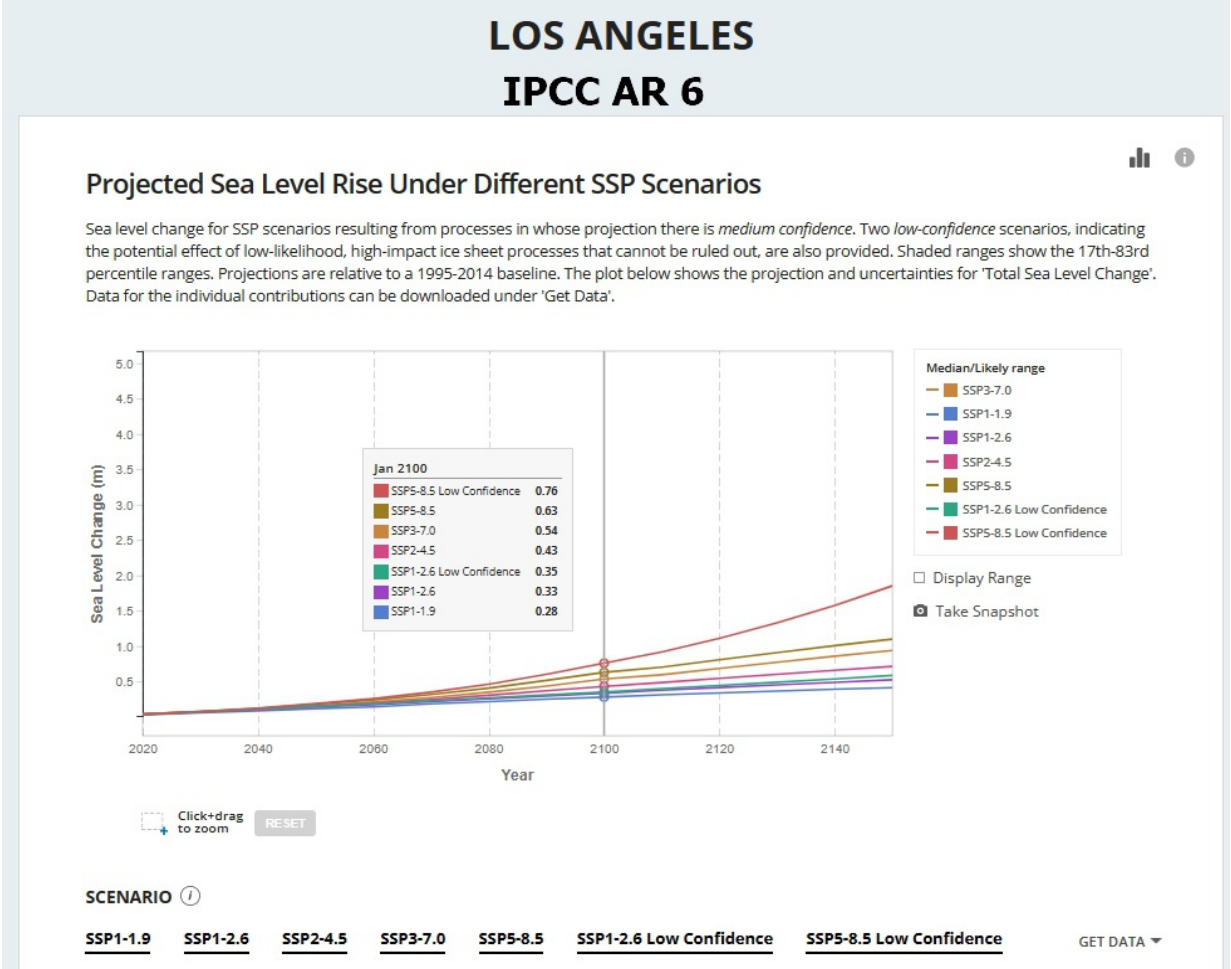


Figure 5. NASA 2023 SLR tool IPCC AR6 estimates for Los Angeles NOAA tide station.

