U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FEMA

October 15, 2015

Matt Hansen, Director
Risk Management Division
City & County of San Francisco
25 Van Ness Ave., Suite 750
San Francisco, CA 94102

RE: FEMA California Coastal Analysis and Mapping Project / Bay Area Coastal Study

Dear Mr. Hansen:

Thank you for submitting comments regarding the San Francisco Bay Area Coastal (BAC) Study draft floodplain work maps prepared for the City and County of San Francisco. The BAC Study is the most comprehensive coastal hazard analysis of San Francisco Bay coastal communities undertaken to date and the study process is designed to be a collaborative process that encourages engaged stakeholders. The U.S. Department of Homeland Security's, Federal Emergency Management Agency (FEMA) shared the data and draft floodplain work maps with the City and County of San Francisco and the affected departments, along with state and federal partners.

FEMA requested and received comments submitted by San Francisco County. The purpose of this letter is to share the response to these comments with you. FEMA and its consultants carefully reviewed all of the submitted comments and detailed responses can be found on the enclosed attachments.

The submitted comments include several references to differences between the FEMA BAC Study results and the Port of San Francisco's Sea Level Rise and Adaptation Study results along the Port of San Francisco waterfront areas. FEMA acknowledges that there are differences between the two studies. Both studies were undertaken for different purposes, using different methods, approaches, analysis timeframes, and boundary condition data. FEMA has not completed a detailed technical review of the Port of San Francisco's Study; however, a preliminary evaluation determined that the study does not meet FEMA Standards and Specifications for floodplain mapping. For example the FEMA Standards specify calculating the wave runup elevation as the value exceeded by 2 percent of the runup events. The Port of San Francisco study calculated the mean wave runup value. In addition, the Port of San Francisco Study did not evaluate wave overtopping or the 0.2 percent annual chance conditions. The Port of San Francisco can update their study to comply with the FEMA Standards and Specifications and resubmit the complete study documentation as a technical appeal, if warranted.

The submitted comments included a copy of the information the Port of San Francisco submitted to FEMA (dated December 14, 2007) following the release of the previous preliminary Flood Insurance Rate Maps in 2007. This submittal contained numerous FEMA MT-2 Coastal Structures Forms for the Port of San Francisco's seawall sections, breakwaters, piers and wharves. This information was used to revise the analysis behind the Port of San Francisco's breakwaters, resulting in a reduction in the wave hazards behind these structures (see Figure 1 in the attached detailed response to comments). However, the 1 percent annual chance stillwater elevations and total water levels used in the submittal were associated with the approximate analysis completed for the 2007 preliminary FIRMs. FEMA recommends that the Port of San Francisco re-submit the documentation using more recent water level and wave data associated with the 1 percent annual chance conditions. In addition, all Coastal Structures Forms and submitted documentation should be reviewed for completeness before resubmitting.

We look forward to working with the City and County of San Francisco on this multi-year coastal analysis and mapping project. If you have questions related to specific comments that were part of your submittal or require additional information, please contact Ed Curtis by telephone at (510) 627-7207, or by e-mail at Edward.Curtis@fema.dhs.gov.

Sincerely,

Juliette Hayes,
Risk Analysis Branch Chief
Mitigation Division
FEMA, Region IX

cc: Naomi Kelly, City Administrator
Jennifer Johnston, Deputy City Administrator

City and County of San Francisco Response to Comments		
Comment ID	**Comment**	**Response**
1	#1: San Francisco Waterfront from Aquatic Park to Pier 54. COMMENT: URS prepared sea level rise/coastal inundation report in June 2011. BFEs resulting from Baker AECOM analysis are not consistent with results of this analysis.	There are multiple differences between the FEMA San Francisco Bay Regional Modeling Study and the associated overland coastal hazard analysis and the URS Sea Level Rise and Adaptation Study completed for the Port of San Francisco (POSF). Both studies were undertaken for different purposes, using different methods and approaches. Most notably, the regional MIKE21 modeling effort used different analysis timeframes and different boundary condition data. Although tidal water levels are generally well understood in San Francisco Bay, the wave climate is not as well characterized due to a lack of available wave data for model calibration and validation; therefore it is reasonable to expect differences in wave modeling output, which will translate to differences in modeling results, particularly when extended to overland coastal hazard analyses. In addition, the overland coastal hazard analysis methods for both studies are different. The POSF Study does not adhere to FEMA Standards and Specifications, which is to be expected as the study was not completed for FEMA coastal analysis and mapping purposes. The San Francisco Bay Regional Modeling Study, which is the foundation of the FEMA study, underwent independent peer review by 2 separate firms and the USACE. The overland coastal hazard analysis also underwent FEMA's independent peer review process. FEMA has not completed a detailed peer review of the POSF Study; however a preliminary evaluation has determined that the study does not meet FEMA Standards and Specifications. For example the FEMA Standard specifies calculating the wave runup elevation as the value exceeded by 2 percent of the runup events. The POSF Study calculated the mean wave runup value. In addition, the POSF study did not evaluate wave overtopping or the 0.2% annual chance conditions. It should be noted that the FEMA coastal analysis for the City and County of San Francisco has been revised based on the documentation provided by POSF dated December 2007. This documentation provided coastal certification forms for several breakwaters, and the breakwaters were taken into account in the revised analysis. Please note that the certification documentation provided in the 2007 submittal is not complete. FEMA recommends that POSF update this documentation with more recent water level and wave information and review all forms for completeness before resubmitting.

