**CITY OF NEWPORT BEACH**
100 Civic Center Drive
Newport Beach, California 92660
949 644-3001 | 949 644-3020 FAX
newportbeachca.gov

April 12, 2017

Mr. Rick Sacbibit
Chief Engineering Services Branch
Federal Insurance and Mitigation Administration FEMA
400 C Street SW
Washington, DC 20472

Re: Request for Revision of the Preliminary FIRM and BFE
Docket No. FEMA-B-1673

Dear Mr. Sacbibit:

Upon reviewing the Preliminary Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) for the City of Newport Beach, we submitted a comment letter to Mr. Edward Curtis on November 22, 2016. In the letter, we identified our major issues and concerns with the data and methods used to establish the Base Flood Elevations (BFEs) and corresponding flood zones. In addition, we stated in the comment letter that the City will provide more accurate determination of the BFEs and flood zone boundaries for the City of Newport Beach by conducting hydrodynamic modeling incorporating survey data of the seawalls that were not used in the FIS.

We have completed our analysis to address the previously raised concerns regarding the technical study supporting the Preliminary FIRMs for the City of Newport Beach. Based on our analysis and findings, we request that the Preliminary FIRMs and BFEs for the City of Newport Beach be revised. The requested revisions, supporting data, and analyses are provided in detail below.

## NEWPORT BAY AND HARBOR (AE ZONE)

For the AE Zone, we request only revision to the flood boundaries, and not the BFEs. We agree with the data and methodology being used in the FIS to establish the BFEs for the AE Zone (as applied to the Newport Bay and Harbor). However, as we pointed out in our previous comment letter, we have two major disagreements with the mapping of the flood boundary. These disagreements are:

(1) The topographic data used in mapping the flood zone did not incorporate the seawall elevations of Newport Bay, especially those along Newport Peninsula and the Balboa Islands.

(2) The use of the “bathtub” model to map the flood extent. Following the FEMA guidelines (FEMA 2009), we provide the following data and new analysis based on a more scientific and accurate method, to support our request for revision to the flood boundaries shown in the Preliminary FIRM for the AE Zone within the City of Newport Beach.

***Additional Data - Surveyed Seawall Data***

Within the Newport Bay and Harbor, most of the bayside shorelines along the Newport Peninsula and the entire Balboa Islands are protected from flooding by seawalls. Figure 1 shows the locations where seawall survey data was available and should be considered in the mapping of the flood boundaries. As shown in the figure, seawall elevation data for the Balboa Islands was collected by a Licensed Civil Engineer in 2010 and the data along the bayside shorelines was conducted by a licensed surveyor in 2017. This data is provided in the DVDs that accompanied this letter, under the folder titled “Seawall Data.”

These survey data were used to define seawall elevations in the two-dimensional (2D) hydrodynamic model of the Newport Bay and Harbor described below.

***More Accurate Method for Mapping – 2D Hydrodynamic Modeling***

As pointed out in our previous comment letter, researchers at the University of California, Irvine (UCI) have been studying urban coastal flooding for over ten years. In one of their studies, they compare the bathtub approach with the use of a 2D hydrodynamic model for flood mapping, using the City of Newport Beach as a test case (Gallien et al. 2011, attached). The study compared the results of these two methods with the observed flood extent caused by an extreme high tide (7.72 ft, NAVD) on January 10, 2005. Additionally, the study examined survey accuracies of seawall elevations in flood mapping. Their major findings are:

(1) the bathtub approach over-predicted the flood extents in Newport Bay, and

(2) it is important to include accurate survey data of the seawall elevations in urban flood mapping.

<u>We believe that the use of 2D hydrodynamic modeling is critical for providing accurate flood mapping for the AE Zone of Newport Bay and Harbor.</u> Hence, we used the FEMA-approved HEC-RAS model (version 5.0) to conduct flood modeling of the Newport Bay and Harbor. HEC-RAS version 5.0 includes 2D flood routing capabilities and allows a time-varying stage hydrograph, which is used to simulate tidal forcing at the ocean boundary. Figure 2a shows the HEC-RAS model domain for the Newport Bay and Harbor. In setting up the model, we started with the Newport Beach topographic data used in the Open Pacific Coast (OPC) Study provided by Ms. Karin Ohman, and added the seawall elevation survey data to the model. As an example of the model grid setup with the seawall data, Figure 2b shows a zoomed view of the computational mesh and the modeled seawall surrounding the corners of Balboa Island and Little Balboa Island.

To map the AE Zone in Newport Bay, a 6-hour simulation was conducted using a 6-hour tide (shown in Figure 3), specified as a time-varying stage hydrograph at the ocean boundary of the model domain. As shown in Figure 3, the tide has a peak at 7.88 ft, NAVD, which is consistent with the 1% still water elevation (SWEL) determined for Newport Bay in the OPC study (IDS#4, Table A-2). The boundary of the AE Zone was defined as the extent of flooding predicted by the HEC-RAS model. In Figure 4, we compared the flood zone areas of the AE Zone that were predicted by the HEC-RAS model and the preliminary FIRM. In the figure, the top panel (Figure 4a) shows the AE Zone that was mapped in the OPC study using the bathtub approach, while the bottom panel (Figure 4b) shows the AE Zone mapped using the HEC-RAS model. As can be seen in the figure, the bathtub approach to mapping predicts a larger flooding extent compared with an approach using the HEC-RAS model. This finding is consistent with the findings in Gallien et al. (2011). Since the bathtub approach over predicts inundated areas, we request that the Preliminary FIRM for the AE Zone be revised based on the more accurate 2D model results which have also incorporated the seawall elevations along the shoreline.

The HEC-RAS model files are provided in the attached DVDs in the folder “HEC-RAS Model for Newport Bay.”

**NEWPORT COAST (VE ZONE)**

For the VE Zone that applies along the open coastline of the City of Newport Beach, we request revisions for both the BFEs and flood zone boundaries. We agree with the methodology used for this zone, but disagree with the select use of a few non-representative beach transects to calculate the BFEs, and propose an improved approach that uses existing beach slope data to calculate the BFEs. In addition, the City has a program to construct beach berms prior to high wave events to protect the structures and public facilities from flooding; hence, the beach berm program should be considered in the selection of the backshore features, which are critical in the evaluation of the flood extent due to wave overtopping.

***Base Flood Elevations (BFEs) for VE Zone***

The BFEs along the open coast were defined by the 1% annual exceedance probability wave runup elevations, which were referred to as total water levels (TWLs) in the OPC Study. The 1% TWLs were determined by conducting wave runup analysis at representative transects of the foreshore beach slope and shoreline orientation for distinct shoreline reaches. The 1% TWLs calculated at each representative transect are rounded to the nearest whole foot to define the BFE for the respective shoreline reach. Figure 5 shows the transect locations along the shoreline that were used for wave runup analysis in the Newport Beach area. The figure also shows the BFE Zones and the VE extents for each of the shoreline reaches calculated based on the slopes of the corresponding transects.

As shown in Figure 5, the OPC study used only a few beach transects to represent the entire Newport Beach Coast; this means that a single beach slope taken at each transect is being used to define an extended shoreline reach. We understand that for mapping purpose it is reasonable to represent the shoreline with limited number of BFE Zones. However, since there is significant variability in foreshore beach slope within shoreline reaches, it is more realistic and reasonable to use the average beach slope—instead of using only a single beach slope where the transect happens to be located—along each reach to calculate the corresponding BFE for that shoreline reach.

