HYDROLOGIC MODIFICATION IMPACT ANALYSIS

Prepared for:

St. Charles Sustainable Fuels, LLC Blue Ammonia Project

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OCM Permit: P20230672

Date:

02/19/2024

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1. INTRODUCTION AND PROJECT BACKGROUND

St. Charles Clean Fuels (SCCF) proposes to construct and operate a Blue Ammonia production facility in St. Charles Parish, Louisiana. The SCCF Blue Ammonia Facility will capture and sequester over 99% of the carbon emissions resulting from the ammonia production process. The project capacity will have two trains that can produce 4,000 metric-tons-per-day (MTD) each. This production facility will be contained on a 230-acre site leased from International Matex Tank Terminal's (IMTT). The IMTT site was established in 1939.

This report satisfies permitting questions posed by the Office of Coastal Management on 10/24/2023, specifically the hydrology questions posed for a Level 4 (Significant Modification Level) Hydrologic Modification Impact Analysis (HMIA) which assesses whether the proposed site will have any modifications to the existing hydrology or on adjacent lands and/or waterways. Adjacent properties, in conjunction with some of the proposed stormwater management features (shown for reference), are shown in Figure 1.

Elevations mentioned throughout this report or shown on figures are referenced to the North American Vertical Datum of 1988, Epoch 2010, Geoid 12B.

2. EXISTING HYDROLOGY AND HYDRAULICS

The regional hydrology encompassing the greater area of the project site is contained via the Mississippi River Levee to the south and the Hurricane and Storm Damage Risk Reduction System (HSDRRS) levee system to the north. Due to higher elevations located near the Mississippi River, runoff predominantly drains south to north (Figure 2) until reaching the Cross Bayou Canal located immediately north of E. Airline Hwy (LA 61). The stage of Cross Bayou Canal is controlled via a pump station containing five (5) 112,500 gallons per minute (gpm) pumps that pump stormwater to Lake Pontchartrain and which is operated by the Pontchartrain Levee District. The pumps are reported to operate with on/off elevations of -0.5 and -1.0 ft NAVD88, respectively. Standing water surface elevations (WSEs) of 1.16' in the canals of the marshes were observed during a survey across the project site layout in 2023.

The site NATURALLY flows from south to north. As part of the development done by IMTT they have constructed gravity channels and two pump stations. The first pump station, located south of the existing railway (referenced herein and shown as Pump Station 1 in Figure 3), contains four (4) pumps with a total pumping capacity of approximately 10,000 gpm (22.28 cubic feet per second [cfs]) and which pumps water underneath the existing railroad and then north via through a series of gravity drainage ditches; the second pump station, located north of the existing railroad and towards the back of the existing IMTT site (referencing herein and shown as Pump Station 2 in Figure 3), contains four (4) pumps with a total pumping capacity of approximately 17,800 gpm (39.66 cfs) and discharges into a drainage ditch that then also drains south to north, eventually flattening to allow sheet flow north to Cross Bayou Canal.

Project contractors will be required to obtain stormwater coverage under LDEQ's LPDES construction permit. This will include the implementation of best management practices to control storm water runoff, regular inspections, and other requirements to ensure water quality.

3. PROPOSED SITE CHANGES

The major proposed site changes include the following major sources of fill placement:

- the proposed SCCF site developed north of the existing IMTT tank farms will be graded to elevations between 5' to 7.5',
- the proposed four (4) new Blue Ammonia tanks located south of the proposed SCCF site that will be owned and operated by IMTT, and
- the proposed heavy haul road which is to extend along the western boundary of IMTT's existing property and provide access from the Mississippi River to the SCCF project site and which will also be graded to elevations between 5' to 7.5'.

Management of the stormwater runoff originating from the SCCF site, the four (4) new Blue Ammonia tanks that will be designed, constructed, and operated by IMTT, and the stormwater runoff originating from the existing IMTT tank farms will be managed by additions and modification to the existing drainage features as described

below. These additions and modifications to the existing site are depicted in Figure 4, in addition to the general flow patterns following the proposed construction.

3.1. Detention Pond

SCCF will construct a permanent detention pond to help detain stormwater runoff: a pond located towards the southeastern portion of the SCCF site. The detention pond will have an outfall located at a minimum elevation of 1' to allow the pond to drain to a dry condition over time and has been sized to detain stormwater volume from the facility development site for the 100-year 24-hour storm event. Stormwater is to be released from the detention pond to a containment ditch situated along the eastern boundary of the SCCF site (Section 3.2).