2	#2: San Francisco Waterfront from Aquatic Park to Pier 54. COMMENT: URS prepared sea level rise/coastal inundation report in June 2011. As per URS analysis, most of the areas have wave heights less than 3 feet with few exceptions (From Pier 33 to Pier 23, Pier 26 through Pier 40, Pier 48 through Pier 54). So these areas should not be in VE zone.	See response to Comment 1
3	#3: San Francisco Waterfront from Aquatic Park to Pier 54. COMMENT: URS prepared sea level rise/coastal inundation report in June 2011. Flood Hazard Boundary ends around the edges of wharves and piers as shown in URS report with few exceptions (Pier 45 Valley area between sheds, Pier 29.5, Area near Pier 14, Mission Creek Area).	See response to Comment 1
4	#4: Entire Port of San Francisco Waterfront. COMMENT: Considering discrepancy between Port-sponsored URS study and FEMA-sponsored Baker AECOM study, there is a need to peer review assumptions/ criteria/ technical data used in Baker AECOM analysis.	See response to Comment 1
5	#5: Entire Port of San Francisco Waterfront. COMMENT: Refer to Port of San Francisco comments submitted to FEMA on December 14, 2007. Analysis and certifications included in this report show the following. (1) Port's piers/wharfs are structurally sufficient to withstand effects of wave action and most of the pier decks are above the expected wave heights; therefore, decks should be removed from SFHA and shown as Zone X. (2) Port's seawall sections are structurally sufficient and have adequate height above expected wave heights to provide protection against 1% annual chance flood; therefore, landside improvements should be removed from SFHA and shown as Zone X. (3) Breakwaters are structurally sufficient to provide protection to many areas of the Port waterfront by reducing the wave height. FEMA study ignored flood protection provided by the existing seawall, wharves and breakwater structures.	We appreciate receiving a copy of the materials provided to FEMA by POSF on December 14, 2007. However, the piers and wharves over open water cannot be mapped in Zone X. It should be noted that the FEMA analysis has been revised based on the documentation provided by POSF dated December 2007. This documentation provided coastal certification forms for several breakwaters, and the breakwaters were taken into account in the revised analysis. The preliminary FIRMs will include protected areas within the breakwaters, as shown on the attached Figure 1. Please note that the certification documentation provided in the 2007 submittal is not complete. FEMA recommends that POSF update this documentation with more recent water level and wave information and review all forms for completeness before resubmitting.
6	#6: San Francisco Waterfront from Aquatic Park to Pier 54. COMMENT: Seawall location is incorrectly assumed somewhere in the middle of Embarcadero Roadway. The actual location of seawall is on the sidewalk near Pier Entrances.	The location of the seawall has been revised based on the materials provided by POSF to FEMA dated December 14, 2007, as well as follow-up materials provided by POSF to assist in more accurately defining the seawall. This change is included in the revised floodplain mapping currently available in the FEMA GeoPlatform at the following link: http://arcg.is/1hYdVUJ