Figure 6 shows the foreshore beach slope of OPC transects 16 to 24 as compared with beach slopes determined at 200 ft (61 m) spacing. Also shown in Figure 6 are the average beach slopes within each shoreline reach, which were calculated using the transects taken at 200 ft (61 m) intervals. The boundaries of shoreline reaches, which define changes in BFEs, are shown in Figure 6 as *black* dashed lines. The OPC foreshore beach slopes of transects 16, 17, 18, 20, 23, and 24 are generally larger than the average foreshore slopes in their respective reaches. Since the BFEs are assigned to an entire shoreline reach, and there is significant variability in transect slopes within reaches, the open coast BFEs in the Newport Beach area should be determined using the average transect slope within each shoreline reach.

Figure 7 compares BFEs calculated based on the average reach slopes using the methods detailed in the OPC Study, with the BFEs reported in the OPC Study calculated using a single beach slope taken at a transect. As shown in the figure and in Table 1, using the average reach slope in the BFE calculations results in lower BFEs for shoreline reaches at transects 16, 17, 18, and 23/24. For reach 22, use of the average slope resulted in a higher BFE. We request that the open coast BFEs be revised to reflect the values determined using average reach slopes, which are presented in Table 1 below.

**Table 1.**

**Open coast BFEs for the Newport Beach area from the OPC Study and the revised BFEs calculated based on the average slope in each shoreline reach.**

| TRANSECT/ REACH | BFE (FT, NAVD88) | |
|---|---|---|
| | OPC STUDY | REVISED[1] |
| 16 | 15 | 14 |
| 17 | 17 | 15 |
| 18 | 14 | 13 |
| 19 | 12 | 12 |
| 20 | 20 | 18 |
| 21 | 21 | 21 |
| 22 | 17 | 18 |
| 23/24 | 20 | 18 |

1. Calculated based on average beach slope

***Flood Zone Delineation for VE Zone***

In the OPC study, 1% TWLs were also used to determine the inland extent of the VE Zone. At the majority of the transects, the 1% TWLs overtopped the foreshore beach crest and inundated the foreshore. In these situations, backshore overtopping analysis was conducted by projecting the 1% TWL across the entire width of the beach to a "backshore feature." In the OPC documentation, a "backshore feature" was loosely defined as a backshore crest or beach transition point. Overtopping extent was then calculated at the selected backshore feature, using the 1% TWL calculated at the foreshore. The VE Zone was mapped to the inland limit of the calculated overtopping extent caused by the 1% TWL overtopping of the backshore feature.

Since the VE Zones are mapped based on the overtopping extent from a selected backshore feature, the inland extents of VE Zones are very sensitive to the location of the backshore feature selected for overtopping analysis. In the Newport Beach area (transects 16 to 24), the semi-formal seawalls of private residences were the most commonly selected backshore features (IDS3, Table 12). However, the private seawalls in Newport Beach are no longer the most distinct backshore crests because the City of Newport Beach has adopted a beach berming program as part of their Storm Action Plan (City of Newport Beach, 2015, attached). As described on Page 6 of the Storm Action Plan, the City implements a beach berming program prior to large, forecasted wave events. Newport Beach staff constructs sand berms along the Newport Peninsula as needed to protect the area from high surf, while paying particular attention to protect private property. Staff will also build berms to protect facilities such as parking lots and the lifeguard headquarters facility. Figure 8 shows examples of beach berms constructed at various locations throughout Newport Beach. In a study to evaluate properties of the beach berms used for flood prevention on Southern California beaches, Gallien (2015) documented the typical dimensions of the beach berm at Balboa Beach near Zone 21. Based on Gallien, the beach berm has a crest at approximately 16 ft (5 m), NAVD, and a foreshore slope of approximately 10%.

Due to the nature of these berms, it is unlikely for such features to appear in elevation data sets. However, because they are constructed in advance of large ocean swells, the constructed berms represent a definable backshore crest in the beach profile and are more appropriate features to use for overtopping analysis than the semi-formal seawalls of private homes. The aerial photo (Figure 8a) illustrates the typical location of beach berms along the beach profile. Gallien et al. (2015) have reported the geometry and characteristics of these beach berms in the Newport Beach area.

In addition to the revised TWLs from the preceding section, the beach berms constructed with the purpose to prevent flooding of the houses should be used to define the backshore features in the backshore analysis. To incorporate the City's existing beach berming program in the backshore analysis, aerial photographs of historical berms were used to estimate the likely locations of the constructed beach berms along the beach profiles. The approximate locations of the historical beach berms were used to define the location of backshore features in the overtopping analysis. For consistency with the OPC Study's methodology, we assumed that these berms failed from overtopping caused by the 1% TWL. We then used the Cox-Machemehl (1986) method (C-M method) to determine the inland extent of overtopping flow from the location of the failed beach berms. The inland extent of overtopping, determined using the C-M method, defined the landward extent of the VE Zones in our analysis. This approach is completely consistent with the OPC Study's methodology; the only difference is that we used the approximate locations of the constructed beach berms to define the backshore feature.

The following sections describe on a zone-by-zone basis how the revised 1% TWLs and inclusion of the berms in the backshore analysis affect the VE Zone Extent.

Zone 16

In Zone 16, the preliminary 1% TWL overtops the foreshore beach crest and backshore beach profile. The VE Zone extent was therefore, based on backshore overtopping analysis in the OPC Study. However, the revised 1% TWL in Zone 16 is not high enough to overtop the backshore dune. Since the revised 1% TWL does not overtop the dune, the revised VE Zone extent is defined as the intersection of the beach dune and 1% TWL. This is consistent with the OPC Study's methodology, where in cases when a backshore feature is high enough not to be overtopped, "the TWL is projected to the base of that feature." Thus, in the revised Zone 16, backshore-overtopping analysis was not conducted. Figure 9 shows the revised versus preliminary VE Zone extents. The change in VE zone extent is based solely on the revised 1% TWL, which reflects the average foreshore beach slope of shoreline reach 16.

Zone 17

In Zone 17, both the revised and preliminary 1% TWLs overtop the foreshore beach crest and any backshore features. However, in the OPC Study, beach berms were not considered in the transect profile, so the semi-formal seawall adjacent to private properties was selected as a backshore feature. In the revised analysis, the approximate location of beach berms was used to define the location of the backshore feature. The location of beach berms was approximated from Figure 8a, which demonstrates the location of berms built in this region of Newport Beach. The absolute elevation of the berm crest was not required, because we assumed that the berm fails during the 1% event and overtopping analysis is conducted using the bare earth elevation. Thus, in Zone 17, the revised VE Zone extent is based on selecting a different backshore feature for overtopping analysis. Figure 10 shows the revised versus preliminary VE Zone extents.

Zone 18

In Zone 18 of the OPC Study, both the preliminary and revised 1% TWLs overtop the foreshore and backshore features. In this study, however, we used two backshore features for Zone 18 - the beach berm from the BFE Zone boundary to 24th Street, and the seawall protecting the West Ocean Front parking lot from 24th Street to the Newport Beach pier. The location of the beach berms was again estimated from Figure 8a. Though the seawall protecting the West Ocean Front parking lot is an observable crest in the OPC Study topographic data, the private seawall was selected as the backshore feature for all of Zone 18 in the OPC Study. The revised VE Zone extent shown in Figure 11 is different from the preliminary VE Zone extent due to the difference in backshore feature locations.