3.2. Containment Ditch along Eastern Boundary of the SCCF Site

SCCF will construct a containment ditch along the southeastern and eastern boundary of the SCCF site which will receive runoff from both the detention pond (Section 3.1) and from IMTT's upsized Pump Station 2 (Section 3.3). This ditch will include a 40-foot bottom width, side slopes of 2:1, starting invert elevation of 0.80', final invert of -0.08', and total of length of 4,211 feet (slope 0.02%). The eastern bank elevation of the containment ditch is to be approximately 4'.

3.3. Proposed Modifications to IMTT's Existing Infrastructure

SCCF has identified impacts to the existing drainage plan utilized by the IMTT facility from the construction of the Ammonia production facility. Modifications to IMTT's existing drainage infrastructure (culverts, canals, pumps, etc.) will be completed by IMTT to maintain the existing drainage pattern from south to north. There are two primary modifications and two secondary modifications to IMTT's existing infrastructure.

The first modification will be to the existing intake canal within IMTT's facility. This canal flows west to east until reaching IMTT's Pump Station 2. The canal will be upsized to a 35-foot bottom width with 2:1 side slopes. The upsized intake canal will be extended to wrap around the proposed Ammonia Tank farm of IMTT such that the starting invert of the canal is 1.98' resulting in a slope of 0.2% over the entirety of the canal's new expanded 3,560-foot length; the bottom invert of the upsized intake canal near IMTT's Pump Station 2 will remain unchanged from its existing elevation at -5.08'.

The second primary modification will be to increase the pumping capacity of Pump Station 2 to 134,658 gpm (300 cfs). The outfall from Pump Station 2 will be directed to the new containment ditch located along the eastern boundary of the SCCF site (Section 3.2). While IMTT will operate this on an as-needed basis, Pump Station 2 was designed with an on/off WSE of 1.5' and 1.0' which is in line with the current operations followed by IMTT.

The secondary modifications will be to upsize three (3) existing IMTT culverts to promote effective drainage as detailed below.

- A single existing 2.5' diameter culvert linking the contained area surrounding Node 2 to the intake canal will be upsized to three (3) 4' diameter culverts.
- Two (2) existing 2' culverts linking the contained area surrounding Node 3 to the modified intake canal will be upsized to two (2) 4' diameter culverts.

3.4. New Intake Canal and Pump

A new intake canal (Intake Canal 02 as depicted on Figure 4) extending from the railroad and along the western portion of the SCCF site will be constructed on the east side of the heavy haul road. Intake canal 2 will divert stormwater south to north that would otherwise be trapped by the construction of the new heavy haul road. This intake canal will include a new pump station (Pump Station 03 as depicted in Figure 4) that will have a pumping capacity of 200 cfs.

4. MODEL SETUP

SCCF created a 2-dimensional United States Army Corps of Engineers (USACE) Hydrologic Engineering Centers River Analysis System (HEC-RAS) model to evaluate potential impacts to maximum WSEs and peak runoff to the existing IMTT site and surrounding areas once construction is complete. The model domain selected included a northern boundary of LA HWY 61 (Airline Highway), a southern boundary of the Mississippi River Levee, and western and eastern boundaries that were sufficiently offset from the proposed facility footprint in order to capture potential hydrological impacts in the surrounding areas.

The model was created using a 2-dimensional mesh with a cell size of 75 feet by 75 feet over the project area. Break lines were implemented at major features such as, existing roads, levees, and waterways within the site boundary. The land use for each cell was derived from the 2019 USGS National Land Use / Land Cover database. The primary land use classification is woody wetlands. The Manning's Roughness layer was developed for the model using the USGS National Land Cover Database. SCCF conducted field verification of existing conditions in 2023.The following assumptions were used to develop the model:

- Design event: 100-year, 24-hour event (13.7 inches of rainfall via NOAA Atlas 14) - applied as a boundary condition over the entire model area.
- Starting WSE: 1-foot NAVD88 (') along the western and eastern boundaries of the project site and within all canals and the detention pond
- A stage hydrograph boundary condition, a time series of the water surface elevation over the simulation time, with a constant value of -0.28' along Cross Bayou
- Normal depth boundary conditions, which assume a uniform flow at a specified slope, of 0.001% along western and eastern boundaries.
- Pump station on/off elevations: 1.0' on / 1.5' off.
- All culverts were assumed to be unblocked.

