Harbor Island FEMA Preliminary Flood Map Appeal
Phase 1 Feasibility Report

Town of Wrightsville Beach, New Hanover County, NC

Submitted to:

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Introduction

The Town of Wrightsville Beach, NC (Town) contracted Applied Technology and Management, Inc. (ATM) to investigate the potential for appealing the recently released FEMA Preliminary Flood Maps affecting Harbor Island (Figure 1). This report summarizes ATM's Phase 1 efforts, including FEMA map materials review, preliminary analyses, and recommendations for the Town's path forward.

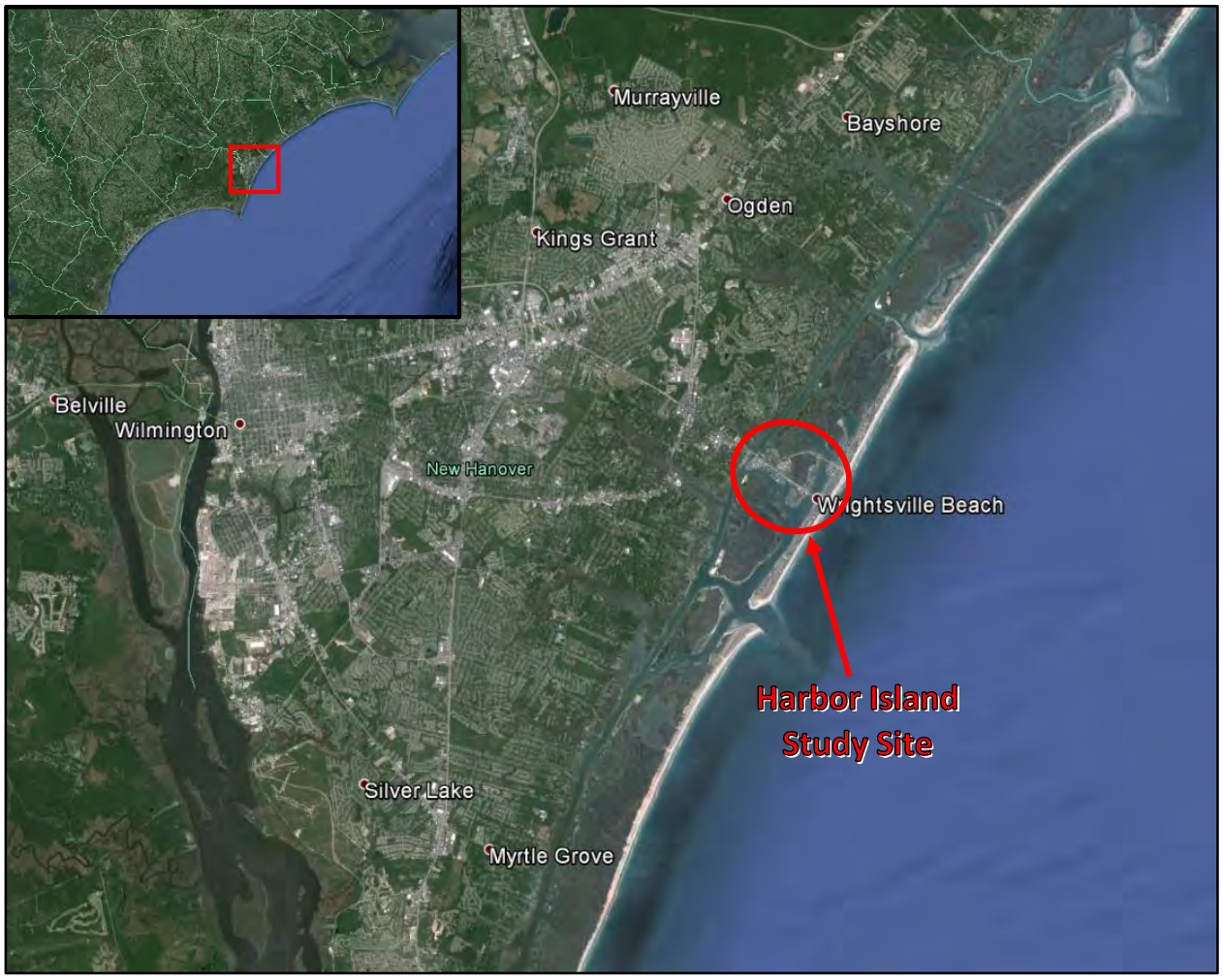


Figure 1. Location and Overview Aerial Imagery of the Approximate Harbor Island Study Area (Google Earth Imagery Date 10/5/2014).

Setting

Harbor Island is located within the limits of the Town of Wrightsville Beach, near the Atlantic Coast of New Hanover County, North Carolina, and is accessed via U.S. Highway 74/76 (Figure 1). The study site (Harbor Island) is approximately 300 acres in size, with about 4,800 ft of the island

frontage facing towards the Atlantic Ocean, which is beyond Banks Channel and Wrightsville Beach (Figure 2).

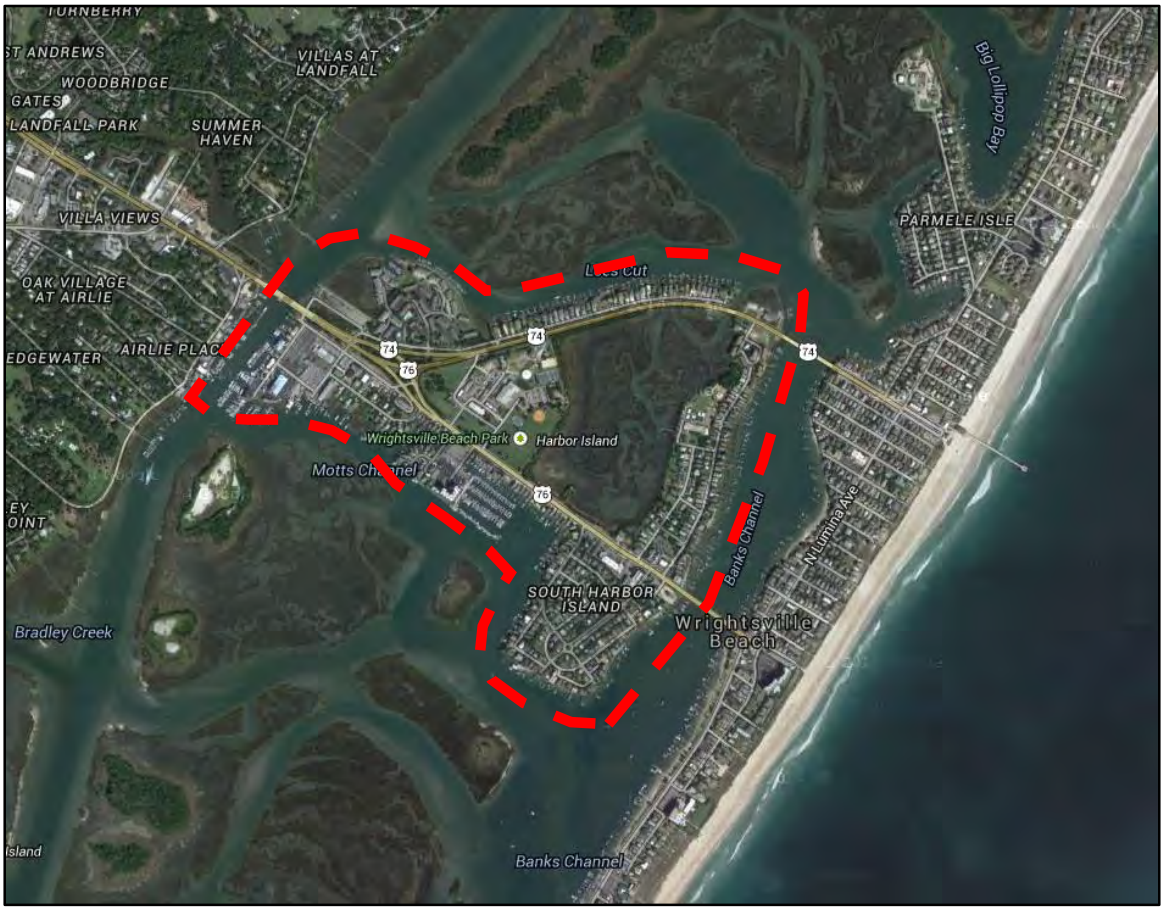


Figure 2. Site View Aerial Imagery of the Harbor Island Study Area (Red Dotted Line) (NOAA Tides and Currents Data Access Viewer Imagery).