7	#7: Entire Port of San Francisco Waterfront. COMMENT: Shoreline displayed is horizontally offset by up to 40' from actual MHW line, and is not consistent with the Seawall. The landward horizontal distance of zone VE appears to be somewhat arbitrary, with no systematic connection to the existence of a seawall, the surface elevation, or wave dissipation by breakwaters, piers, or other structures.	The location of the seawall has been revised based on the materials provided by POSF to FEMA dated December 14, 2007, as well as follow-up materials provided by POSF to assist in more accurately defining the seawall. This change is included in the revised floodplain mapping currently available in the FEMA GeoPlatform at the following link: http://arcg.is/1hYdVUJ The landward distance of the VE zone can be set by two primary factors: a) the topographic contour associated with the VE Zone elevation, or b) the calculated overtopping distance.
8	#8: Entire Port of San Francisco Waterfront. COMMENT: URS prepared sea level rise/coastal inundation report in June 2011. BFEs from the Baker AECOM work do not correlate exactly with TWLs described in URS study; however, there does not appear to be a large systematic bias.	See response to Comment 1
9	#9: Entire Port of San Francisco Waterfront. COMMENT: URS prepared sea level rise/coastal inundation report in June 2011. A note about elevation sources - the elevation model used in the URS modeling was created from a 2007 LiDAR flight, where the Baker AECOM work (presumably) used a newer, more precise US Coast Survey Dataset.	The San Francisco Bay Area Coastal Study uses the 2010/2011 LiDAR collected by NOAA and the USGS as part of the California Coastal Mapping Program. BakerAECOM provided this data to Damon Burgett with the Port of San Francisco in December 2012.
10	#10: Fort Mason surrounding base flood elevations. COMMENT: The BFE west, north, and east of Fort Mason increases from 15 ft to 18 ft then reduces to 13 ft. Why is there drastic change in BFE at this location?	The BFEs change based on many factors, most notably the orientation of the transect relative to the prevailing wave climate and the structure type and shoreline slope. This area includes differences in these factors which result in variations in the calculated Total Water Level.
11	#11: General. COMMENT: What was the scale of the hydrologic/hydraulic modeling conducted and is it refinable to increase resolution near the shore lines?	No hydrologic/hydraulic modeling was completed for the San Francisco Bay Area Coastal Study. The foundation of the study is a MIKE21 regional hydrodynamic and wave model that is used to calculate tidal water levels, storm surge, and wave dynamics. This model was run for 31-years (1973 to 2004), and the full 31-year time series is output at over 8,000 points along the complex San Francisco Bay shoreline. The overland coastal hazard analysis uses this time series of regional model output as the boundary condition input data for the transect-based analysis. The transects are spaced in order to reasonably approximate the shoreline, considering variations in inland land use, shoreline orientation, shoreline type, shoreline slope, nearshore bathymetry, the wave climate, and other factors. This analysis cannot be readily refined to a more detailed scale without the addition of additional transects.

12	#12: General. COMMENT: Is there a technical report giving assumptions and calculation methods to estimate the BFEs?	Yes, two reports (the overland coastal hazard analysis technical report and the floodplain mapping technical report) and all underlying technical data were provided to CCSF for review during the Flood Risk Review and Comment Period in 2013. These reports and the underlying technical analyses have been updated in response to CCSF's comments. The updated reports and study documentation can be provided to CCSF again after the preliminary FIRMs are released. Please request this documentation directly from FEMA in writing (email is fine) after the preliminary FIRMs are released.
13	#13: General. COMMENT: What is the largest tidal level recorded and what return period does it represent? Do the generated results (elevations) trend with previously recorded extreme levels?	The largest tidal levels at the Presidio tide gage were recorded in January and December 1983. The results from the San Francisco Bay Regional Modeling Study trend well with previously recorded extreme water levels at the Presidio tide gage and other tide gage locations with San Francisco Bay. It should be noted that the San Francisco Bay Regional Modeling Study relied on the 31-year period from 1973 to 2004, and the model output matches well with the Presidio tide gage over this period. The modeling report from the San Francisco Bay Regional Modeling Study can be provided upon request. The 31-year period of record is considered to be representative of current coastal storm surge conditions. Since 1983, several extreme high water level events have occurred (typically during strong El Nino winters) that exceed the water levels recorded in the preceding 100 years (i.e., before 1983). The model was calibrated and validated to 13 coastal storm surge events that occurred during the 31-year simulation period.

14	#14: Treasure Island shoreline. COMMENT: The use of a 31-year dataset that contains a widely recognized ~100-year Return Period (RP) event (27-Jan-1983) and an extreme analysis using a Generalized Extreme Value Distribution (GEVD) with Maximum Likelihood (ML) fit results in a parent distribution that is inappropriate for extreme water levels in the bay. The 1% annual chance Still Water Levels (SWL) at Treasure Island derived from the GEVD distribution are over predicted by approximately 0.6 ft. In an analysis that utilized a 63-year long water level dataset, the 1% annual chance SWL was found to be 9.2 ft NAVD88. Mapping with this value would result in a BFE for the interior AE zones of 9 instead of 10, and the landward extents of the zone AE would be reduced.	The San Francisco Bay Area Coastal Study was initiated in 2003 under FEMA's Map Modernization Program. At this time, a panel of experts in statistical analysis and FEMA coastal hazard analysis was convened to review and inform the development of the San Francisco Bay Regional Modeling effort. Of primary interest was the ability of the model(s) to appropriately characterize the physical variability of tidal dynamics, ocean driven swell, and wind-driven waves along the complex San Francisco Bay shoreline. Also of importance was the ability to have sufficient data, for a sufficient time frame, with which to make statistical estimations of the 1% extreme values, such as the 1% SWEL and the 1% wave height. Although the San Francisco Presidio tide gage does indeed have a long historical record that goes back over a century, this record represents only one component of the overall complex problem. Additional data, such as long-term wind records and ocean wave conditions were required to force the regional-scale hydrodynamic model. Based on the availability of all data required for the modeling effort at the time, and the recommendations of the panel to have a minimum of 30-years of model output data for completing the generalized extreme value analysis, the regional model was run for 31-years, from 1973 to 2004 (the initial modeling effort was completed in 2005, therefore the model simulations used the full extent of the best available data at the time). The limiting factor proved to be the availability of hindcast data for ocean swell, which are important for the assessment of wave dynamics in the Central Bay and along the shorelines of Marin, San Francisco, Contra Costa and Alameda Counties. This study used all available GROW data offshore of the Golden Gate.