Measurements and models from NASA show that SLR is tracking to be about 1.0 feet to 2.5 feet in the year 2100. Measurements and models from NOAA have SLR to be between 0.66 feet to 5.3 feet (NOAA-2107 Int-High) in the year 2100. The typical design life of commercial development is less than 75 years or at most about the year 2100. Reviewing Figure the 3 high RCP scenarios yields a range of SLR from 2.2 feet (66% probability) to ~6.6 feet (0.5% probability) in the year 2100. **Based on the discussion above (the current best available science), the SLR range for the project with an ~ 75 year design life, is about 2 feet (high probability) to 6.6 feet (very low probability).** Using the design bay water elevation 7.2 feet NAVD88, the potential range of Alamitos Bay water level in the year 2100 due to SLR is 9.2 feet NAVD88 to 13.8 feet NAVD88.

Future Flooding CoSMoS

There are few tools available to determine how SLR may impact the potential for flooding of the site in the future. The United States Geological Survey (USGS) has also developed a model called the Coastal Storm Modeling System (CoSMoS) for assessment of the

vulnerability of coastal areas to SLR and the 100-year storm, https://ourcoastourfuture.org. However, the use of CoSMoS is limited by the following disclaimer.

Disclaimer: This interactive mapping tool, including its data and other information ("tool and data") are provided for informational purposes. The tool and data are not for the purpose of providing advice or guidance on issues or activities related to its content including, but not limited to, navigation, investment, development or permitting. The tool and data are based on model simulations, which are subject to revision and do not take into account many variables that could have substantial effects on flooding, erosion, and emerging groundwater. Real world results will differ from results of the tool and data. Commercial use of this tool and data are prohibited.

The tool and data are provided "as is" without any representations or warranties as to their accuracy, completeness, performance, merchantability, or fitness for a particular purpose. The entire risk associated with the results and performance of the tool and data is assumed by the user. OCOF, Point Blue and all their partners ("OCOF") shall not be responsible or liable to you for any loss or damage of any sort incurred in connection with your use of the tool and data.

The use of CoSMoS for future flooding potential at this inland site, located away from the open coast and protected by levees and bulkheads, needs to be qualified. Simply running the program with a specified SLR scenario may yield nonsensical results. Some of this is the result of the program's inability, in some cases, to recognize rapidly changing elevations, such as a bulkheads, or coastal structures like the entrance jetties to Alamitos Bay and the San Gabriel River jetties. These variables and others (such as accurate model elevation data) have a substantial effect on the flood extent and depth determined by CoSMoS as explained in the disclaimer above. Because the site is about 1/2 mile from the Pacific Ocean, the 100 year storm (wave event) would not impact the site. Figure 6 is the CoSMoS output that shows the site is just vulnerable to flooding with 3.3 feet of SLR. This is misleading because the lowest FF is +11 feet NAVD88, which would require about 3.8 feet of SLR to be flooded by bay water. The CoSMoS output does not take into account the elevation of the existing and proposed improvements on the site.