Zone 19

In Zone 19, our revised 1% TWL is not significantly different from that used in the OPC Study, and the BFEs are the same when rounded to the nearest whole foot (Table 1). At transect 19, overtopping of the foreshore crest is not predicted using the preliminary or revised 1% TWL, so backshore analysis is not applicable. We are not requesting revisions to the VE Zone extent in Zone 19.

Zone 20

In Zone 20, both the revised and preliminary 1% TWL overtop the foreshore and any backshore features in the beach profile of transect 20. In the OPC Study, the backshore features appear to be the private seawall between sand dunes, and the base of the sand dunes elsewhere within the shoreline reach. In our study, we used Figure 8a to estimate the location of beach berms in Zone 20. The beach berms were again selected as the backshore feature in Zone 20. Figure 12 shows the revised versus preliminary VE Zone extent for Zone 20.

Zone 21

The OPC Study documentation lists a parking lot as the backshore feature in Zone 21 (Table 12, IDS Report 3). However, it is clear that the backshore feature used for overtopping analysis in the OPC Study is actually a berm *adjacent* to the parking lot. Indeed, in shoreline reach 21, the OPC Study topographic data includes one of Newport Beach's berms. Since overtopping analysis appears to be conducted from the base of this beach berm, and our revised 1% TWL results in the same BFE when rounded to the nearest whole foot (Table 1), we are not requesting revisions to the VE Zone extent in Zone 21.

Zone 22

In Zone 22, our calculated 1% TWL is higher than the 1% TWL determined from the OPC Study. In this case, our 1% TWL causes overtopping of the foreshore crest and any apparent backshore features. Therefore, in Zone 22, we conducted backshore-overtopping analysis, which did not appear to be conducted in the OPC study. Again, we used the approximate location of beach berms to define the backshore feature location. Figure 13 shows the revised versus preliminary VE Zone extent, with the revised results of this study extending slightly further inland compared with the OPC Study results.

Zone 23/24

In Zone 23/24, which includes two different transects, both the preliminary and revised 1% TWL overtop the foreshore beach crest and backshore features. In the OPC Study, a backshore dune was selected as the backshore feature for transect 23, while a private seawall was selected as the backshore feature for transect 24. We used the approximate location of beach berms to define the location of the backshore feature for both transects 23 and 24. In this study, the overtopping extent from the approximate location of the beach berms was calculated using runup parameters from both transects 23 and 24. The average overtopping extent of transects 23 and 24 was used to define the VE Zone Extent for Zone 23/24. The revised versus compared VE Zone extent is shown in Figure 14.

Table 2 compares the data used in the OPC Study for backshore overtopping analysis with the data used in our study. In summary, we request that the revised BFE's and VE Zones be incorporated in the FIRMs so that 1) the existing beach berm program is accounted for in the flood zone delineation, and 2) the variability in foreshore beach slope is more rigorously accounted for.

**CLOSURE**

Thank you for providing the opportunity for the City of Newport Beach to review the draft proposed Flood Insurance Rate Maps (FIRMs) and accompanied technical studies for Orange County. We would also want to thank Ms. Karin Ohman who has been very helpful to provide us the data used for the City of Newport Beach in the studies. Upon review of the BFEs and preliminary FIRM, and after conducting our own technical analyses using additional data, we request the following revisions of the BFEs and FIRMs to be made:

1. Revise the FIRM for the AE Zone to the proposed revised flood map shown in Figure 4b, which was developed based on more accurate 2D hydrodynamic modeling.
2. For the VE Zone, revise the BFEs to those shown Table 1. The proposed revised BFEs were developed based on more accurate use of the available beach slope data. In addition, revise the preliminary FIRM for Zone 16, 17, 18, 20, 22 and 23/24 to the proposed revised VE Zone extents shown in Figures 9 to 14.

Please refer any questions or correspondence to Seimone Jurjis, Assistant Community Development Director, or Samir Ghosn, Principal Civil Engineer, at (949) 644-3200.

Sincerely,

Dave Kiff
City Manager

c: Mr. Edward Curtis, PE, CFM, FEMA-Risk Analysis Branch
Kim Brandt, AICP, Community Development Director
Seimone Jurjis, PE, CBO, Assistant Community Development Director
Samir Ghosn, PE, Principal Civil Engineer
Ying Poon, Everest International Consultants, Inc.

Attachments

## REFERENCES

City of Newport Beach, 2015. Storm Action Plan. Municipal Operations Department, Nov. 16, 2015. Cox, J.C. and J. Machemehl, 1986. Overland Bore Propagation due to an Overtopping Wave. Journal of Waterway, Port, Coastal and Ocean Engineering. Vol. 112, pp. 161-163.

FEMA, 2009. Appeals, Revisions, and Amendments to National Flood Insurance Program Maps – A Guide for Community Officials. December 2009.

Gallien T.W., J. E. Schubert, and B. F. Sanders, 2011. Predicting tidal flooding or urbanized embayments: a modeling framework and data requirements. Coastal Engineering 58 (2011), 567-577.

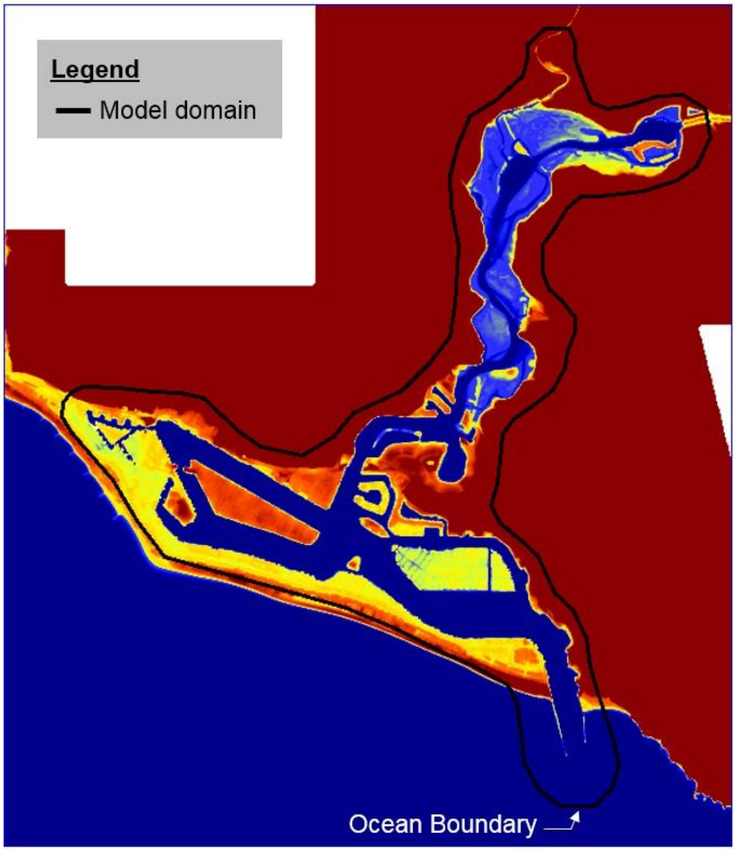
Gallien T.W., W.C. O'Reilly, R.E. Flick, R.T. Guza, 2015. Geometric properties of anthropogenic flood control berms on southern California beaches. Ocean and Coastal Management 105 (2015) 35-47.