As seen in Figure 2, the area is mostly developed with single family homes, with a mix of commercial and townhome/condo development as well. A portion of the island's interior is comprised of intertidal marsh. The site is separated from the mainland by the Atlantic Intracoastal Waterway (AIWW) to the northwest and bordered by Lees Cut, Banks Channel, and Motts Channel to the north, east, and south, respectively (Figure 2). Numerous marsh and USACE AIWW spoil islands are present throughout the area, to the northeast and southwest. The Atlantic Ocean shoreline of Wrightsville Beach, where the FEMA WHAFIS[1] wave model transects begin (discussed in subsequent sections), is approximately 1,800 to 2,500 ft southeast of the Harbor Island/Banks Channel shoreline. Banks Channel widths between Harbor Island and Wrightsville Beach range from approximately 600 to 1,200 ft. As was concluded in the FEMA preliminary Flood Insurance Study (FIS) and subsequent mapping efforts, under elevated water

[1] WHAFIS = Wave Height Analysis for Flood Insurance Studies (FEMA wave model)

level and storm conditions, Harbor Island will generally be exposed to locally regenerated wave effects from the offshore waves breaking on and traveling over the Wrightsville Beach barrier island.

Basis of Preliminary Flood Map Appeal

ATM reviewed the relevant preliminary FEMA mapping studies, datasets, model results, and Flood Insurance Rate Maps, for any potential issues that may affect final results and merit an appeal. Two items were initially discovered that showed potential for appeal: 1) outdated/ misrepresentative topographic data and 2) misrepresentative WHAFIS resulting wave periods and heights near Harbor Island. WHAFIS model carding (e.g., building, upland vegetation coefficients) was also investigated and found to be implemented in typical conservative FEMA methodology. Based on ATM experience with FEMA map reviewers, WHAFIS carding was originally proposed to be left similar to preliminary model runs (discussed further below).

ATM's experience with Letters of Map Revision (LOMRs) for project sites similar to the Harbor Island study area led to initial proposals of developing new, more detailed transects starting at the Harbor Island Shoreline along Banks Channel, behind the Wrightsville Beach barrier island. New starting wave conditions would be developed based on fetch analyses utilized in previously successful LOMR studies by ATM as well as updated topographic data. This method is based on the dissipation (and effective blocking) of long period ocean swell as it impacts barrier island topography. Potential for offshore wave conditions (i.e., long-period swell) propagating to the subject shoreline, if any, is not significant based on a review of BFEs across the barrier island and remote distances to any open ocean inlet. Wave characteristics (heights and especially periods) behind barrier island complexes are generally governed by locally generated wind waves, with minimal contribution from ocean swell (varies by site). SWAN wave modeling in an estuarine region similar to the project site by NC State University supports this concept and notes peak periods are about 3 seconds (produced by wind generation and not ocean swell) under extreme storm conditions (Dietrich, 2011). In combination with updated topographic data that accurately represented site conditions, ATM recommended this initial strategy for the Harbor Island study site.

In order to effectively coordinate a potential appeal, ATM contacted representatives of the North Carolina Flood Mapping Program (NCFMP) to discuss initial approaches and other issues. A conference call was hosted by NCFMP representatives and a representative from the technical reviewing entity (i.e., Dewberry) on preliminary map efforts and appeals. It was recommended that ATM forego their initial proposal (new transects and starting wave conditions with updated topography) and utilize the existing FEMA preliminary map transects, incorporating the updated topography and implementing what is known as "BU" or building cards in FEMA's WHAFIS model. These BU cards model built structures with the potential to obstruct wave energy. Estimates of 15 to 20-percent "open space" inputs for the BU cards were initially suggested to ATM by technical review staff. These and other issues are detailed in the following sections. Based on the discussions with, and recommendation from NCFMP and other representatives, ATM utilized

existing FEMA preliminary map transects, updated topography and "BU" WHAFIS model cards as the basis for the current study.

FEMA's *Appeals, Revisions, and Amendments to National Flood Insurance Program Maps, A Guide for Community Officials* (December 2009) document states that appeals to preliminary flood maps must be supported by documentation showing that the proposed BFE's and/or base flood depths are scientifically incorrect or technically incorrect.

The current study shows that the Preliminary Flood Insurance Rate Maps for the study site (Harbor Island, NC) are:

1) Scientifically incorrect due to assumptions made as part of the methodology are inappropriate or incorrect (i.e. building obstruction "BU" WHAFIS card inputs neglected existing structures).

2) Technically incorrect due to methodology that was based on insufficient or poor-quality data (i.e. topographic data utilized is outdated and/or misrepresentative of site conditions).

The following sections detail the methodologies utilized to account for WHAFIS obstruction BU cards and topographic data that is more representative of actual site conditions at the Harbor Island, NC study site.

Building Obstructions

Structures such as homes or buildings have the potential to obstruct wave energy as it propagates inland from offshore hurricane conditions. In order to account for these obstructions, FEMA's WHAFIS model uses "BU" cards to represent structures with the potential to inhibit wave energy transmission along the WHAFIS transects. BU cards are specified on the transect as rows of structures perpendicular to the transect and require input values representing the number of rows and the ratio of open space to total space. This is simply the sum of distances between the structures in a row, divided by the total length of that row (FEMA, 2007). FEMA's Wave Transformation, Focused Study Report describes the modeled wave transmission through BU cards (FEMA, 2005):

> *"Energy propagation though rows of buildings is determined by the fractional open aperture between the buildings along a row, and the number of rows within the segment. The fraction of incident energy passing through a row is assumed to be equal to the average fractional open aperture between adjacent buildings; between rows, energy is assumed to be laterally redistributed before encountering the subsequent row."*

FEMA guidelines state that if structures are elevated above the base flood wave crest on pilings or columns, waves will propagate under the structures with minimal reduction in height and mapping partners should code these buildings using the BU card and indicate 100-percent open space (acknowledging the buildings but assuming they are completely transparent to waves) (FEMA, 2007). Assuming a 100-percent open space is a very conservative approach and typically adopted for most FEMA mapping efforts, including the preliminary mapping efforts for the New Hanover County, NC Harbor Island study area. However, the conservatism of this approach does not accurately reflect the realistic conditions of the Wrightsville Beach barrier island and Harbor Island development characteristics.

Figure 3 shows an oblique view of the study area from the open ocean looking landward (Google Earth 3D Imagery). Preliminary FEMA mapping efforts conservatively neglected the presence of all the structures shown below. While a small fraction of the structures in the developed areas are open foundations, supported on piles or columns above the base flood level (validating 100-percent open space), an overwhelming majority are enclosed structures, on-grade, or curtain-wall (crawl space) structures which would realistically constitute as obstructions to the passage of wave energy.

Figure 3. Oblique View Aerial Imagery of the Wrightsville Beach barrier island and Harbor Island Study Site. Viewing from the open ocean looking landward. View south of Causeway Drive (Top) and north of Causeway Drive (Bottom). (Google Earth Imagery, 3D Buildings).

Based on aerial measurements, site reconnaissance, and engineering judgment, ATM developed an average fractional open aperture of 25% for use in WHAFIS BU cards, larger (and more conservative) than the 15-20% initially suggested during discussions with mapping partners. Due to the relatively less dense development in the northwest portion of Harbor Island, BU cards in this area were conservatively left at 100-percent open space.

Topographic Data

FEMA Preliminary Mapping Efforts-Topographic Data Sources

The preliminary FEMA mapping efforts for New Hanover County were based on North Carolina 2001 LiDAR datasets and ground surveys collected in October/November 2010. A statewide triangulated irregular network (TIN), and 10-ft resolution digital elevation model (DEM) raster were produced and the 10-ft DEM was utilized. Where field survey data exist, such as those collected in order to identify primary frontal dunes, the survey data superseded the LiDAR based DEM (source: NC_NewHanover_County_Methodology_Summary_Report_ 11122013.doc).

Updated Preliminary Mapping Efforts-Topographic Data Sources

The topography utilized for this study includes several sources of data:

1. Field survey data collected by FEMA (October 2010 beach survey data used by FEMA)
2. National Coastal Mapping Program 2010 LiDAR (Wrightsville Beach updated topography)
3. North Carolina 2001 LAS (raw LiDAR data used by FEMA)

The data sources utilized for this study were generally prioritized in the order shown above (i.e. field survey data supersedes all other data, then 2010 LiDAR taking priority, and finally, the 2001 LiDAR). The field survey data was provided by FEMA NC mapping partners and was incorporated directly into WHAFIS model transects (discussed in subsequent sections). All datasets were referenced to the North American Vertical Datum 1988 to match the preliminary mapping datum.

The 2010 LiDAR, which only covers the Wrightsville Beach barrier island portion of the study site, is an updated and more detailed and accurate dataset than the 2001 LiDAR utilized by FEMA. The 2010 data was obtained from NOAA Digital Coast (http://www.csc.noaa.gov/digitalcoast/, see Appendix # for LiDAR metadata) and processed for the Wrightsville Beach island area, as an improvement on the less detailed topography utilized for the preliminary mapping efforts. Data was downloaded in Geotiff/raster (DEM) format with a horizontal resolution of 3 ft.