To analyze the capacity of the proposed detention pond, the site was divided into appropriate drainage areas. Runoff hydrographs were developed for each drainage area using USACE's Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) v4.9. SCCF applied the hydrographs developed for each drainage area as internal boundary conditions in the master HEC-RAS 2-D model and applied them to the pond. Furthermore, SCCF sized outfall structures associated with the pond to allow water surface elevations (WSEs) in the pond to stage below the proposed bank elevations of approximately 5.25'.

The existing conditions model (ECM) terrain relied on USGS 2017 1-m resolution lidar supplemented with recent topographic and hydrographic information collected in 2023. The existing terrain (Figure 5) around the project area contains continuous marsh separated intermittently by small bayous and trenasses, with marsh elevations varying between 0.5' to 2.0'.

The terrain generated is associated with the proposed construction of the proposed conditions model (PCM) by modifying the ECM terrain according to the grading plans associated with the facility (Figure 6) and according to the proposed drainage features identified within Section 3

5. ASSESSMENT OF IMPACTS TO EXISTING HYDROLOGY AND HYDRAULICS

5.1. Reporting Locations

The impacts of the proposed SCCF site and modifications to IMTT's existing site were assessed considering both maximum WSE and peak flow. Assessments were performed via the application of (a) nodes strategically located within and offsite of the proposed development to compare maximum WSE (Figure 7) and (b) profile lines located along the western, eastern, and northern boundaries of the site to compare changes in peak flow (Figure 8). Nodes were placed at specific locations as follows:

- Nodes 1 through 5 which are located on various locations within IMTT's existing facility,
- Nodes 6, 6A, and 7 which are located to the west of the reporting boundary within an existing undeveloped low-lying wooded area,
- Nodes 8 and 9 which are located to the east of the reporting boundary within an existing undeveloped low-lying wooded area,

- Nodes 10 through 11 which are within the proposed eastern containment ditch,
- Node 12 which is within the proposed detention pond to verify the maximum stage reached, and
- Nodes 13 and 14 located at the northern back portion of the SCCF site.
- Nodes 15 and 17 are located south of the railroad and within residential areas.

5.2. Impacts to Maximum Water Surface Elevations

The project with improvements will have very minimal impacts (less than 0.25 ft.) to WSE on the IMTT site and properties surrounding the project area. Table 1 lists maximum change of WSE from the existing conditions to the final WSE following construction at each node. The change in WSE should have no impact on existing flood control measures. The increases are localized and dissipate as stormwater flows towards the Cross Bayou pump station.

Table 1. Resulting Delta (Δ) in Maximum WSE (')

Existing IMTT Infrastructure					Western Boundary			Eastern Boundary		Northern Boundary		Southern Residential	
Node 1 Δ	Node 2 Δ	Node 3 Δ	Node 4 Δ	Node 5 Δ	Node 6 Δ	Node 6A Δ	Node 7 Δ	Node 8 Δ	Node 9 Δ	Node 13 Δ	Node 14 Δ	Node 15 Δ	Node 17 Δ
0.18	*0.24*	*-0.34*	*-0.04*	*-0.30*	*0.10*	*0.04*	*0.04*	*0.03*	*0.07*	*0.09*	*0.09*	*0.00*	*0.00*
* positive Δ values implies Maximum WSEs are increasing in the proposed condition.													

Table 2 lists the maximum WSE recorded for the proposed detention pond and the containment ditch located along the eastern boundary. Rasters of the predicted deltas in maximum WSE across the entirety of the model domain can be found in Figure 9.

Table 2. Maximum WSE (') Recorded at Each Node

Containment Ditch		Pond
Node 10	Node 11	Node 12
3.93	*1.64*	*4.97*

5.3. Impacts to Rates of Discharge and Water Flow Patterns

While the proposed SCCF site and IMTT facility alter existing flow patterns, the improvements to both the SCCF and IMTT facilities prevent higher runoff rates from impacting the immediate surrounding locations. As shown via Table 3, the increases in peak flow at Eastern Boundary 2, Western Boundary 2, and the Northern Boundary occur only beyond the northern boundary of the site where no existing residential, commercial, or industrial structure are present. These increases in peak stormwater runoff should have no adverse impact on existing flood control measures.

A summary of the model results for the proposed conditions can be found in Table 3.