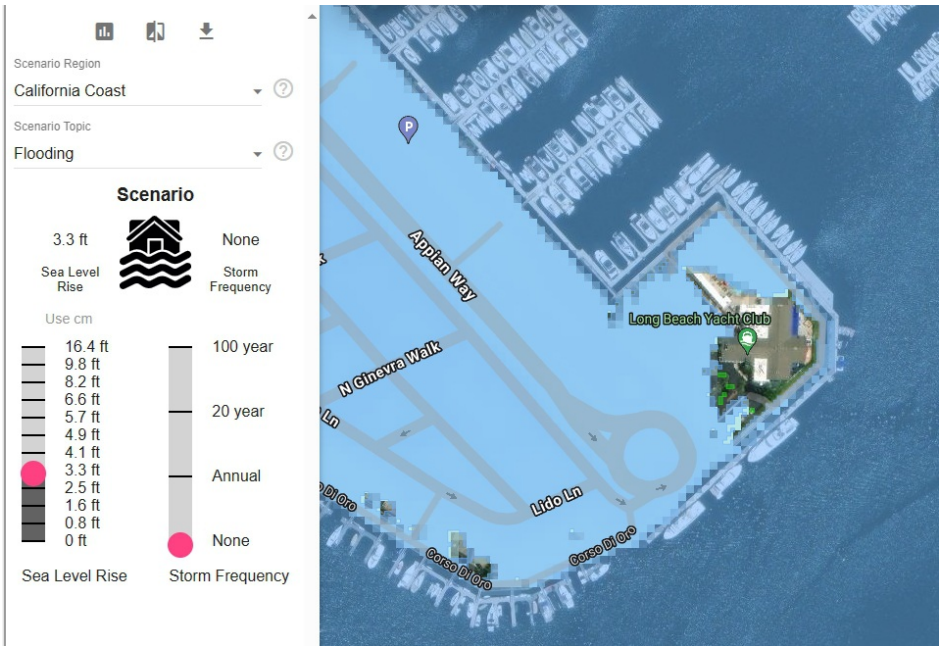


Figure 5. CoSMoS output for 1.6 feet SLR.

Future Flooding Model NOAA 2022

The subject site is not on the open ocean and is not in an area that is subject to wave runup or shoreline erosion. NOAA has flood modeling in consideration of SLR (NOAA, 2022) that is a more current model than the CoSMoS program. The NOAA web mapping tool (link provided in References) helps to visualize community-level impacts from coastal flooding or sea level rise (up to 10 feet above average high tides). Photo simulations of how future flooding might impact local landmarks are also provided, as well as data related to water depth, connectivity, flood frequency, socio-economic vulnerability, wetland loss and migration, and mapping confidence. As previously mentioned, the CCC has used the older USGS CoSMoS model for assessment of the vulnerability of coastal areas to SLR and the 100-year storm. The CoSMoS program is more applicable to open ocean settings with waves, and, therefore, is not be the most appropriate model for the Alamitos Bay site. The NOAA model can be used to show under what amount of SLR the site will begin to regularly flood at very high tides. Figure 7 is the model output for 4 feet of SLR and it shows that there is the beginning of flooding of the site, and flooding of nearby public streets and properties. As with the CoSMoS model it is not clear of the bulkhead elevation surrounding Long Beach Yacht is part of the modeling.