The 2001 LiDAR data was also obtained from NOAA Digital Coast (see Appendix # for LiDAR metadata) and processed for the site and immediate surroundings. The 2001 LiDAR data coverage is much larger than the 2010 data, which was limited to the Wrightsville Beach barrier island. The 2001 dataset is only available in LASer (LAS) file format, a public binary file format for the interchange of 3-dimensional point cloud data. The LAS data was processed in ESRI ArcGIS 9.3 software. The LAS data was "unclassified" which means that LiDAR data points included return signals from trees, buildings, and other objects, in addition to bare-earth ground points.

ATM used standard methodology to process the LAS data to classify and remove all non-ground points, leaving only bare-earth topography. Only the last return signals were classified as "ground points" and an extra fine granularity was used for improved resolution and processing. Finally, a step threshold was placed on data points and processed to remove non-ground returns such as buildings and trees. The resulting bare-earth triangulated irregular network (TIN) was merged with 2010 LiDAR DEM.

Topographic Data Analysis

Figure 4 shows a comparison of the topography utilized in the preliminary FEMA mapping and the processed NOAA Digital Coast LiDAR datasets ATM utilized for the current study.

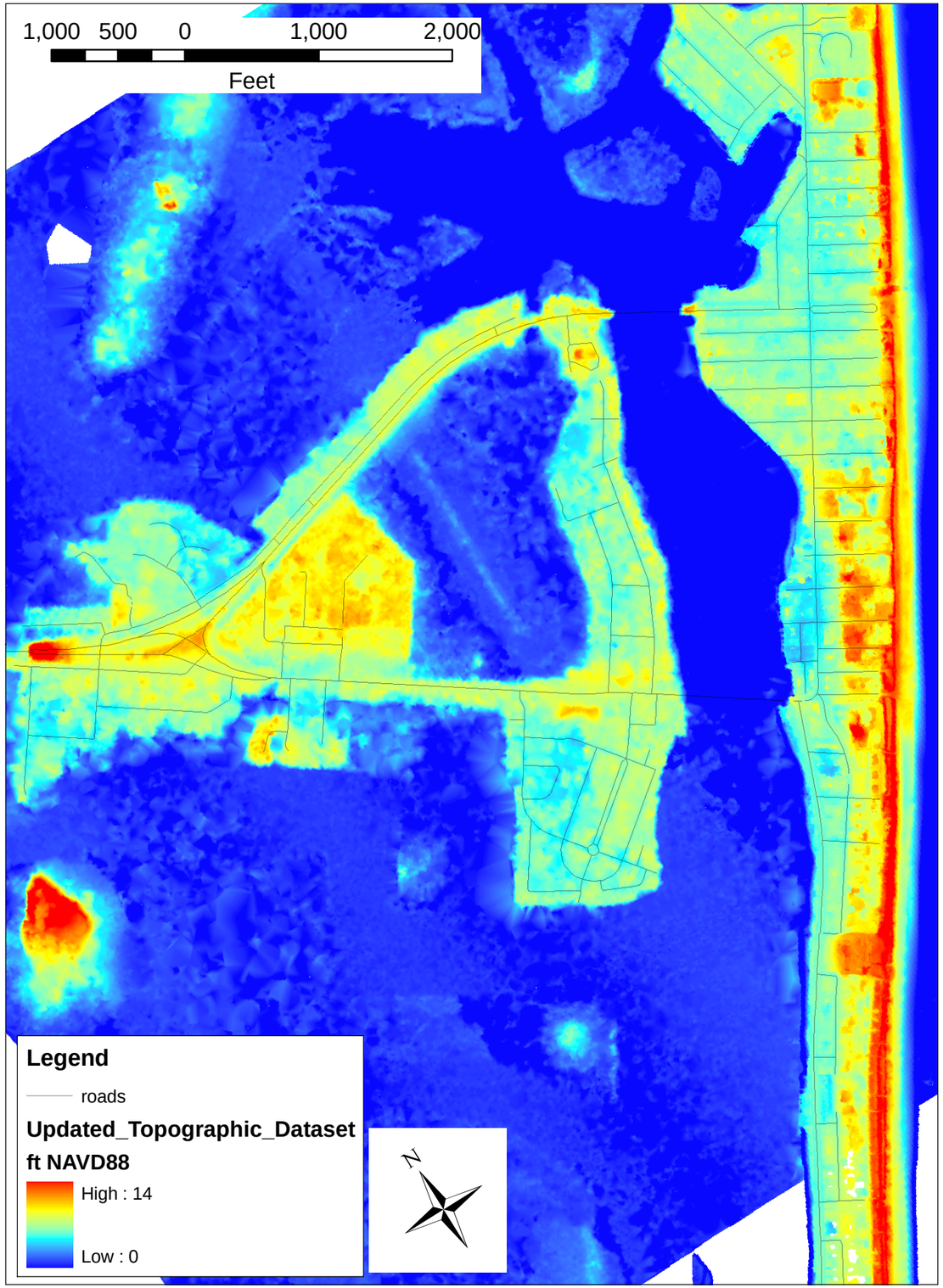
It can be seen that the FEMA topographic data generally exhibits lower elevations than the updated datasets used for the current study. The ground-classified, "bare earth" 2010 National Coastal Mapping LiDAR dataset is considered improved and more accurate data along the Wrightsville Beach barrier island. In order to verify the processed 2001 LAS topographic dataset utilized for the current study in the vicinity of Harbor Island, a site specific survey was conducted to determine ground truth elevations throughout the project area (Robert H. Goslee & Assoc., PA, 2015).

Figure 5 shows the locations of surveyed elevation points. Points were focused along the preliminary FEMA mapping transects and specifically located along the large main road (Causeway Drive) running through Harbor Island. The fixed nature (constant elevation) and open space (no trees or buildings to interfere with raw LiDAR data collection and subsequent processing) along Causeway Drive make an ideal location for comparing 2001 LiDAR data to recent topographic survey points. Table 1 summarizes the comparison of the survey data to FEMA's DEM used in the preliminary mapping, and the updated topographic dataset utilized for the current study.

Table 1. Comparison of Topographic Datasets with Site Surveys

		FEMA Preliminary Mapping Topographic Dataset	Updated Topographic Dataset
Causeway Drive Survey Points	Maximum Difference	-1.00 ft	0.52 ft
	Average Difference	-1.25 ft	0.21 ft
	Minimum Difference	-1.48 ft	-0.48 ft
All Survey Points	Maximum Difference	2.85 ft	2.33 ft
	Average Difference	-0.91 ft	0.44 ft
	Minimum Difference	-6.34 ft	-3.50 ft

** Positive Values Indicate Dataset Elevations Higher than Survey Data, Negative Values Indicated Dataset Elevations Lower than Survey Data*