		The study team and FEMA recognize that statistical analyses are complex, and there are many methods (and nuances within methods) for determining extreme values. Although different methods may produce slightly different results – even given the same length of record or sample size – the primary goal is to choose one single method that will converge on reasonable results for all processes across the entire San Francisco Bay domain. This exercise resulted in the approach used by the study team. The study team also acknowledges that that the length of record (e.g., 31 years vs. 50 years vs. 100+ years) can also make a difference in determining the extreme values. This difference is based both on the sample size for the analysis, and also based on the nature of the events that were captured during the time period being evaluated. The 31-year period evaluated for the San Francisco Bay Area Coastal Study captured both periods of quiescence and periods with large storm events (both large swells and high winds). If a different 31-year period was selected, the resulting extreme values may differ – this is the nature of statistical analyses of complex natural physical processes. The long-term (i.e., 100+ year) record at the Presidio tide gage was reviewed in detail. After removing trends associated with sea level rise, an increasing trend in extreme water levels was still evident. Annual maximum tide levels are rising faster than sea level rise. The number of extreme tide events that occur each year that exceed 7 feet NAVD88 in elevation have more than doubled since 1980, and the largest extreme tides on record all occur after 1980. This analysis provides justification for FEMA's consideration of the most recent period (i.e., 1973 - 2004) when calculating the 1% annual chance stillwater elevations that best approximate *current* coastal flood risks. Although different statistical methods were evaluated at multiple points throughout the San Francisco Bay Area Coastal Study process, including undergoing independent peer review by several entities, in the end, it was agreed that the methods used by the study team are defensible and reasonable.
15	#15: Treasure Island shoreline - transects 48 and 49. COMMENT: Clipper Cove and the surrounding southeast- and east-facing shorelines experience very little wind wave action. A detailed Total Water Level (TWL) Analysis using 63 years of wave data only found TWL elevations of 10 ft NAVD88 for these reaches instead of the 11 and 12 ft elevations reported in the draft FEMA mapping.	Supporting data for this comment were not provided within the detailed responses to comments. Based on a review of the model output from FEMA's San Francisco Bay Regional Modeling Study, there was sufficient wave action to produce total water levels approximately 1 to 2 feet greater than the 1% stillwater level elevation.

16	#16: All transect locations. COMMENT: Review of the transect-based analysis to determine TWL would be aided by the inclusion of plots of the bathymetric/topographic profile used for each coastal transect as an appendix.	The analysis profiles were included as part of the full submittal that was provided to CCSF during the Flood Risk Review and Comment Period. The updated reports (revised in response to the comments submitted) can be provided to CCSF again after the release of the preliminary FIRMs and Flood Insurance Study Report.
17	#17: Hunters Point/Candlestick Point shoreline - transects 33-40. COMMENT: The use of a 31-year dataset that contains a widely recognized ~100-year Return Period (RP) event (27-Jan-1983) and an extreme analysis using a Generalized Extreme Value Distribution (GEVD) with Maximum Likelihood (ML) fit results in a parent distribution that is inappropriate for extreme water levels in the bay. The 1% annual chance Still Water Levels (SWL) at Hunters Point/Candlestick Point derived from the GEVD distribution are over predicted by approximately 0.5 ft. In an analysis that utilized a 63-year long water level dataset, the 1% annual chance SWL was found to be 9.5 ft NAVD88 instead of the 10.0-10.2 ft NAVD88 found in the FEMA study.	See response to Comment 14
18	#18: Hunters Point shoreline - transects 35 and 36. COMMENT: The Hunters Point shoreline between transects 35 and 36 varies significantly, with a complex configuration of drydocks, berths, and seawall piers. Despite this, the entire shoreline between these points has been given a BFE value of 15 that was calculated at the transects. Advanced wave modeling including reflection and defraction found 1% annual chance Total Water Levels (TWL) of between 10 and 14 feet along the shoreline between the transects. The shoreline surrounding Drydock 4 was found to have computed BFEs of less than 12. The flood hazard mapping seems to indicate that the two large pier structures extending out from the shoreline near the drydock entrance were treated as pile-supported in the FEMA analysis, when in fact they are solid and extend through the water column, partially-protecting the surrounding shorelines from wave exposure.	The two large piers were treated as pile supported in the draft coastal analysis and floodplain mapping. The results have been updated to consider these structures as supported on fill, and the hazard zones have been revised to Zone X where appropriate. It is understood that more detailed and highly-resolved modeling can produce different results. FEMA methods do not consider complex configurations of drydocks, berths and structures within the transect-based analysis. There will be a comment and appeal period after issuance of the preliminary FIRMs. If more advanced wave modeling and analysis has been completed in this area to support modifications to the 1% annual chance stillwater elevations or 1% annual chance total water levels, this can be provided to FEMA during the comment and appeal period for consideration before the effective FIRMs are published.
19	#19: All transect locations. COMMENT: Review of the transect-based analysis to determine TWL would be aided by the inclusion of plots of the bathymetric/topographic profile used for each coastal transect as an appendix.	See response to Comment 16