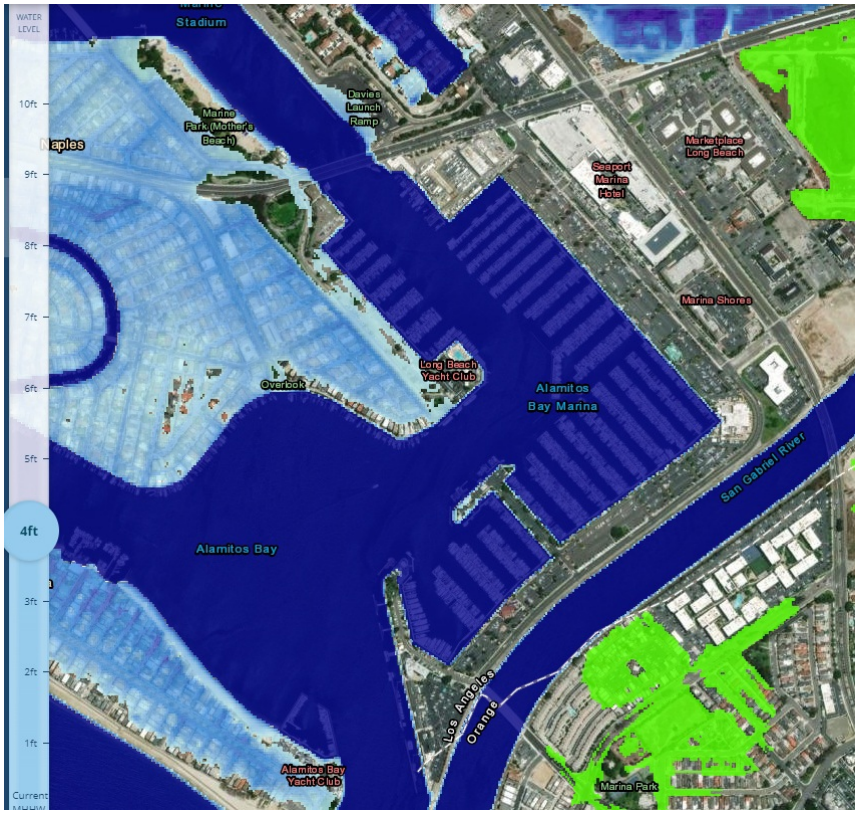


Figure 7. NOAA SLR modeling with 3 feet of SLR.

The site, being in a slightly higher than many sections of Long Beach, will be unreachable by the nearby public roads to the north long before the residences may be subject to flooding, if no regional SLR adaptation plan is implemented. This vulnerability is not just at this particular site or development. Some of Long Beach and most of Seal Beach, along with other surrounding communities, are vulnerable to flooding.

Waves and Wave Runup

The potential surface gravity waves (ocean swell) is nil. The site is located behind the public walkway and bulkhead. Boat wakes and wind waves to are too small to overtop the offsite bulkhead and public boardwalk.

Tsunami

Tsunami are waves generated by submarine earthquakes, landslides, or volcanic action. Based upon recent modeling, the maximum tsunami runup in the Long Beach open coast area is about 1 meter in height. Any wave, including a tsunami, that approaches the site in will be refracted, modified, and reduced in height by the Alamitos Bay jetties, and as it travels into the bay. Due to the infrequent nature and the relatively low 500-year recurrence interval tsunami wave height, and the elevation of the proposed improvements, the site is reasonably safe from tsunami hazards.

It should be noted that the site is mapped within the limits of the California Office of Emergency Services tsunami innundation map. The tsunami inundation maps are very specific as to their use. Their use is for evacuation planning only. The limitation on the use of the maps is clearly stated in the **PURPOSE OF THIS MAP** on every quadrangle of California coastline. In addition, the following paragraph is taken from the CalOES Local Planning Guidance on Tsunami Response concerning the use of the tsunami inundation maps.

> *Inundation projections and resulting planning maps are to be used for emergency planning purposes only. They are not based on a specific earthquake and tsunami. Areas actually inundated by a specific tsunami can vary from those predicted. The inundation maps are not a prediction of the performance, in an earthquake or tsunami, of any structure within or outside of the projected inundation area.*

The CalOES maps model the inundation of a tsunami with an approximate 1,000 year recurrence interval (0.1% event). The Science Application for Risk Reduction (SAFRR) tsunami study headed by USGS investigated a tsunami scenario with a 200-240 year recurrence interval. The SAFRR modeling output is shown in Figure 8 and reveals that the site is barely within the more probable (0.4% event) tsunami inundation zone. The City of Long Beach has clearly marked tsunami evacuation routes for the entire Long Beach/Alamitos Bay area.