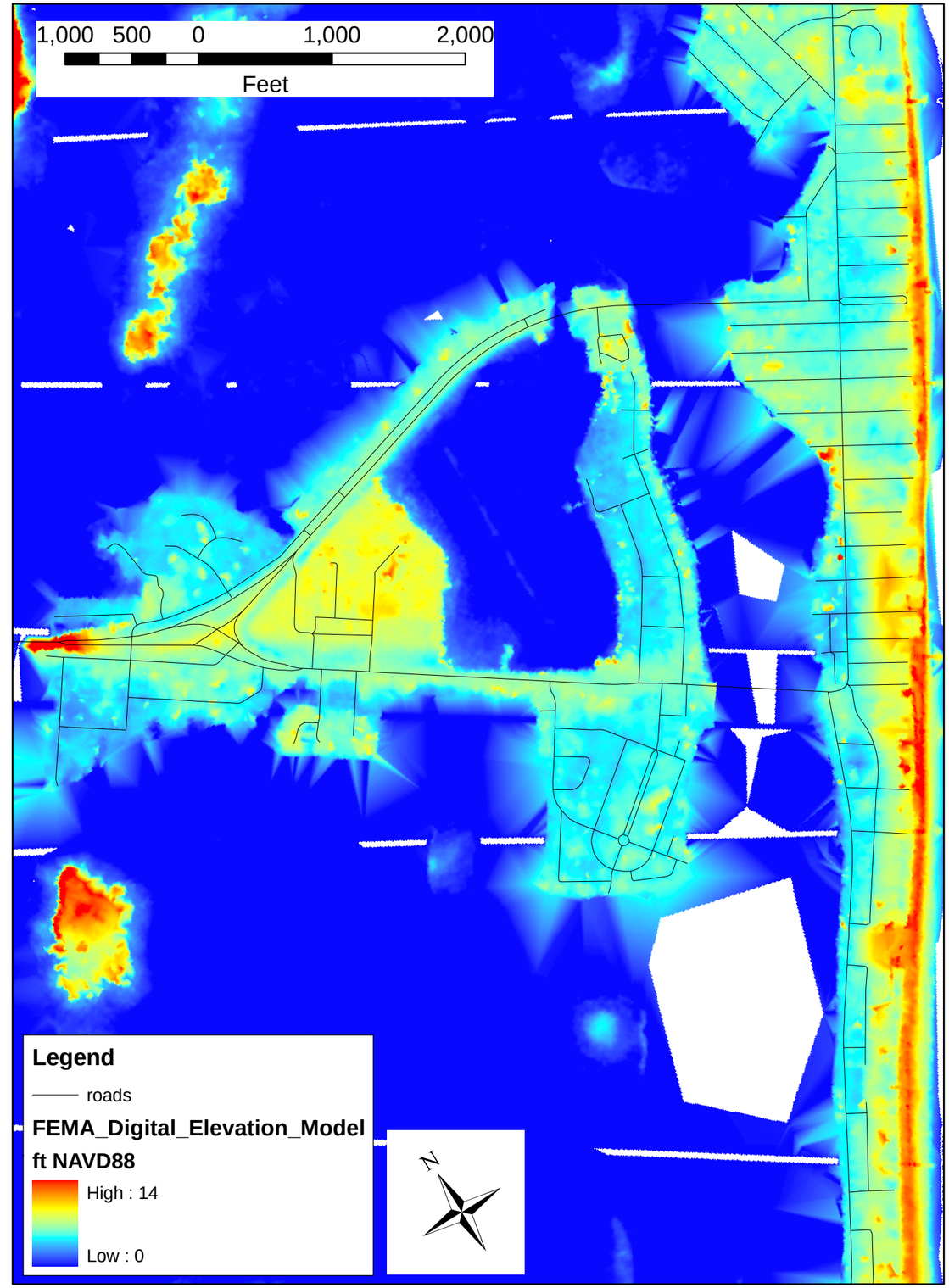


Figure 4. Comparison of Updated Topographic Dataset Utilized for the Current Study (left panel) and the Digital Elevation Model (DEM) (rigth panel) Used by FEMA for Preliminary Mapping Efforts. Roadway Lines Shown for Reference.

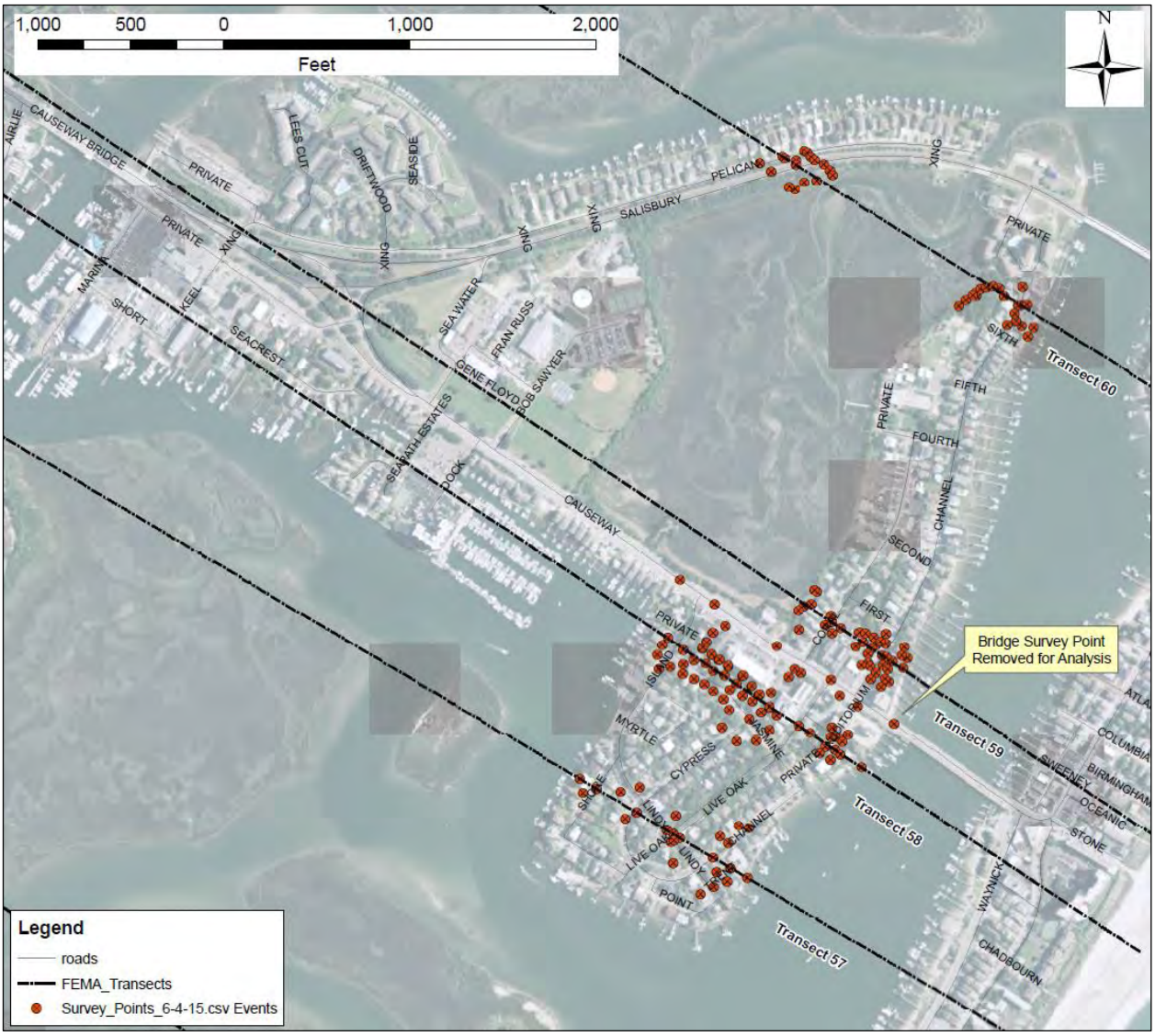


Figure 5. Locations of Site Specific Survey Elevation Data Points (to 6/4/15). Preliminary FEMA Analysis Transects Shown for Reference. Note Bridge Survey Point Removed for Analysis with FEMA and Updated Topography Datasets.

Based on site observations and site specific topographic survey data, the combined dataset utilized in the current study (2010 LiDAR and processed 2001 LAS) represent the best available and most accurate and detailed topography for the study area and is representative of the general conditions at the site and surrounding marshes and upland areas. This topographic dataset is considered a significant improvement on the data utilized in FEMA's Preliminary Mapping Efforts.

It should also be noted that a new set of 2014 LiDAR topographic data was released as the current study was in its final stages. The current study relied on the previously described updated topographic dataset since incorporation of the recently released 2014 data would require duplicated efforts and was deemed impractical.

Existing Study Site Topography

Based on the updated/improved dataset used for the current study, the topography of the area (i.e., Harbor Island and Wrightsville Beach) varies by location (see Figure 6 on the next page). Along the Atlantic coast, the Wrightsville Beach dune system reaches heights of 16+ ft NAVD88, with elevations between approximately 8 and 11 ft NAVD88 generally in the interior areas of the barrier island. Elevations along Wrightsville Beach typically decrease to approximately 4 to 7 ft NAVD88 moving toward Banks Channel.

Harbor Island (study site) topography generally ranges between approximately 6 and 9+ ft NAVD88 along Banks Channel, portions of the island interior and areas along Lees Cut. Various areas maintain elevations up to 12+ ft NAVD88 near Wrightsville Beach Park and along U.S. Highway 74/76. The remainder of the developed island is generally between 4 and 6 ft NAVD88. A developed area of relatively lower elevation exists on the southern portion of the island (south of Causeway Drive) west of Live Oak Drive. The intertidal marsh within and surrounding the island typically maintain elevations between 1 and 2 ft, with more substantially vegetated islands and USACE AIWW spoil islands reaching elevations of 8 to 12+ ft. NOAA tidal datums for Wrightsville Beach are shown in Table 2 for reference.