Table 3. Resulting Delta (Δ) in Peak Flow at Site Boundaries (CFS)

Boundary	Existing Conditions Peak Flow [cfs]	Proposed Conditions Peak Flow [cfs]	Difference (Δ) from Existing Conditions
Eastern Boundary 1	86.14	23.12	-63.02
Eastern Boundary 2	117.80	191.76	73.96
Western Boundary 1	158.33	101.21	-57.12
Western Boundary 2	132.98	250.89	117.91
Northern Boundary	188.26	228.14	39.88

5.4. Water Quality Parameters and Potential Impacts

The primary parameters of concern associated with construction of the facility will be total suspended solids (TSS). SCCF will apply for LPDES Construction Stormwater Permit which will require SCCF to prevent the release of heavily silt laden water from leaving the project site. SCCF will visually monitor non-point discharges of stormwater according to permit requirements. Point discharges will be directed into designated outfalls and monitored and sampled according to permit requirements. SCCF will prepare and submit Discharge Monitoring Reports (DMRs) to the LDEQ as required by the permit.

SSCF will apply for and obtain an LPDES Water Discharge permit for operations of the facility. All water discharged during operations of the facility will be treated on site prior to discharge to meet LDEQ water quality standards; therefore, there will be no effect on water quality. SCCF will monitor specific parameters and report water quality parameters at discharge locations as required by the state.

5.5 Identification of the steps, procedures and/or BMPs to be used to lessen point source and non-point source impacts on surface water quality.

SCCF will develop and implement a site wide Stormwater Pollution Prevention Plan (SWPPP) as part of the Notice of Intent (NOI) for LPDES Construction Stormwater permit. The SWPPP will identify the measures to be implemented (silt fence, straw wattles, and detention ponds). Periodic inspections will ensure that BMPs are maintained and effective in preventing heavily silt-laden water from leaving the site.

For operations, a SWPPP will be developed as part of the LPDES Discharge Permit. The Operational SWPPP will identify measures to be implemented (stormwater ponds, curbing for stormwater management, water treatment for wastewater generated on site, etc.). The Permit will indicate allowable discharges and monitoring requirements.

6. CONCLUSIONS

The evaluation performed for this project illustrates that the plans associated with the proposed SCCF site should have no appreciable impact on the existing drainage network or surrounding area. In particular, as demonstrated by Figure 7, no increases in maximum WSE are predicted south of the Canadian National railroad, which is where residential neighborhoods are located. The largest increases in maximum WSE between existing conditions and proposed conditions, outside of the areas contained within IMTT's existing facilities, will occur north of the proposed development and should result in temporary increases of less than a tenth of a foot.