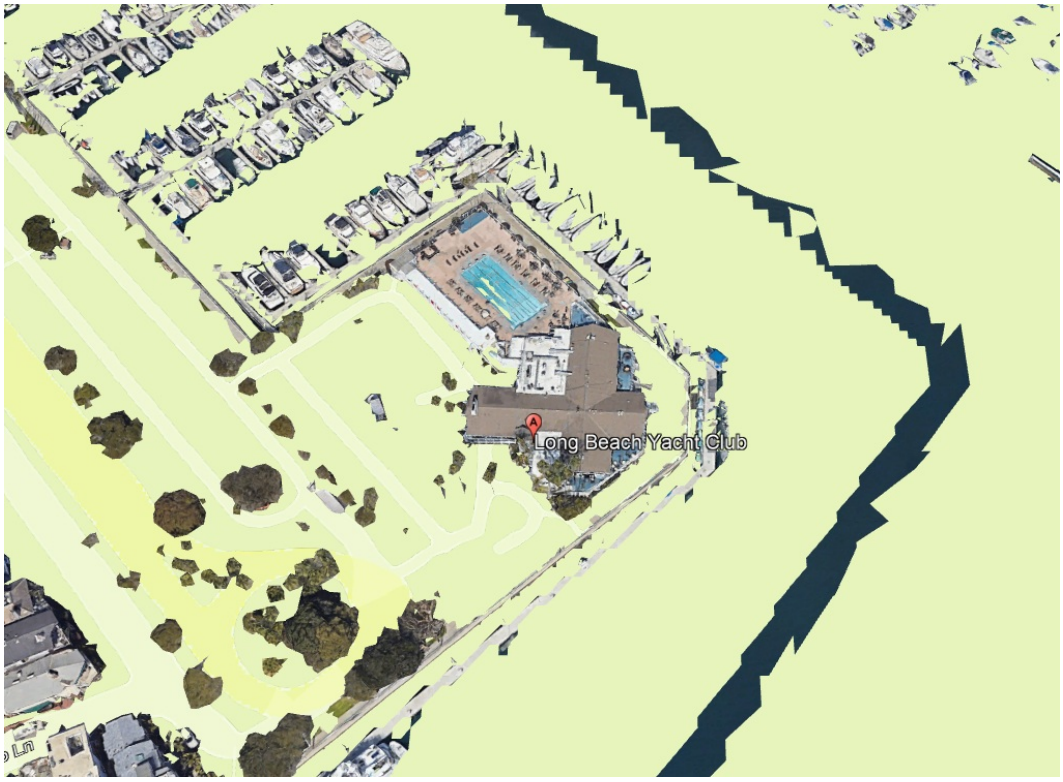


Figure 8. SAFRR tsunami modeling output for the site.

ADAPTATION

The Project, as designed, has the flexibility to adapt to SLR levels higher than levels predicted by the current best available science. The proposed development (standard timber and concrete construction) can be retrofitted with waterproofing material in the future to adapt to SLR, if needed. In addition, floodproofing the development will follow the FEMA guidelines as described below. The landscape improvements can be permeable, which will mitigate water ponding on-site and reduce the potential for building flooding. The project can incorporate flood resistant material such as tiles and non-paper faced gypsum board. The building utilities (e.g. gas and electric meters, AC units, and furnaces) could be elevated where possible such that they will not be impacted by flooding. These utilities may also be relocated to higher floors if necessary. Additionally, outdoor equipment can also be elevated in the future in response to new SLR information. The lowest floor access areas are such that they can be protected with temporary sand bag type flood sheilds as needed.

Moreover, the Project would comply with the Federal Emergency Management Agency (FEMA) publication (FEMA P-259) concerning retrofitting flood prone structures. Currently, FEMA practices include “dry flood proofing” and “wet flood proofing.” Dry flood proofing is the sealing of the development below the design flood elevation to make it flood proof and

impermeable to flood waters. Sealant systems include wall coatings, waterproofing compounds, impermeable sheeting, and supplemental impermeable wall systems. Doors, windows, and vents can be flood proofed with removable shields. FEMA notes that these types of dry flood proofing systems are effective up to 3 feet of water depth. Wet flood proofing involves allowing flood waters to enter in a way that minimizes the damage to the structure and its contents. While these types of systems are not needed now, the design of the proposed development will allow for retrofitting. Furthermore, it is very likely that additional effective flood proofing systems will be developed in the future, and these new technologies may be incorporated into the project once available.

The City of Long Beach adopted a Climate Action Plan (LBCAP) in August 2022. LBCAP identifies elevating walkways, seawalls, and levees as part of their SLR adaptation actions (LBCAP, page 99). The top of the boardwalk around LBYC is at about elevation +10 feet NAVD88. It will take almost 3 feet of SLR for the Alamitos Bay water to overtop the bulkhead. The LCCAP identifies elevation of streets and pathways as part of their SLR adaptation actions (LBCAP, page 70). The LBCAP does not identify the site area as suitable for the managed retreat (remove development) adaptation action.