20	#20: Mission Bay South. COMMENT: There are areas in the Mission Bay South Project Area (generally south of Mission Creek and north of Mission Bay Boulevard South) designated Zone AE and Zone X (shaded). Developable areas within these zones will be raised to be outside the floodplain. Specifically, permanent improvements for all buildings must be at/above an elevation of 99 feet (Mission Bay Datum). Some grading activities have been completed and FEMA's mapping is out-of-date. In addition, other improvements are underway and a work necessary to remove SFHAs from developable parcels will be done by the time the FIRM is finalized. We request that the underlying data be updated to reflect grading work that has already been completed, and that we be allowed to provide updated information before the finalization of the FIRM to ensure that the final FIRM includes the most up-to-date topographic information.	The San Francisco Bay Area Coastal Study relied on the best available topographic data at the time the study was undertaken, the 2010/2011 LiDAR collected by the USGS and NOAA as part of the California Coastal Mapping Program. If grade improvements have been complete, survey data (collected by a licensed surveyor) can be provided to FEMA before the effective FIRMs are published. If grade improvements are complete, please submit the survey data for consideration -- this data can be submitted at any time after the preliminary FIRMS are released (scheduled for November 12, 2015) and before the appeal period ends (estimated to be May 2016, note that this date may change). Alternatively, if grade improvements are still in progress, updated survey data can be submitted to FEMA for a letter of map revision after the improvements area complete.
21	#21: San Francisco Waterfront from Aquatic Park to Pier 54. COMMENT: URS prepared sea level rise/coastal inundation report for the Port of San Francisco in June 2011. Proposed BFEs are inconsistent with this study.	See response to Comment 1
22	#22: All areas of the City proposed to be included in the FIRMs. COMMENT: Considering discrepancy between Port-sponsored URS study and FEMA-sponsored Baker AECOM study, there is a need to peer review assumptions/ criteria/ technical data used in Baker AECOM analysis.	See response to Comment 1
23	#23: All areas of the City subject to increased flood hazards due to sea-level rise. COMMENT: The FIRM would be more useful for both land use planning and environmental impact review purposes if it accounted for future sea-level rise.	Your comment is appreciated. FEMA encourages planning and development efforts that account for sea level rise and increasing storm surge activity that could occur above and beyond FEMA's mapped existing coastal hazard conditions. FEMA is currently undertaking a Sea Level Rise Pilot Study on the CCSF open Pacific Coast to evaluate how future sea level rise could be accounted for on FIRMs or on other non-regulatory products. CCSF has been an active stakeholder in this pilot study.
24	#24: General. COMMENT: Is there a way to include topography in the map or maps for ease of review? Will there be an accompanying planimetric layer or as a separate map?	Topography is generally not included on the draft work maps. However, the digital preliminary FIRM data can be downloaded from the FEMA Map Services Center once the preliminary FIRMs are released. CCSF can review the digital data alongside any aerial or topographic data sets available.