**Table 2.**

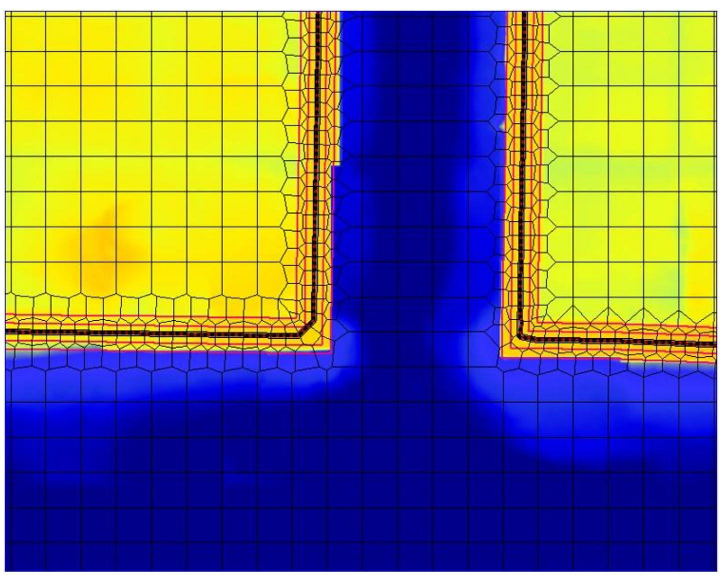
**Backshore analysis parameters used in the OPC Study compared to proposed parameters used in this Study. Requested changes given at the last row of the table**

| Transect/ Reach | 1% TWL | Backshore Feature | Backshore Crest Elevation | Runup Exceedance | Bore Propagation (ft, VE zone limit) |
|---|---|---|---|---|---|
| **OPC Study Backshore Overtopping Parameters** | | | | | |
| 16 | 14.50 | Seawall (removed) | 14.03 | 0.48 | 9.32 |
| 17 | 16.50 | Seawall (removed) | 14.70 | 1.85 | 18.47 |
| 18 | 13.50 | Seawall (removed) | 11.15 | 2.37 | 20.64 |
| 20 | 20.20 | Seawall (removed) | 11.87 | 8.32 | 42.14 |
| 22 | 17.00 | Beach-Structure Transition | 13.13 | 3.89 | 27.66 |
| 23 | 19.50 | Backshore Dune | 16.60 | 2.88 | 25.09 |
| 24 | 20.00 | Seawall (removed) | 16.87 | 3.14 | 24.10 |
| **Revised Backshore Overtopping Parameters** | | | | | |
| 16 | 13.60 | Backshore Dune | 14.34 | -0.74 | N/A |
| 17 | 14.70 | Temporary Berm (removed) | 14.16 | 0.54 | 9.59 |
| 18 | 12.80 | Temporary Berm/ Seawall (removed) | 11.35 | 1.45 | 15.42 |
| 20 | 17.70 | Temporary Berm (removed) | 9.94 | 7.76 | 38.14 |
| 22 | 18.40 | Temporary Berm (removed) | 14.92 | 3.48 | 24.86 |
| 23 | 18.40 | Temporary Berm (removed) | 16.90 | 1.40 | 16.66 |
| 24 | 18.30 | Temporary Berm (removed) | 17.36 | 0.94 | 12.67 |
| **Requested Changes** | Calculate 1% TWL using average foreshore beach slope in respective shoreline reaches. | Use the location of temporary beach berms as backshore features for consistency with Newport Beach's berming program. | N/A | N/A | N/A |