CONCLUSIONS

- The project design life is 75 years or less. The design SLR range for 75 years based upon the current best available science is 2 feet (likely) to about 6.6 feet (unlikely).

- The site is in a slightly higher section of Long Beach, and the nearby streets and adjacent areas are protected from flooding by bulkheads and levees.

- The lowest finished floor elevation is +11 feet NAVD88.

- There is no need for new shore protection over the life of the development. In the future, depending upon the rate of SLR, the community will need to increase the height of the existing flood control systems (bulkheads and levees) in the area. This is a reasonable adaption strategy given that it is our understanding that the San Gabriel River levees and the Naval Weapons Station will implement this type of strategy. Not adapting to SLR in this manner will result in the inundation of vast areas and several communities and cities.

CCC SLR GUIDANCE INFORMATION

Step 1. Establish the projected sea level rise range for the proposed project's planning horizon using the best available science.

Considering the current best available science, the SLR estimate over the project design

life the “likely” range in the year ~2100 is about 2 feet. In addition, the analysis herein considered a unlikely SLR of 6.6 feet.

Step 2. Determine how physical impacts from sea level rise may constrain the project site, including erosion, structural and geologic stability, flooding, and inundation.

The analysis herein shows that it is unlikely that flooding of the development will occur with less than 3 feet of SLR. The lowest finished floor elevation is at elevation 11 feet NAVD88. There is no potential for waves to reach the site or for erosion to impact the site.

Step 3. Determine how the project may impact coastal resources, considering the influence of future sea level rise upon the landscape as well as potential impacts of sea level rise adaptation strategies that may be used over the lifetime of the project.

The project will not impact coastal resource considering the influence of future SLR. There will be no impacts to coastal access and recreation, water quality, ESHA or wetlands, natural landforms, scenic resources, and archaeological resources. Finally, if SLR is greater than 3 feet, the project adaptation strategies described herein would avoid any impact to the site or coastal resources.

Step 4. Identify alternatives to avoid resource impacts and minimize risks throughout the expected life of the development.

The project does not impact resources and minimizes flood risk through the project design.

Step 5. Finalize project design and submit CDP application.

The project architect will incorporate this report into the design.

RECOMMENDATIONS

1. The design and materials of the proposed development should be such that waterproofing may be retrofitted in the future, if necessary.

2. To prevent future groundwater issues from impacting the buildings, we recommend that all new below grade foundations be waterproofed.

Based upon the analysis and discussion herein, the proposed development is reasonably safe from coastal hazards for the next 75 years including shoreline movement, waves and wave runup, and flooding with future SLR for the next 75 years. It should be noted that future flooding hazards due to SLR are shared by all development around Alamitos Bay. The public roads for access to the site will be impassable due to ocean flooding long before the flood water level approaches the FF elevation of the development. SLR impacts

will be a regional problem and only solved by a regional management plan. The future seawall modification will likely mitigate any SLR impacts on the public walkway and adjacent properties. The proposed development will neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or adjacent area.

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

Respectfully submitted,

GeoSoils, Inc.
David W. Skelly MS, PE
RCE#47857

REFERENCES

City of Long Beach, 2022, City of Long Beach, LB CAP, Climate Action Plan, dated August.

FEMA Website, 2023 https://msc.fema.gov/portal/home & Homebuilders Guide to Coastal Construction, FEMA P-499

Kopp, Robert E., Radley M. Horton Christopher M. Little Jerry X. Mitrovica Michael Oppenheimer D. J. Rasmussen Benjamin H. Strauss Claudia Tebaldi Radley M. Horton Christopher M. Little Jerry X. Mitrovica Michael Oppenheimer D. J. Rasmussen Benjamin H. Strauss Claudia Tebaldi "Probabilistic 21st and 22nd century sea-level projections at a global network of tide-gauge sites" First published: 13 June 2014

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NOAA, 2023, https://tidesandcurrents.noaa.gov/datums.html?id=9410660

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State of California Sea Level Rise Guidance 2018 Update, by Ocean Protection Council, dated in March 2018.