25	#25: Caltrain Corridor. COMMENT: In addition to highlighting the main features such as freeway, include also Caltrain track corridor as it is a major transportation landmark for Caltrain review, and for others as a general reference.	The FIRM panel will include TIGER/Line data (Topologically Integrated Geographic Encoding and Referencing system) from the U.S. Census Bureau. TIGER/Line data include a wide collection of geographic feature types, such as roads, and railroads.
26	#26: Caltrain Corridor. COMMENT: On Caltrain corridor footprint, is it possible to show tracks and stations (platforms and buildings)?	The FIRM panel will include TIGER/Line data (Topologically Integrated Geographic Encoding and Referencing system) from the U.S. Census Bureau. TIGER/Line data include a wide collection of geographic feature types, such as roads, and railroads.
27	#27: Caltrain Corridor. COMMENT: Within San Francisco, a good segment of the Caltrain corridor cannot be shown because it is under Interstate 280 and in tunnels. How will this be addressed on the map?	The FIRM panels will include TIGER/Line data (Topologically Integrated Geographic Encoding and Referencing system) from the U.S. Census Bureau. TIGER/Line data include a wide collection of geographic feature types, such as roads, and railroads. Underground railways may not be depicted on the FIRMs. The FEMA coastal analysis does not consider flood hazards associated with these subterranean assets and features.
28	#28: Caltrain Corridor. COMMENT: On Caltrain footprint, will the map show features such as walls between the 280 ramp and the Caltrain station/rail yard in the China Basin area?	The FIRM panels will include aerial imagery as a base, but this level of feature will not likely be visible at the map scale of the panels.
29	#29: SFO. COMMENT: The use of a 31-\year dataset that contains a widely recognized ~100-year Return Period (RP) event (27-Jan-1983) and an extreme analysis using a Generalized Extreme Value Distribution (GEVD) with Maximum Likelihood (ML) fit results in a parent distribution that is inappropriate for extreme water levels in the bay. The 1% annual chance Still Water Levels (SWL) at SFO derived from the GEVD distribution are over predicted by approximately 0.5 ft. The Base Flood Elevations (BFE) derived from this quantity are most relevant for the AE zone covering the airport interior, where the BFE should be 10 instead of 11.	See response to Comment 14. Please also note that the mapping in the vicinity of the San Francisco International Airport (SFO) was revised using the model output from the FEMA South Bay Regional Modeling Study, which included a 54-year hindcast simulation. A longer simulation period was possible since the GROW data (necessary for modeling the longer-period waves entering through the Golden Gate) is not an important consideration in South Bay hydrodynamics. The use of the South Bay model output will result in a BFE of 10 for the SFO area. Using the North/Central Bay data, this area resulted in a 1% SWEL of 10.5, which rounded to 11. Using the South Bay model output results in a 1% SWEL of 10.4, which rounds down to 10. The SFO area is in the transition zone between the two modeling studies, and the South Bay model output was not available when the initial analysis for CCSF was completed.

30	#30: SFO. COMMENT: FEMA's Total Water Level (TWL) results at points around the SFO shoreline have for the most part been confirmed by Moffat & Nichol's independent analysis; however, the VE zone along the southern shoreline (Mudflat Reach, transect 61) with a BFE of 14 is based on an over prediction of wave runup. The Van der Meer equations that form the basis for wave runup calculations according to FEMA guidance have since been updated to include reductions in wave runup due to grass and vegetation-covered slopes. The transect used to represent this section is densely-vegetated with low and high marsh plants, so should experience reduced runup heights due to the additional roughness. Our calculations give a BFE of 12 for this reach.	FEMA re-evaluated this transect during the analysis and floodplain mapping revisions, but the BFE remained at 14 using the available bathymetry and topography. In a follow-up meeting, Moffat & Nichol noted they had obtained bathymetry in this area that can be used to support the reduced BFE. This updated data was provided to FEMA by SFO after the August 25, 2015 meeting with CCSF. The BFE at transect 61 has been revised to Zone VE 12 (from Zone VE 14), as shown in the attached Figure 2.
31	#31: SFO. COMMENT: BFEs for coastal areas of unincorporated San Mateo County and the City of Millbrae directly adjacent to the SFO shoreline are given as 10 on the effective San Mateo County FIRM. The BFE of 11 given in the draft San Francisco FIRM is inconsistent with the BFEs in directly adjacent areas.	The effective mapping shown for the San Mateo County FIRM was not based on the new San Francisco Bay Area Coastal Study results. This effective mapping for San Mateo County was based on the previous analysis completed in the 1980s. The San Mateo County coastal analysis associated with FEMA's San Francisco Bay Area Coastal Study was in progress at the time of the CCSF Flood Risk Review and Comment Period. However, the BFEs in the vicinity of SFO have been revised as noted in response to Comment 29. The San Mateo County preliminary FIRMs were released on August 13, 2015, and the BFEs in the vicinity of SFO are consistent with the adjacent BFEs in San Mateo County.
32	#32: Terminal area. COMMENT: Based on LiDAR data and as-builts, ground elevations around Terminals 2 and 3 and Boarding Areas C, D and E are higher than 10.5. These areas should be shown as Zone X.	The study relies on the USGS and NOAA LiDAR collected in 2010/2011. FEMA provided the LiDAR data used in the San Francisco Bay Area Coastal Study to SFO for their use in 2012. If discrepancies have been found in this LiDAR data, please supply FEMA with a copy of recent survey data (collected by a licensed surveyor) for review. As a part of the bare-earth processing of the LiDAR, data from immediately surrounding the buildings is sparse. As a result, it could not be concluded that the entirety of the area should be mapped as Zone X; therefore they are included in the floodplain. If additional data is available to fill in the elevation data immediately surrounding the buildings, it may be used to further refine the floodplain mapping. This survey data can be submitted at any time after the preliminary FIRMS are released (scheduled for November 12, 2015) and before the appeal period ends (estimated to be May 2016, note that this date may change).
33	#33: All transect locations. COMMENT: Review of the transect-based analysis to determine TWL would be aided by the inclusion of plots of the bathymetric/topographic profile used as well as resulted water levels for each coastal transect as an appendix.	See response to Comment 16