Table 2. NOAA Tidal Datums

Station: 8658163, Wrightsville Beach, NC		
Datum	**ft, NAVD88**	**Description**
MHHW	1.77	Mean Higher-High Water
MHW	1.42	Mean High Water
NAVD88	0.0	North American Vertical Datum of 1988
MTL	-0.48	Mean Tide Level
MSL	-0.49	Mean Sea Level
DTL	-0.38	Mean Diurnal Tide Level
MLW	-2.38	Mean Low Water
MLLW	-2.53	Mean Lower-Low Water

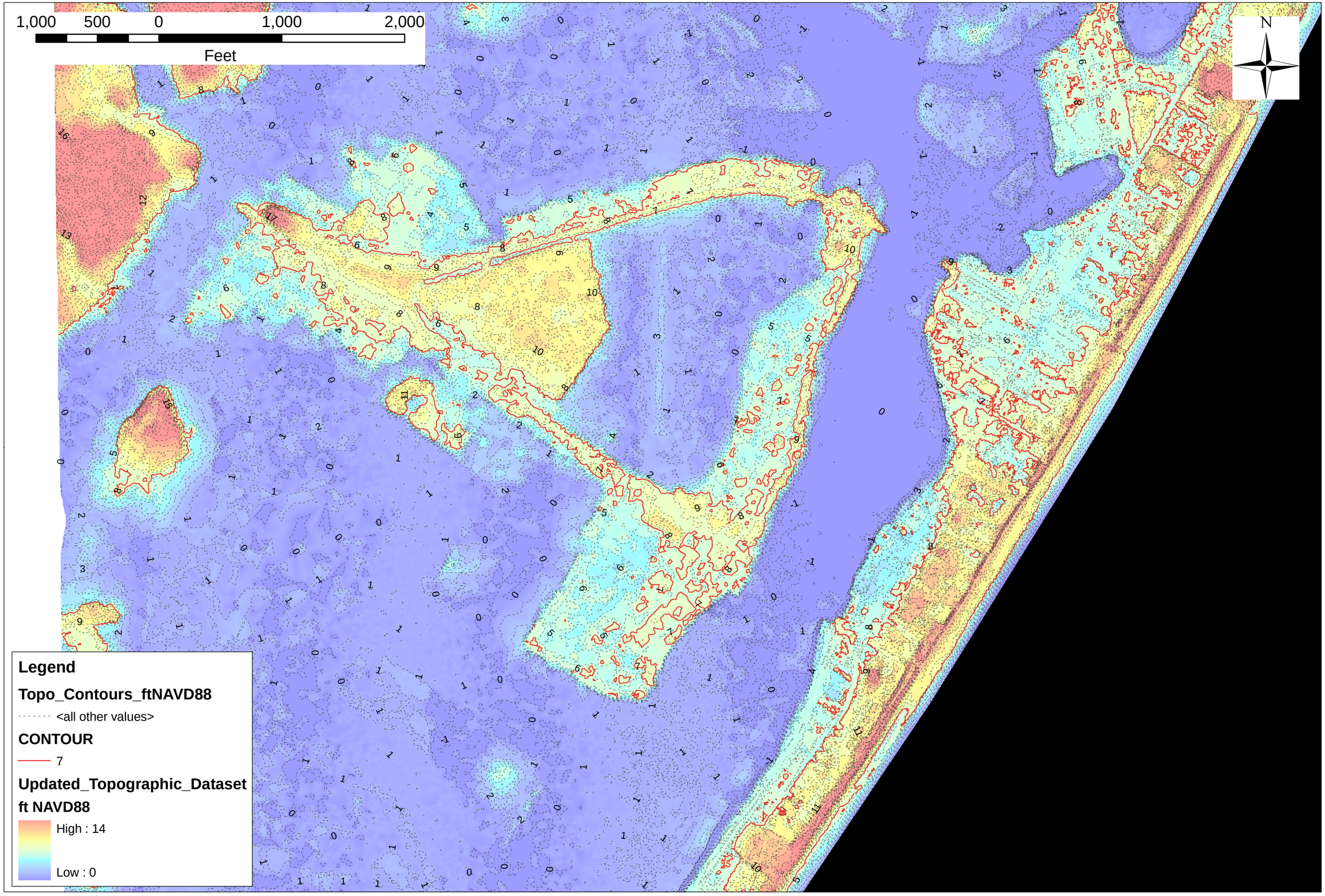


Figure 6. Study Site Topography Utilized for the Current Efforts (Merged 2001 and 2010 LiDAR Topographic Data downloaded from NOAA Digital Coast) overlaid on ESRI Aerial Imagery. 7 ft NAVD88 Contour Highlighted for Reference.

Preliminary FEMA Flood Hazards and Zones

The preliminary FEMA Flood Insurance Rate Map (FIRM) dated 08/29/14 locates the Harbor Island study site within Zones VE, elev. 13-15, and AE, elev. 12-14, as shown on the August 29, 2014 New Hanover County Preliminary Flood Insurance Rate Map (FIRM) #3720, Panels 3157K, 3166K, and 3167K (Figures 7 - 9). The FIRM scale for the project area is 1" = 500' for all panels. A review of the preliminary Flood Insurance Study (FIS) for New Hanover County shows that there are four FEMA analysis transects in the immediate vicinity of the site (Figure 9). It is noted that the preliminary FIS transects are spaced approximately 550 to 2,000 ft apart along the shoreline.

Data contained in the preliminary FIS (summarized in Table 3) indicates that the 100-year still water elevation (SWEL) along the closest transects ranges from 10.7 ft NAVD88 at the Wrightsville Beach/Atlantic Ocean shoreline to 11.9 ft NAVD88 on the mainland at the terminus of the transects. This was confirmed upon review of the preliminary mapping CHAMPS/WHAFIS digital model files. The current study utilized the same spatially variable 100-year SWEL as FEMA's preliminary mapping efforts. In keeping with the preliminary FIS, wave setup along the ocean front shoreline was included in the SWEL.

Table 3. Coastal Transect Parameters (source: preliminary FIS)

Coastal Transect	Starting Wave Conditions for the 1% Annual Chance		Starting Stillwater Elevations (ft NAVD88) Range of Stillwater Elevations (ft NAVD88)				
	Significant Wave Height Hs (ft)	Peak Wave Period Tp (sec)	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	.2% Annual Chance
57	19.7	12.6	*	*	*	10.7	14.4
			*	*	*	10.7 - 11.6	14.3 - 15.5
59	19.7	12.6	*	*	*	10.7	14.4
			*	*	*	10.7 - 11.9	14.3 - 15.8
61	19.7	12.6	*	*	*	10.7	14.4
			*	*	*	10.7 - 11.7	14.3 - 15.6

**Excerpt from Preliminary FIS, Table 20*

Offshore waves propagating inland on the SWEL (including wind-regenerated waves) result in the ultimate BFE for the site. With the exception of updated topography, BU card coefficients, and minor stationing additions for topographic resolution, the transects utilized for the current study are identical to preliminary FEMA transects (including transect locations, starting wave conditions, variable SWEL heights, WHAFIS stationing, model cards, etc.).