**Figure 1. Sea Wall Survey Locations**




**(a) HEC-RAS Model Domain**



**(b) Zoomed view of the computational mesh near the Balboa Island sea wall**

**Figure 2. HEC-RAS Model Setup**

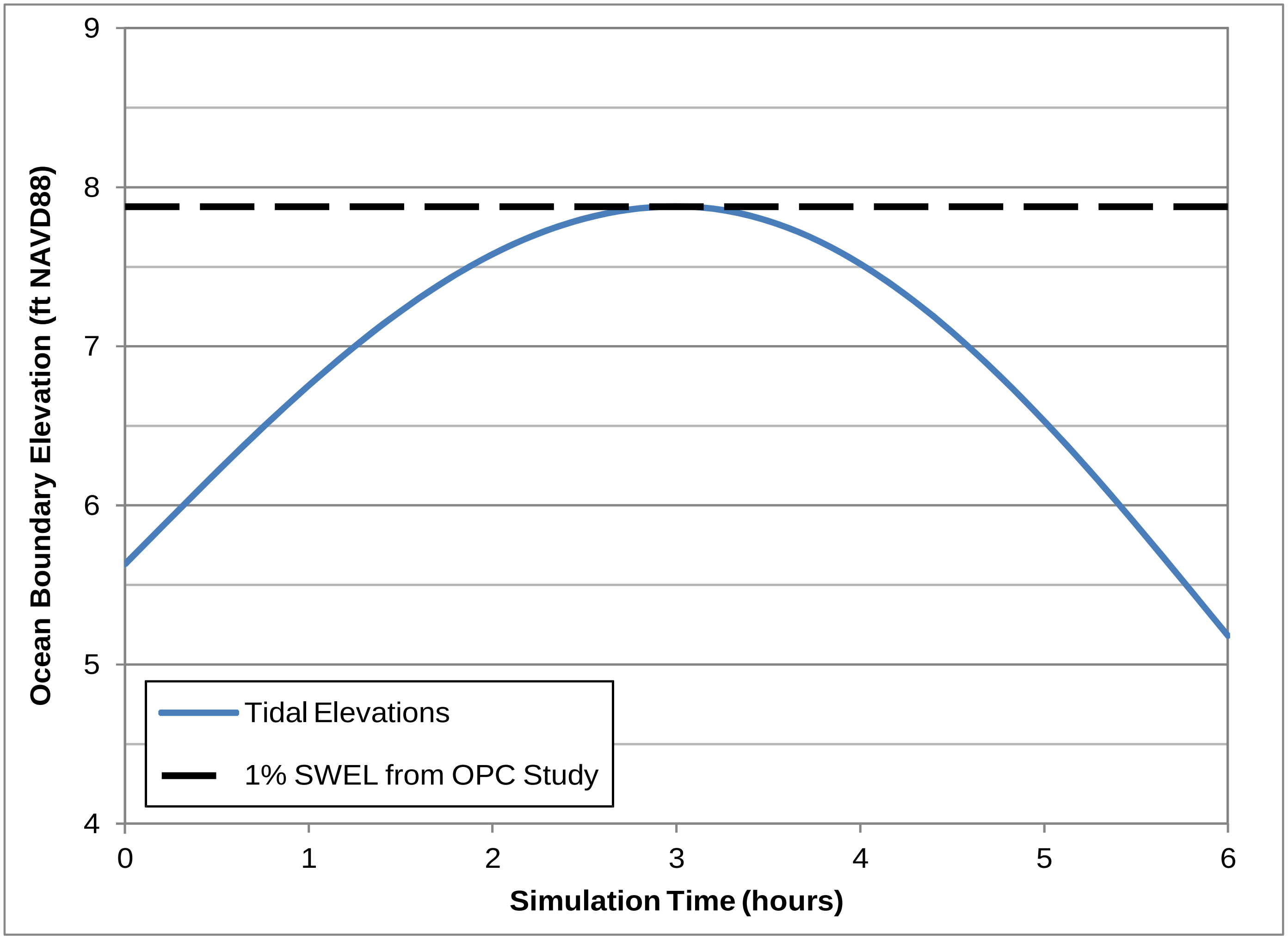



**Figure 3. Tides Applied at the Ocean Boundary of HEC-RAS Model**


**(a) Preliminary FIRM AE Zone**

**(b) Proposed revised flood zone**

**Figure 4. Comparison of Preliminary FIRM AE Zone with the Proposed Revised Flood Zone**

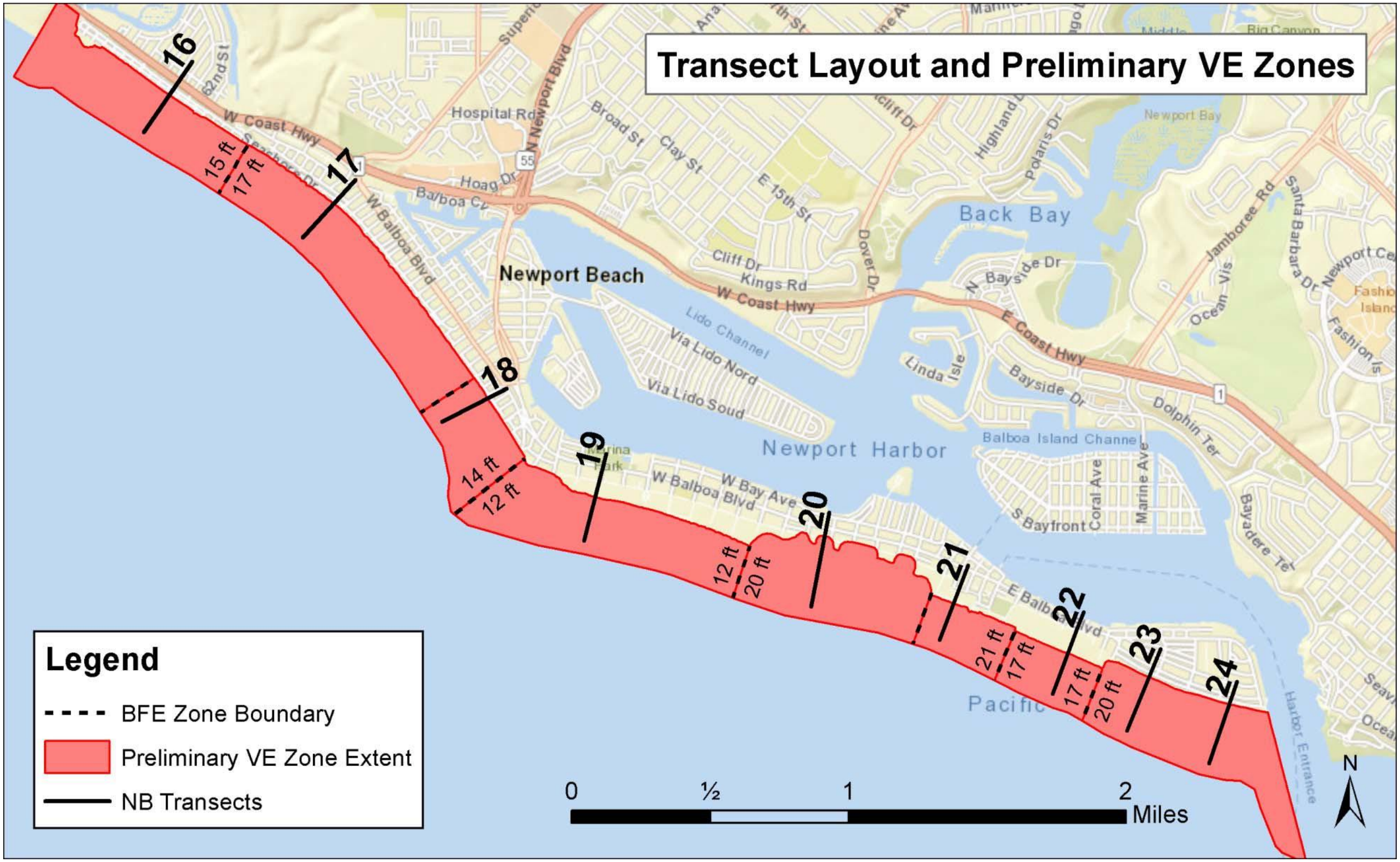



**Figure 5.** The Newport Beach (NB) transects and preliminary VE Zone extent. The black, dashed lines show the BFE zone boundaries, or the transition between different BFEs defined by transects within the shoreline reach. Shoreline reaches are the areas between BFE zone boundaries. The BFEs, in feet NAVD88, shown within their respective shoreline reaches.

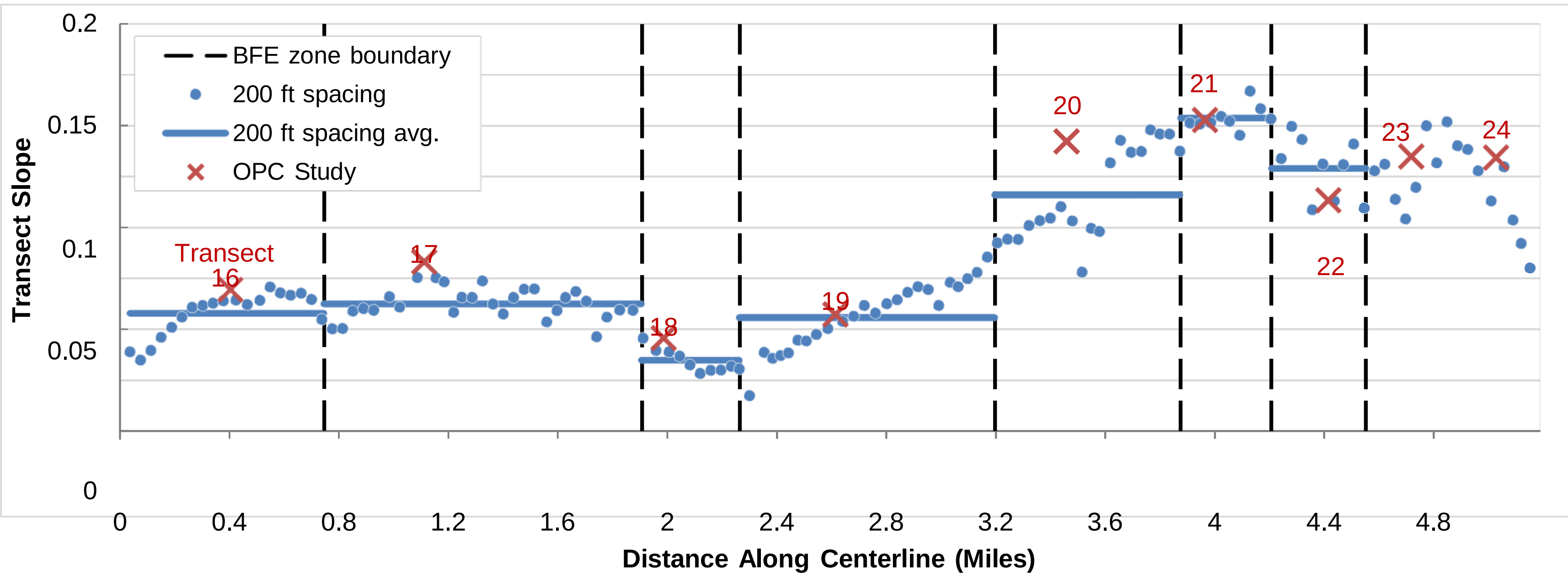



**Figure 6.** The foreshore slopes of the transects used in the OPC Study compared to the transect slopes calculated at 200 ft increments