34	#34: Transect 62. COMMENT: Transect 62: TWL is less than SWEL. Is this possible?	This is the result of the statistical analysis and the differences in the distribution curves. While we agree that at face value it does not seem to make physical sense, it does make statistical sense and is not considered an error. This issue occurs where waves are small and are not likely to represent the maximize coastal hazard. In these instances the 1% annual change stillwater elevation is used to appropriately identify the flood hazard. This is discussed in the report documenting the overland coastal hazard analysis.

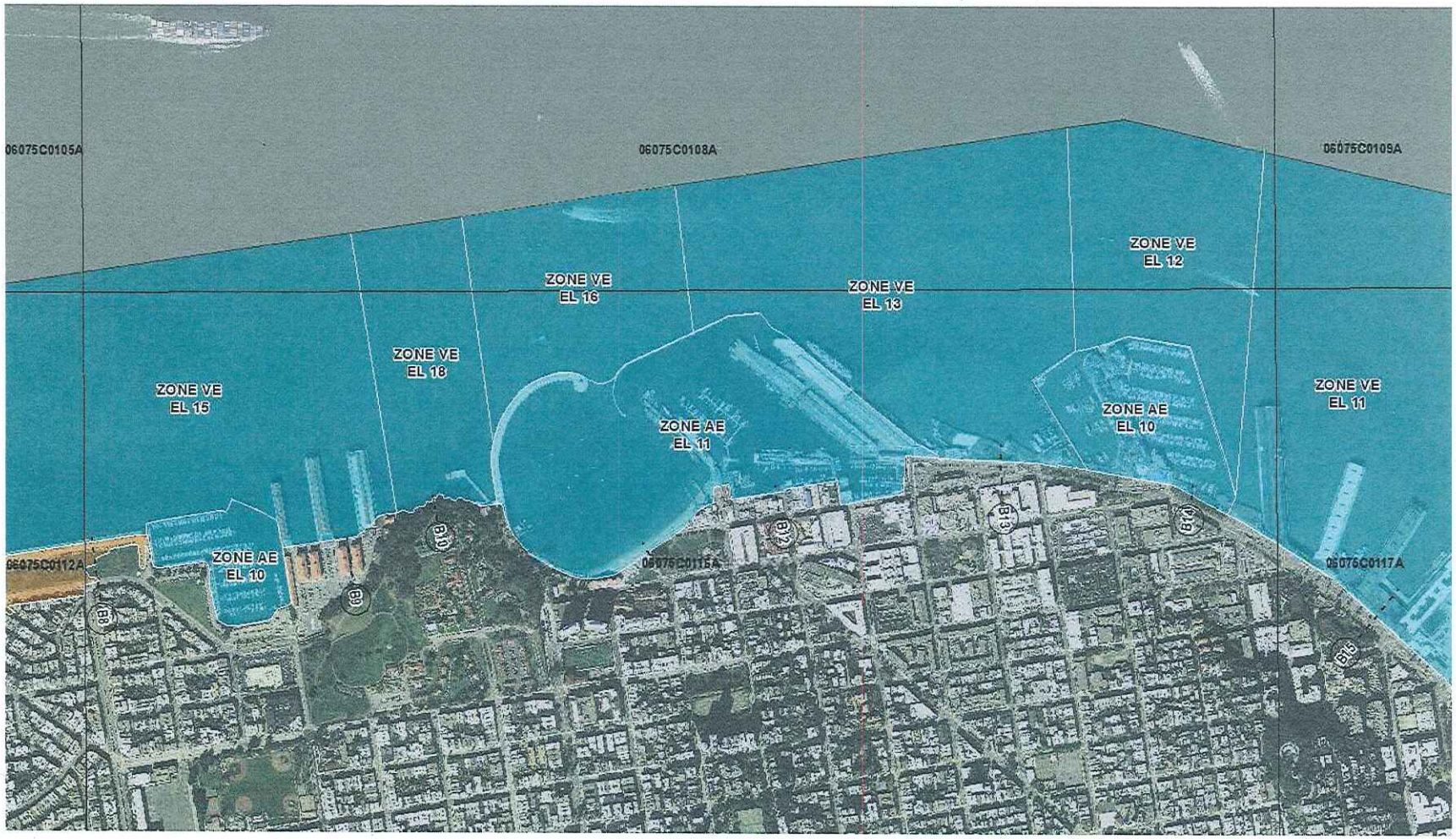

Figure 1. Revised floodplain mapping along the Port of San Francisco shoreline

Figure 1 highlights areas behind breakwaters now mapped as Zone AE (previously Zone VE). Please note this mapping has not been updated on the FEMA GeoPlatform, but the mapping shown in Figure 1 will be included within the preliminary Flood Insurance Rate Maps (Panel 0116A).