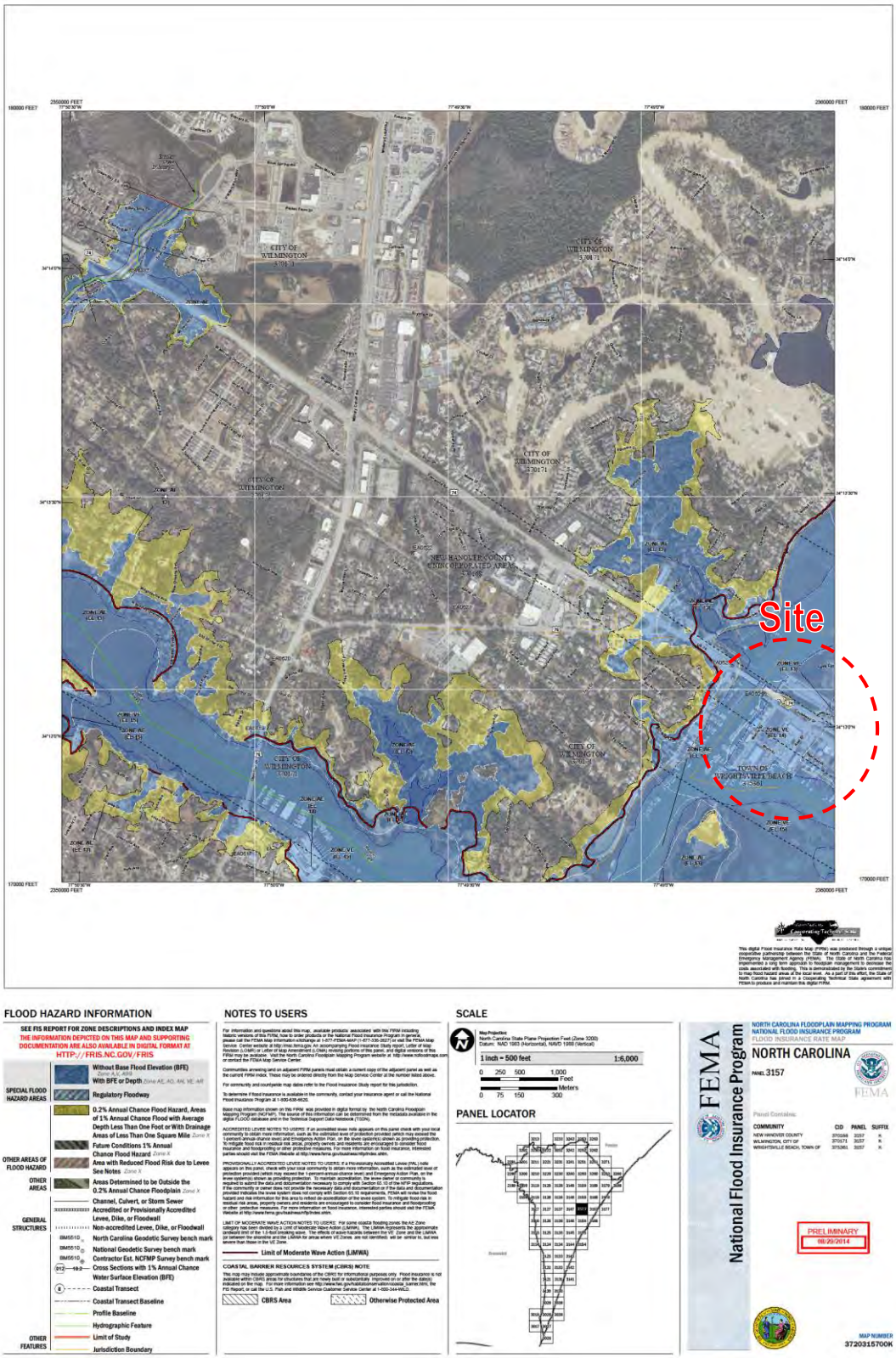


Figure 7. Preliminary FIRM Panel 3157K

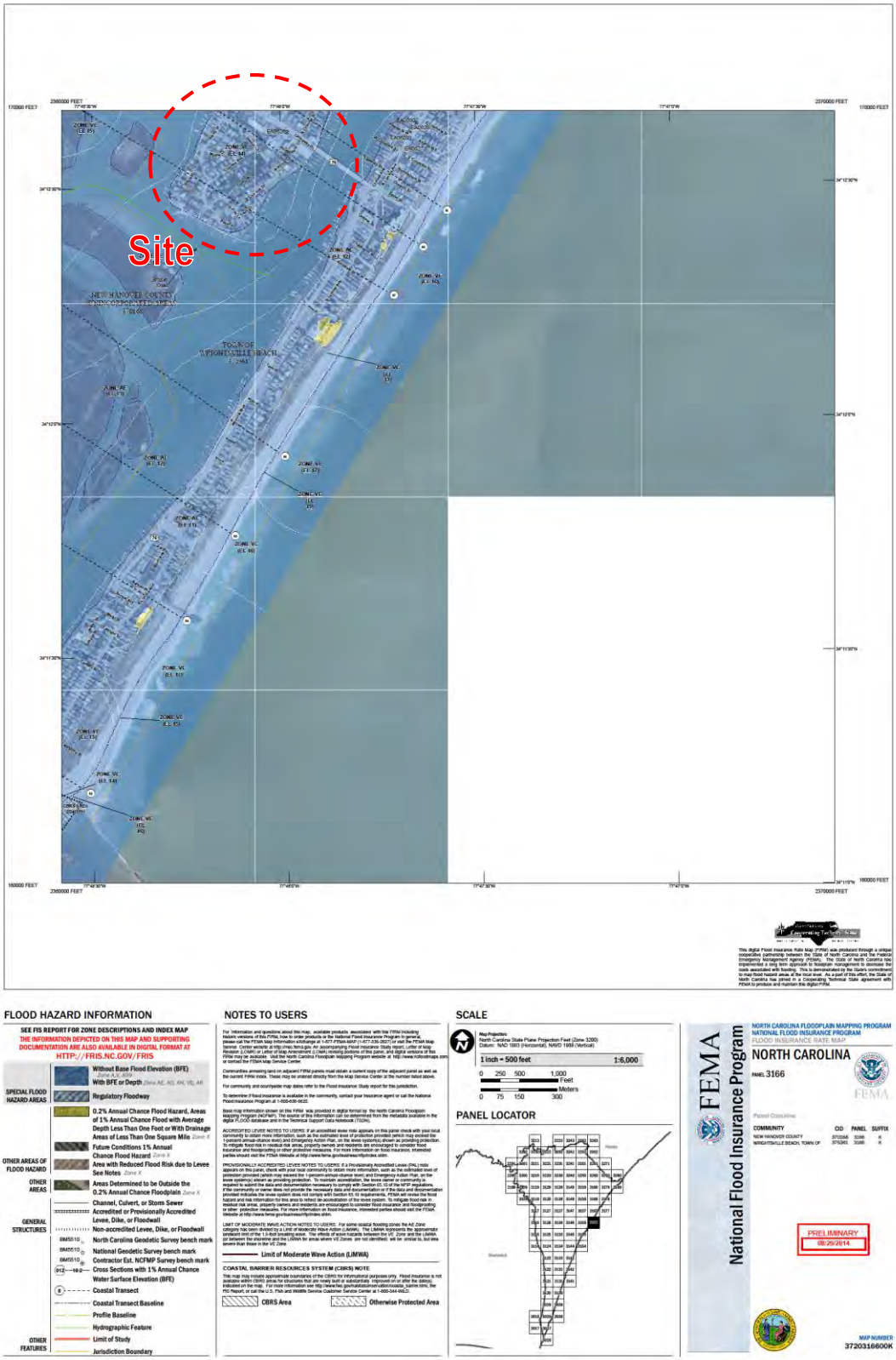


Figure 8. Preliminary FIRM Panel 3166K

Figure 9. Preliminary FIRM Panel 3167K

Figure 10. Preliminary FIS Transects (AECOM, 2013).

CHAMP - WHAFIS Analysis

The revised wave modeling undertaken for this study utilized the same methodology and inputs as preliminary FEMA efforts with the exception of the improved topographic data and BU card coefficients described in previous sections. Starting 100-yr wave conditions (Table 3) included significant wave heights of 19.7 ft and deep water periods of 12.6 seconds, consistent with FEMA preliminary mapping efforts.

Base flood conditions at the Harbor Island site were computed using CHAMP v. 2.0 (the latest version) by running the preliminary FEMA transects from the ocean shoreline over the Wrightsville Beach barrier island, across the marsh/Harbor Island project site area and onto the upland/mainland. Original FEMA WHAFIS stationing, SWEL heights, and model cards were utilized.

Due to the relatively high density development of structures on both Wrightsville Beach and Harbor Island, WHAFIS model runs utilized the BU cards, discussed earlier. For consistency, the updated WHAFIS runs incorporated eroded beach/dune topographic profiles from original FEMA preliminary mapping efforts. These profiles were integrated from the beginning of the transects to the primary frontal dune heel points.

It is apparent from the updated WHAFIS analysis that the topographic data and “transparent” BU cards utilized in the preliminary FIS/FIRM do not resolve the actual topography and resulting realistic wave height conditions that are characteristic of the upland at the subject site. The updated analysis for the current study reveals that a majority of the Harbor Island study site should be located in FEMA Flood Hazard AE Zones (elev. 12 and 13 ft NAVD88) instead of the VE Zones shown in the Preliminary FIRMs. Figures 11-13 depict the preliminary flood map zones, proposed revisions, and final proposed preliminary flood map zones for the Harbor Island study site, respectively, based on the results of the current study.