ATTACHMENT 1: FIGURES

***Figure 1**. Property Ownership Map*

***Figure 2**. Regional Hydrology Map*

***Figure 3**. Local Drainage Map – Existing Conditions*

***Figure 4**. Local Drainage Map – Proposed Conditions*

***Figure 5**. Existing Model Terrain*

***Figure 6**. Proposed Model Terrain*

***Figure 7**. Maximum WSE Comparison Nodes*

***Figure 8**. Flow Comparison Locations*

***Figure 9**. Maximum WSE Delta between Models (PCM – ECM)*

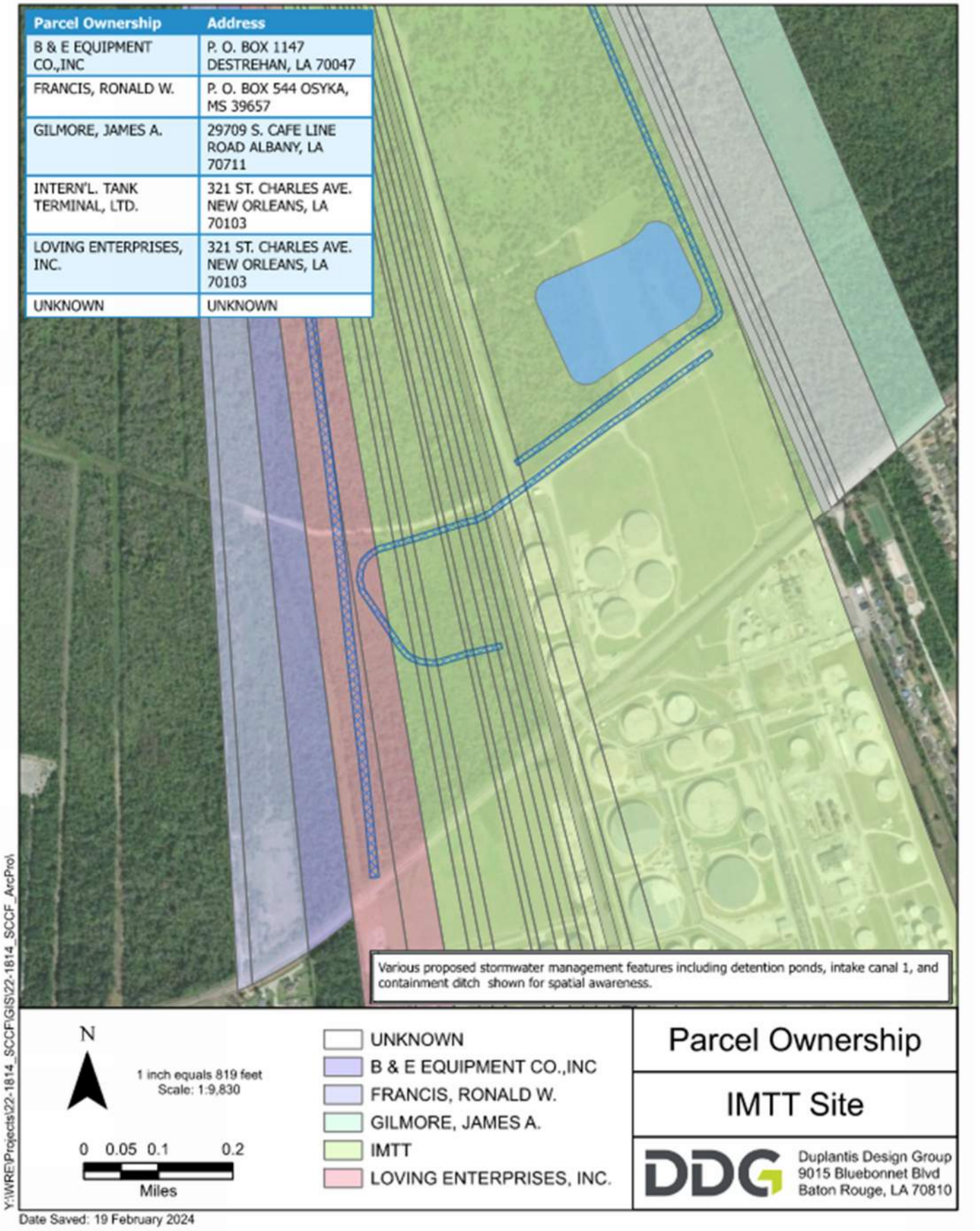

Figure 1. *Property Ownership Map*

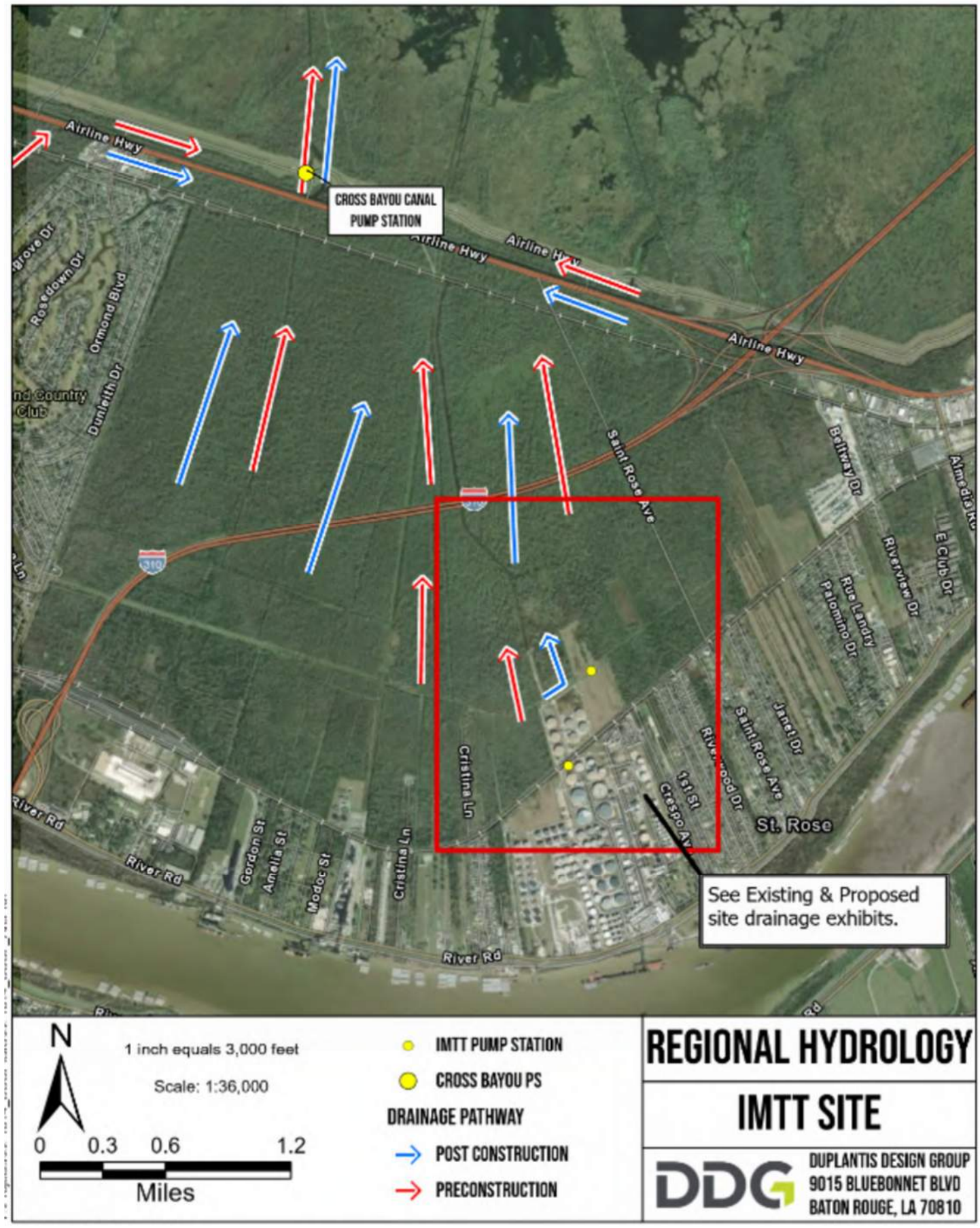

Figure 2. *Regional Hydrology Map*

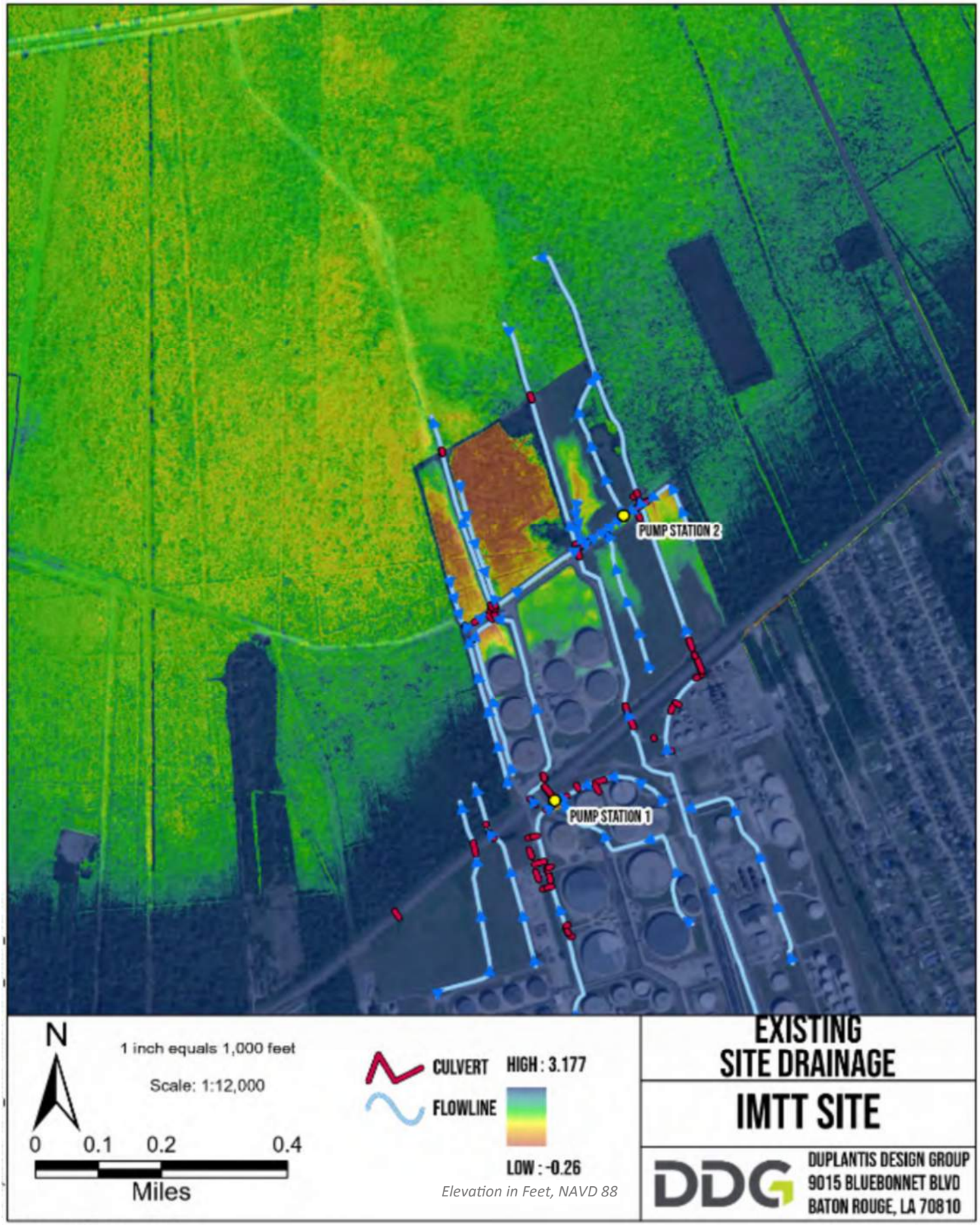