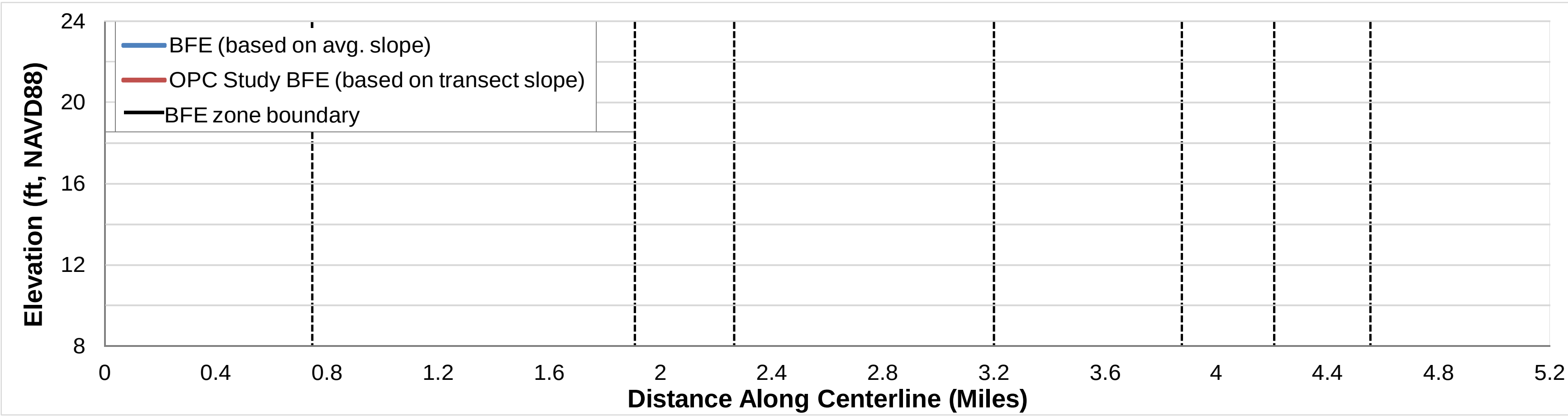



**Figure 7.** BFE calculated using the average slope within each shoreline reach (blue line) compared to the BFE calculated in the OPC study (*red* line)



**Figure 8.** (a) Aerial photo of beach berms constructed on February 2nd, 2016 between 8th and 12th Street. (b) Beach berm constructed on February 18th, 2017 between 42nd and 44th Street. (c) Berms constructed on August 31st, 2011 just south of Balboa Pier.