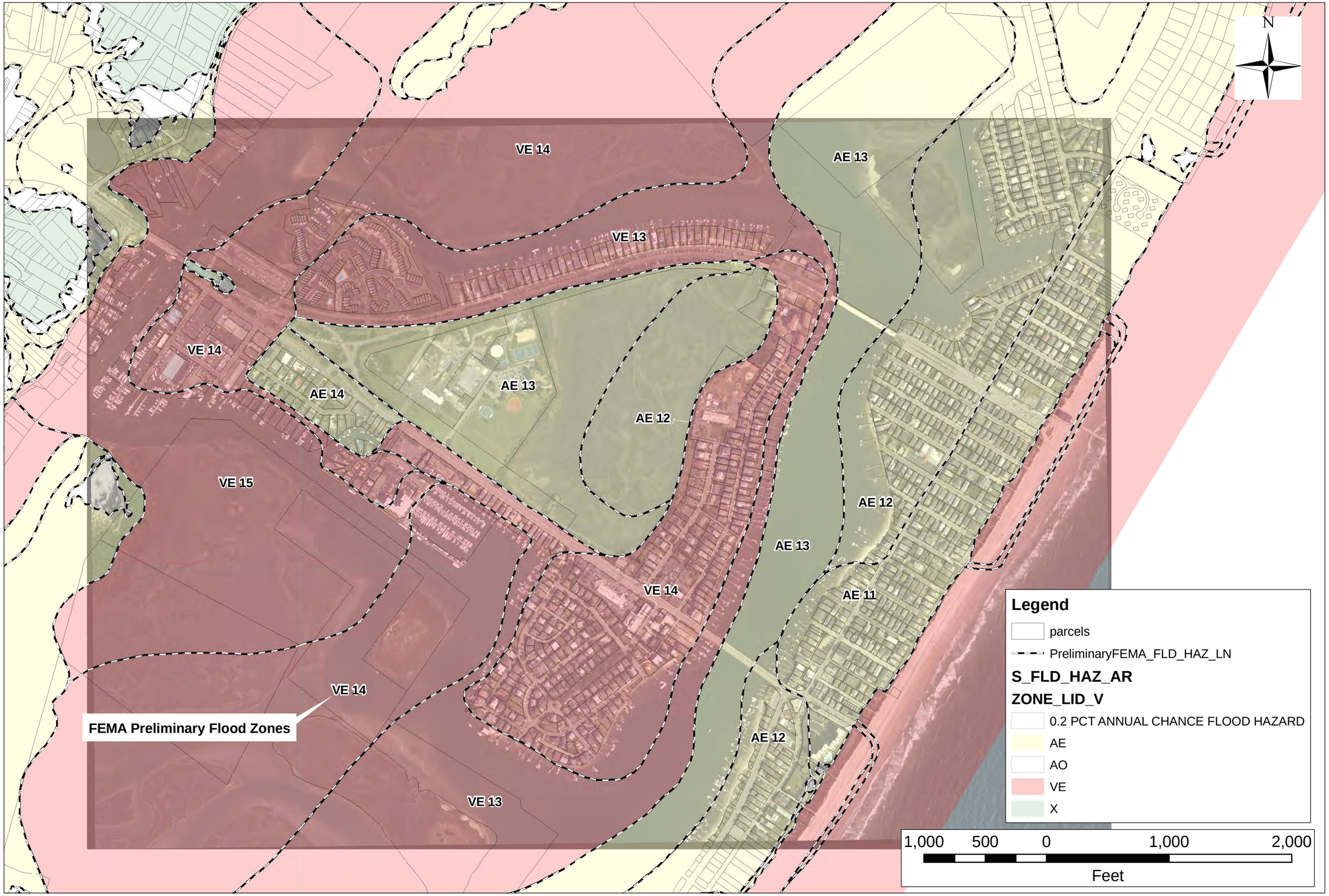


Figure 11. Preliminary FEMA Flood Hazard Zones for Harbor Island, NC Study Site. (2010 NOAA Imagery)

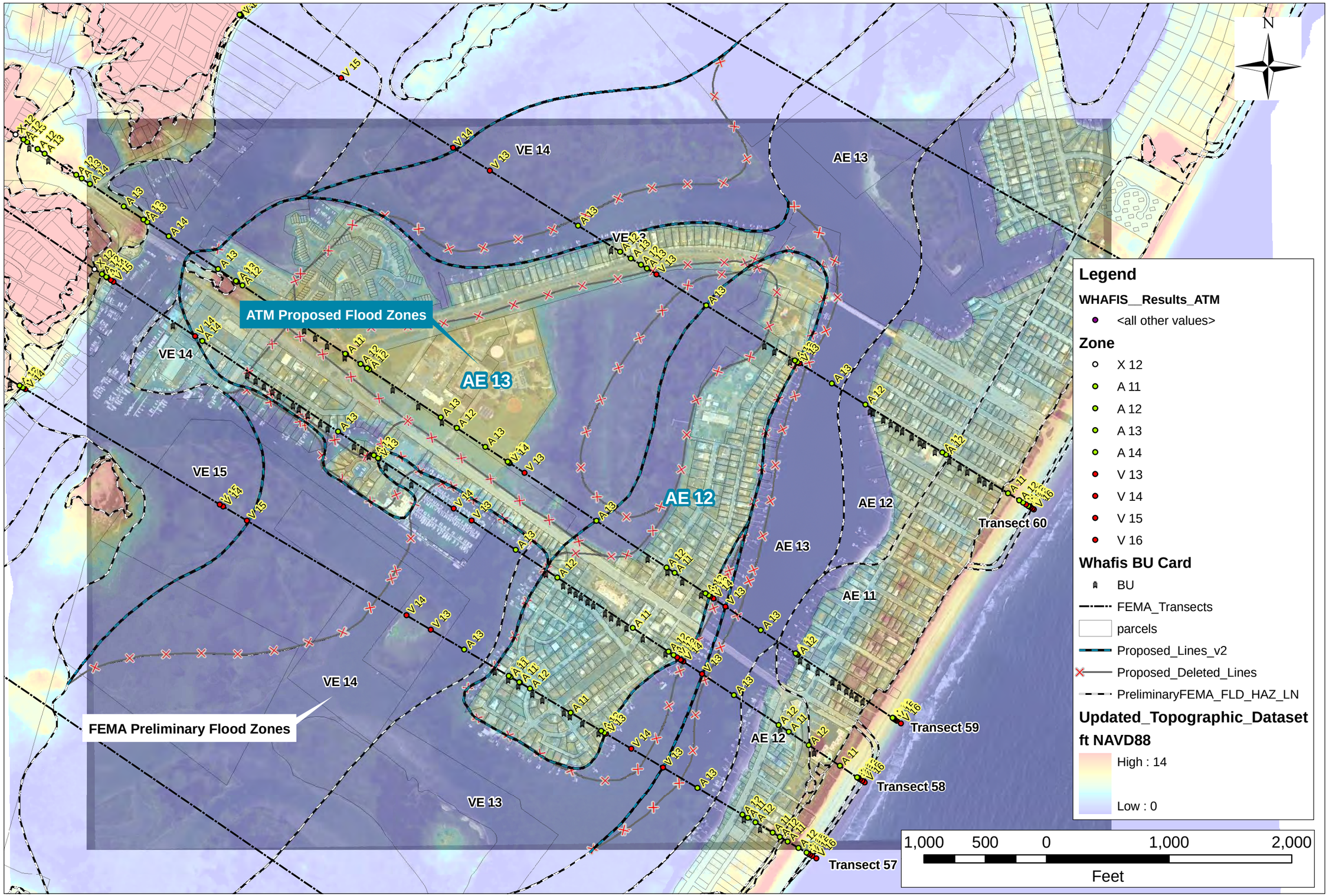


Figure 12. Detailed WHAFIS Results,Preliminary FEMA Flood Hazard Zones, and Proposed Map Revisions for Harbor Island, NC Study Site. (2010 NOAA Imagery)