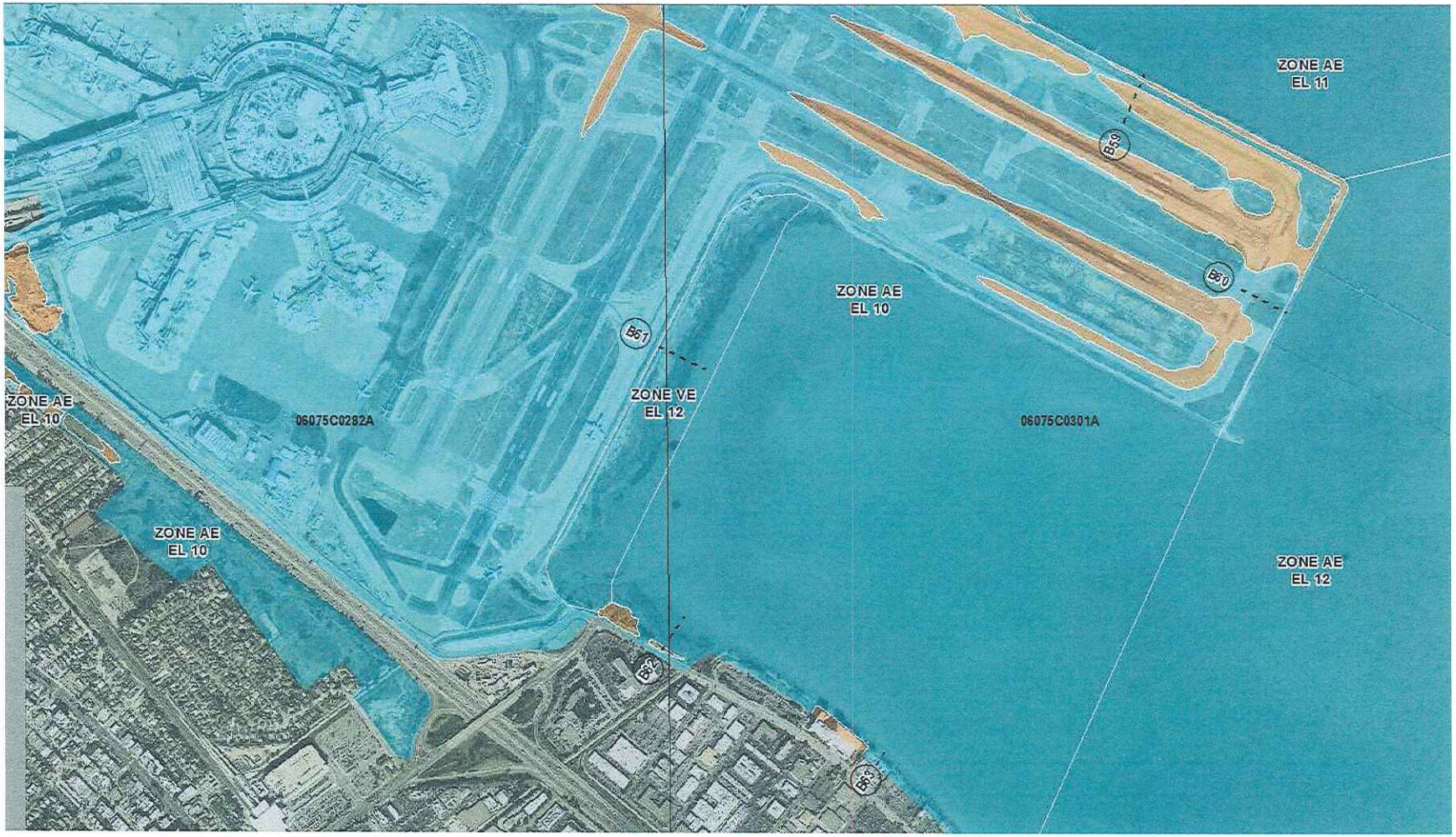

Figure 2. Revised floodplain mapping for the San Francisco International Airport (SFO)

Figure 2 highlights the change in VE Zone designation (from Zone VE 14 to Zone VE 12) along the shoreline at Transect B61, based on revised topography data supplied by SFO for this area. Please note this mapping has not been updated on the FEMA GeoPlatform, but the mapping shown in Figure 3 will be included within the preliminary Flood Insurance Rate Maps (Panels 0282A and 0301A)