(c) 8/31/2011 south of Balboa

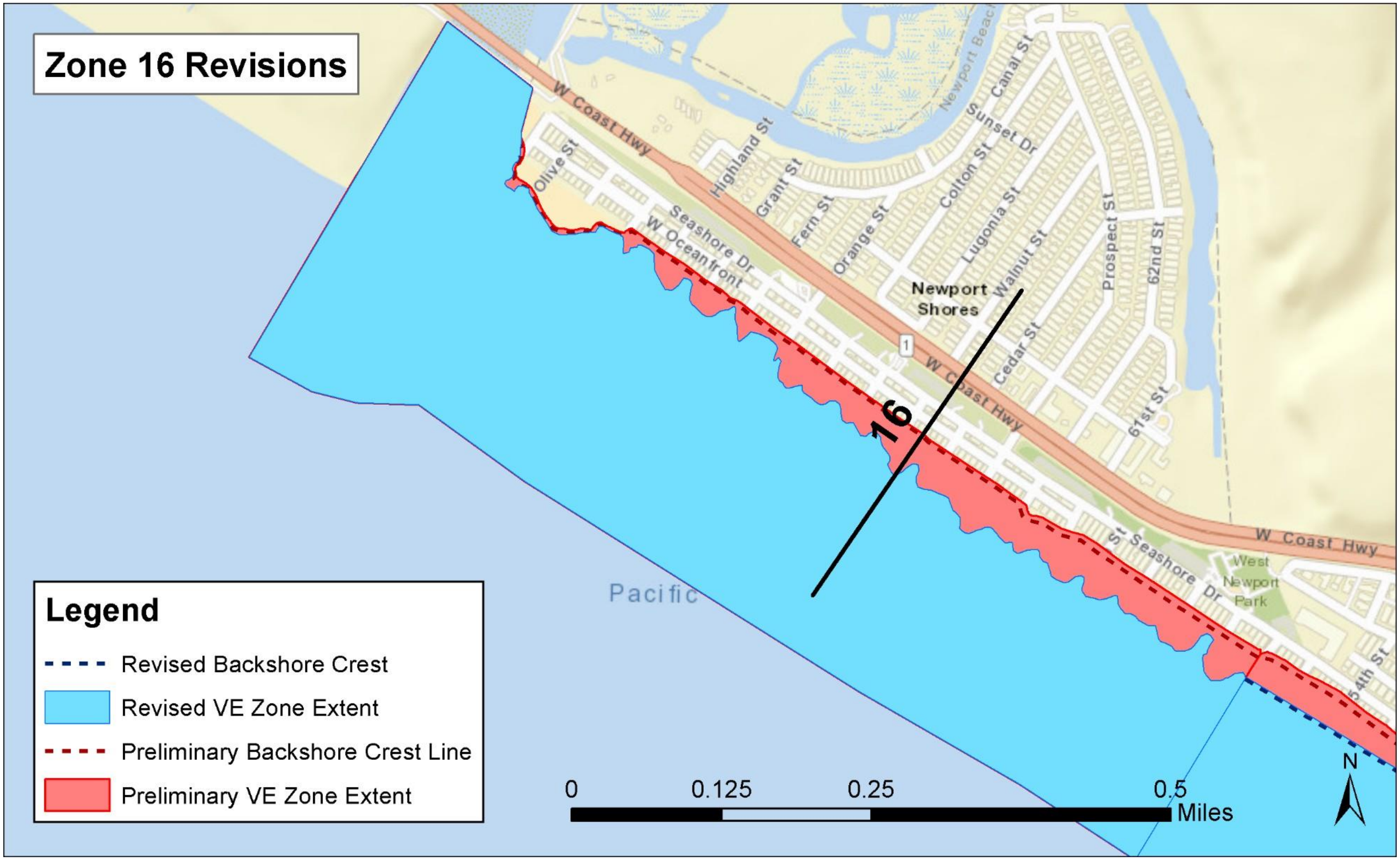



**Figure 9.** **Proposed Revised VE Zone Extent for Zone 16**

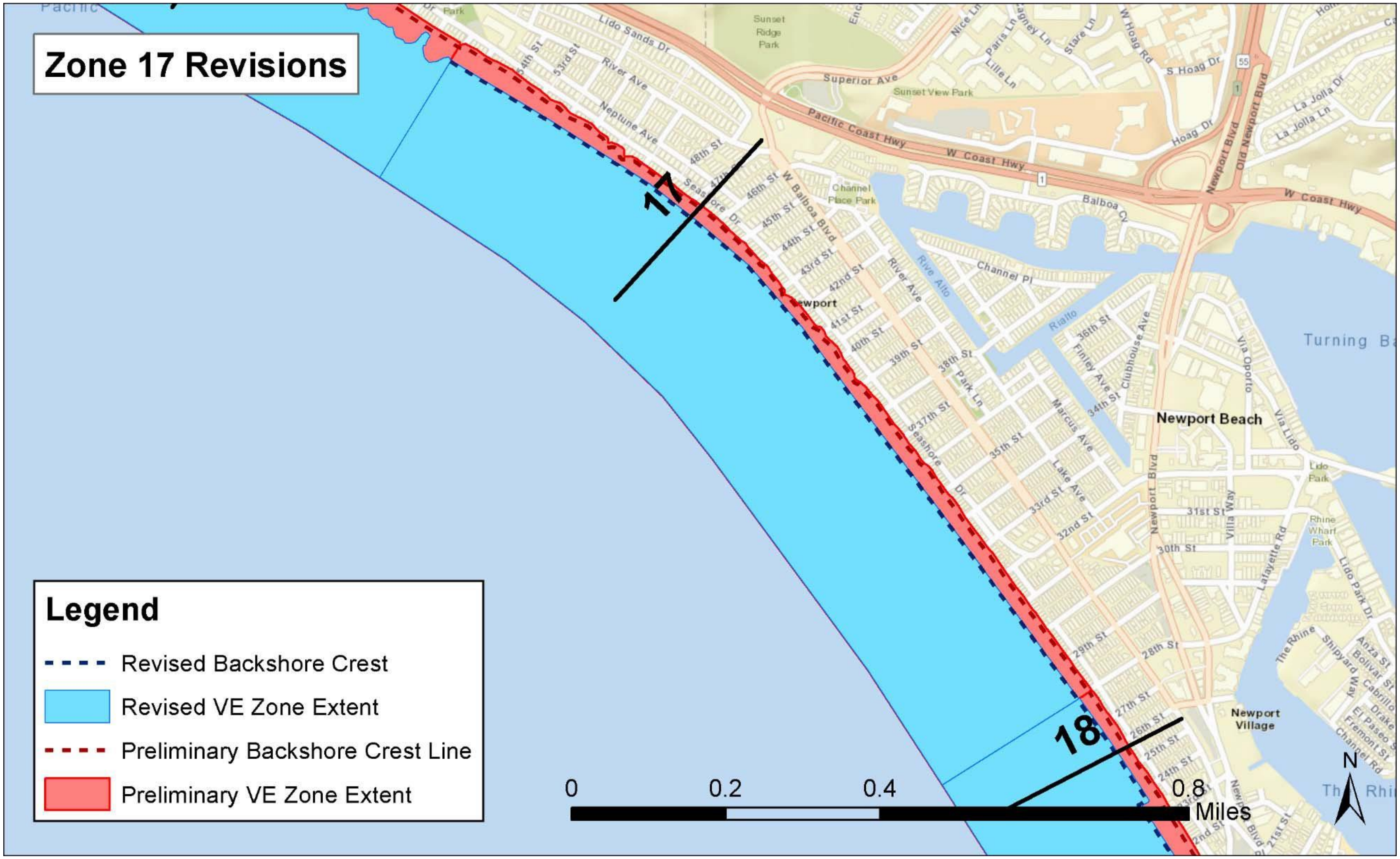



**Figure 10**. Proposed Revised VE Zone Extent for Zone 17

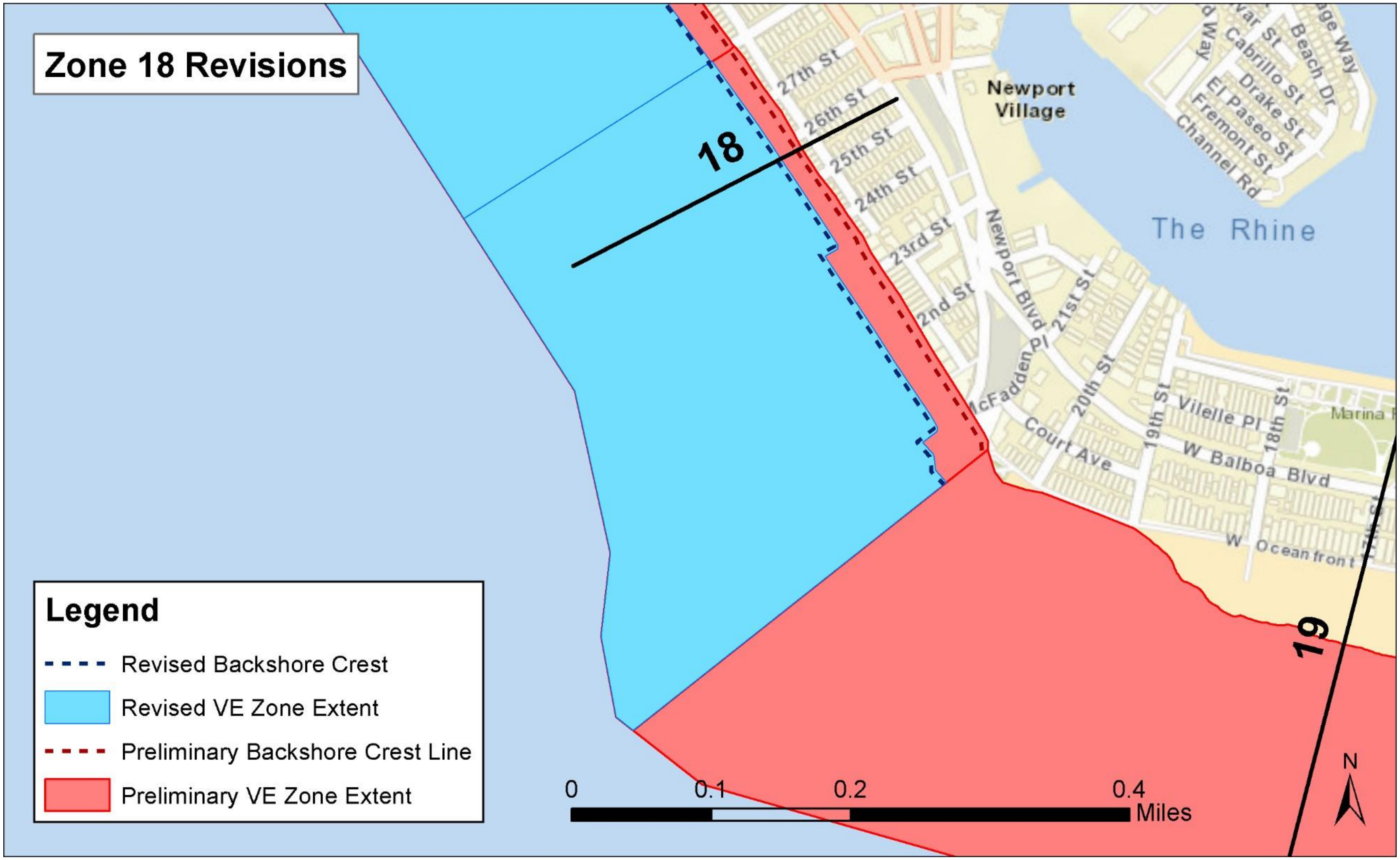