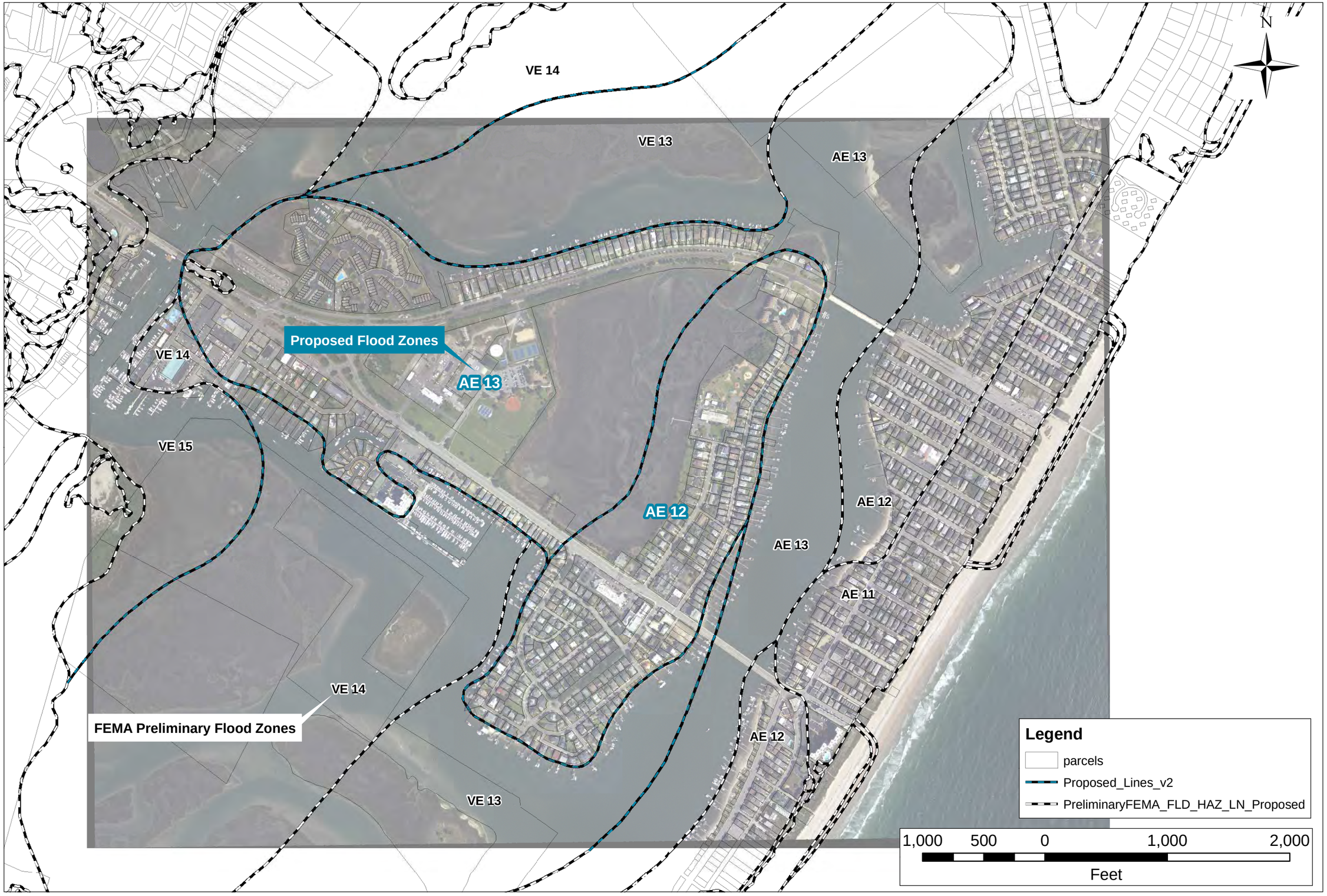


Figure 13. Proposed Revised Flood Hazard Zones for Harbor Island, NC Study Site. (2010 NOAA Imagery)

Summary Recommendations

Based on the results of the Phase I Feasibility Study, it is ATM's opinion that an appeal to the preliminary FEMA flood maps based on the current improved topographic data and modified BU carding would very likely be successful in remapping a majority of the subject site into an AE flood zone. If adopted, the proposed revised zones would benefit most of the structures within the Harbor Island project area through a successful appeal and revision.

It is ATM's recommendation that interested parties review this report and consider options moving forward. If the Town chooses to move forward with the Phase II Appeal Application and Submittal based on the results provided herein, note that the final outcome and any requests for additional information by FEMA following appeal submittal, if any, cannot be predicted and will have to be addressed as the FEMA review progresses. Potential changes to transitioning and interpolation of the proposed revised flood lines per FEMA request may also alter the revised lines shown herein, but these changes are typically minor in ATM's experience.

Due to additional open water exposure during extreme conditions, there is a specific possibility that FEMA reviewers will request proposed flood lines that "hug the shoreline" be shifted slightly inland (based on additional analysis), potentially affecting the final revised zone of structures directly along the waterfront. Appendix A contains high resolution exhibits showing close-up views of the proposed revised flood zones along Harbor Island's shoreline based on the current study. Of particular note is the northwest area of the island and small areas near Dock Drive that remain in VE Zones (see figures A-10, A-11). Structures along the remainder of the shoreline are typically critically close to the waterline and proposed revised VE/AE delineation. Based on the available aerial imagery (NOAA 2010 and ESRI Imagery), these remaining waterfront structures are shown to be in AE Zones. However, it should be recalled that during the review process, this delineation may shift landward based on FEMA technical review.

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NOAA Digital Coast http://coast.noaa.gov/dataviewer/#, National Coastal Mapping Program, Wrightsville Beach, NC 2010 LiDAR Data.

NOAA Digital Coast http://coast.noaa.gov/dataviewer/#, North Carolina 2001 LiDAR LAS Data.

NOAA Tides and Currents http://tidesandcurrents.noaa.gov/, Station: 8658163, Wrightsville Beach, NC

Robert H. Goslee & Assoc., PA, 2015. Topographic Survey Data. June 26, 2015.

APPENDIX A

High Resolution Site Exhibits Harbor Island Shoreline

with Proposed Revised Flood Zones

ATM APPLIED TECHNOLOGY & MANAGEMENT

Figure A-1: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

APPLIED TECHNOLOGY & MANAGEMENT

Figure A-2: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

Figure A-3: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

ATM APPLIED TECHNOLOGY & MANAGEMENT

APPLIED TECHNOLOGY & MANAGEMENT

Figure A-4: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

APPLIED TECHNOLOGY & MANAGEMENT

Figure A-5: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

ATM APPLIED TECHNOLOGY & MANAGEMENT

Figure A-6: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

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Figure A-7: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

APPLIED TECHNOLOGY & MANAGEMENT

Figure A-8: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

Figure A-9: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

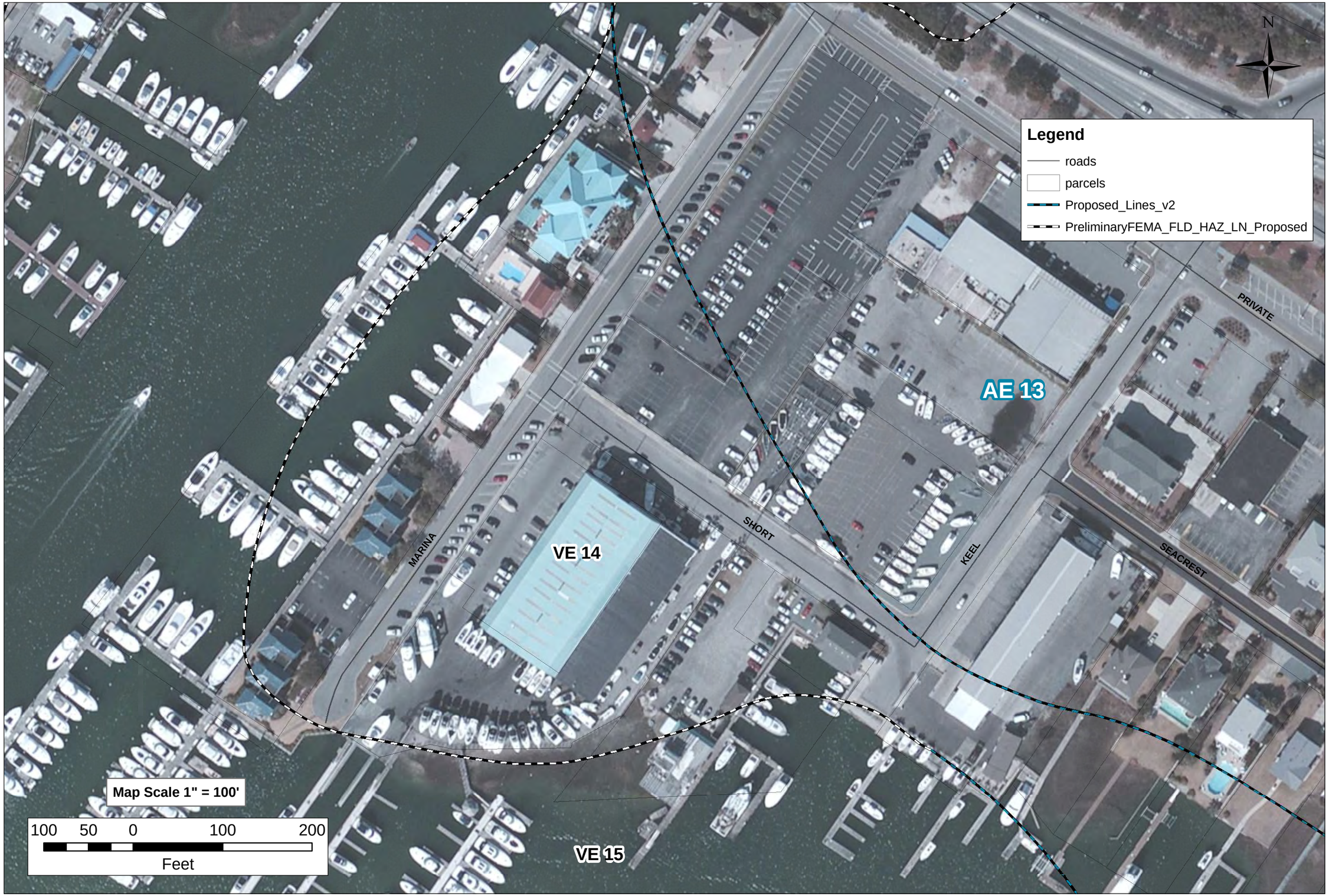

Figure A-10: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

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Figure A-11: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

Figure A-12: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

Figure A-13: Zoom Site View of Preliminary FEMA Flood Hazard Zones and Proposed Map Revisions. (ESRI Imagery)

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