**Figure 11**. **Proposed Revised VE Zone Extent for Zone 18**

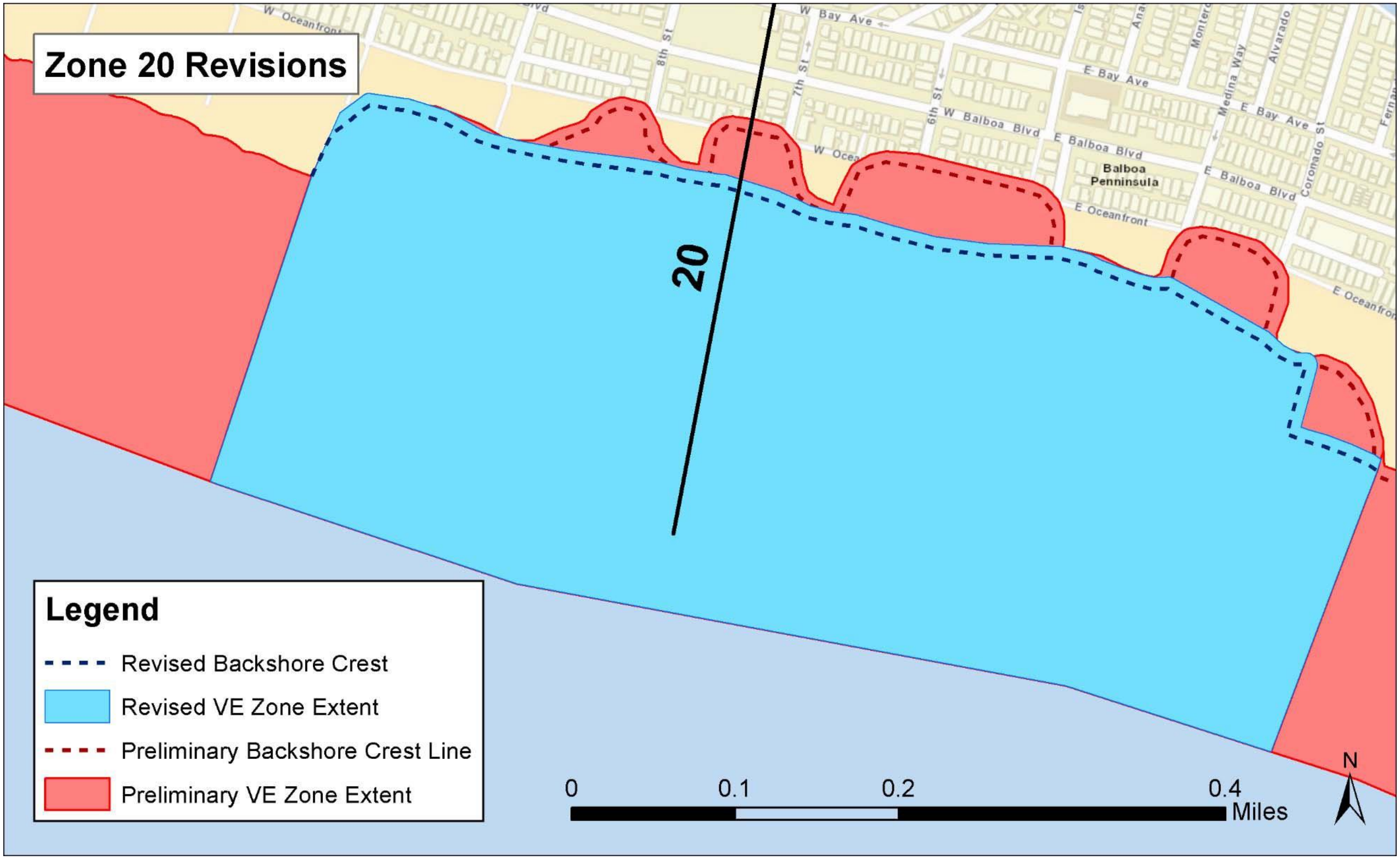



**Figure 12.** **Proposed Revised VE Zone Extent for Zone 20**


**Figure 13.** **Proposed Revised VE Zone Extent for Zone 22**

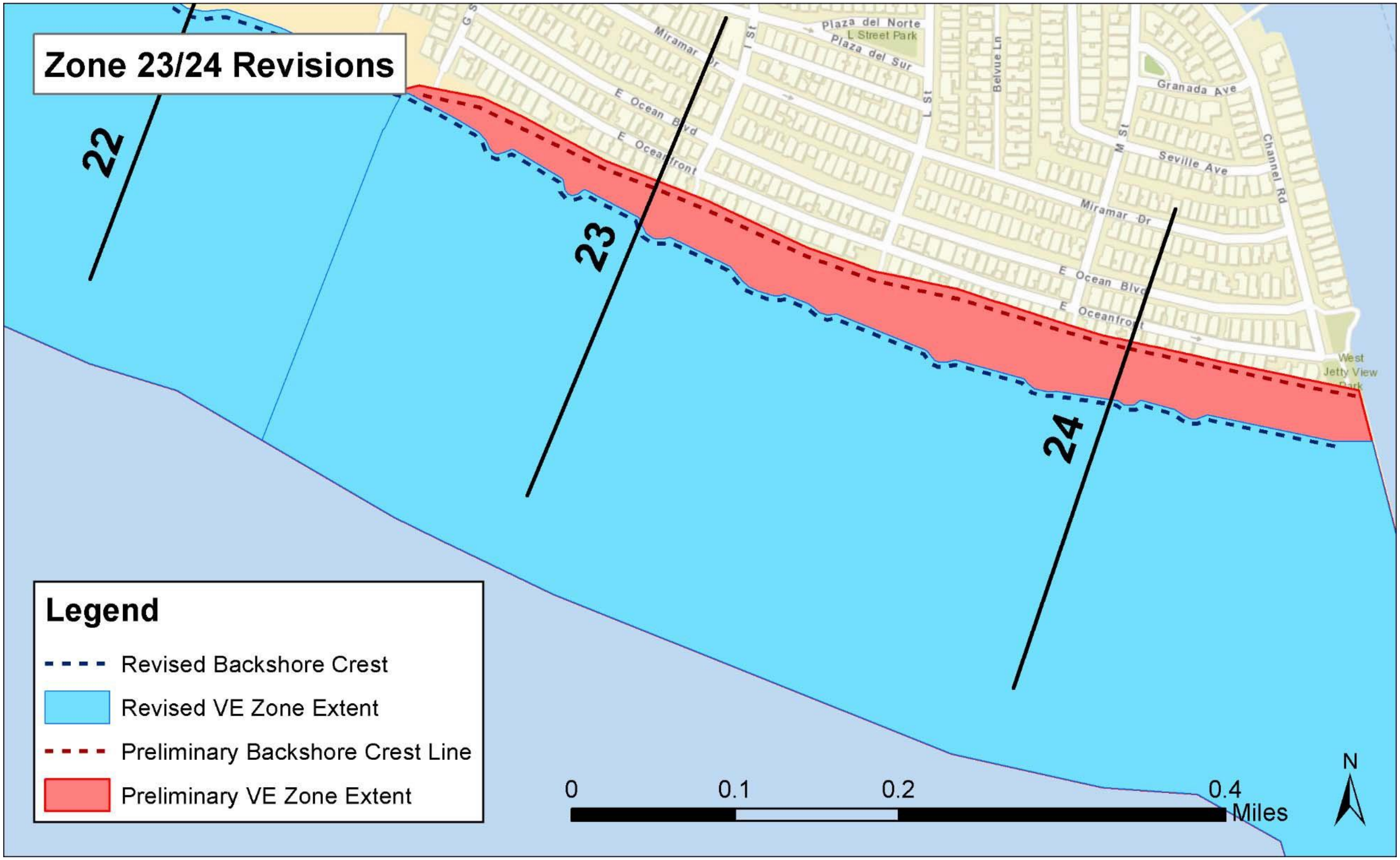



**Figure 14. Proposed Revised VE Zone Extent for Zone 23/24**