Figure 3. *Local Drainage Map – Existing Conditions*

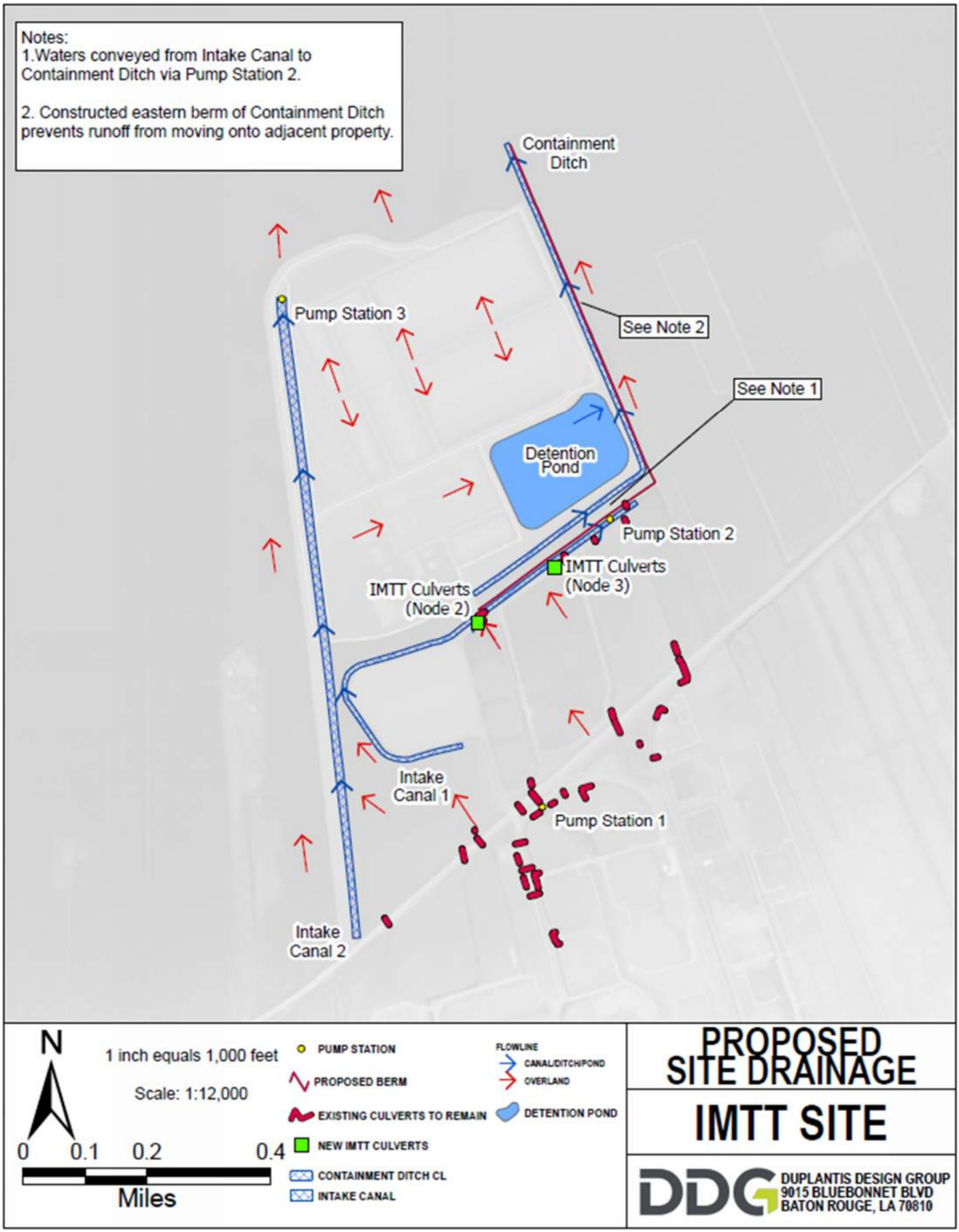

Figure 4. *Local Drainage Map – Proposed Conditions*

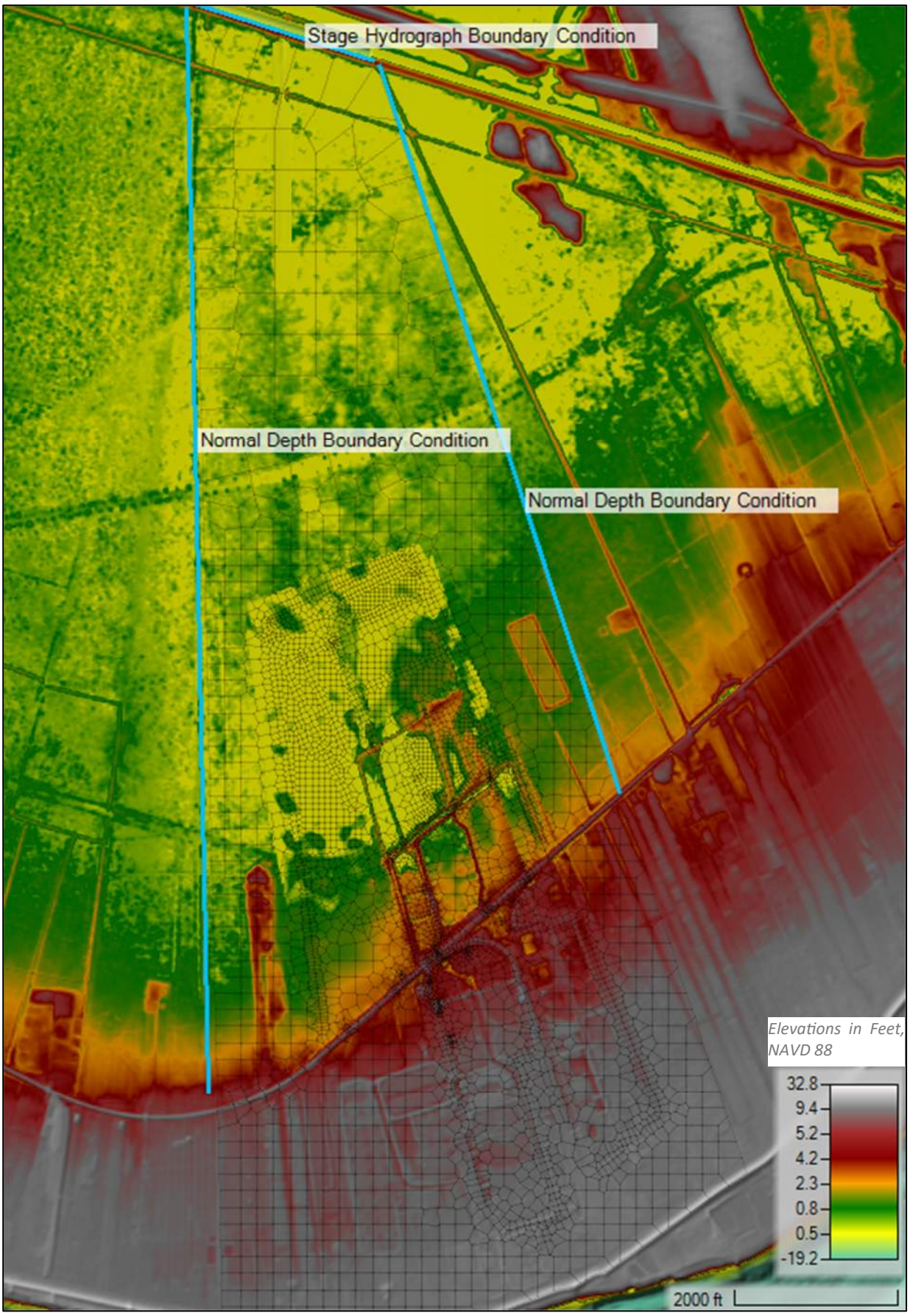

Figure 5. *Existing Model Terrain*

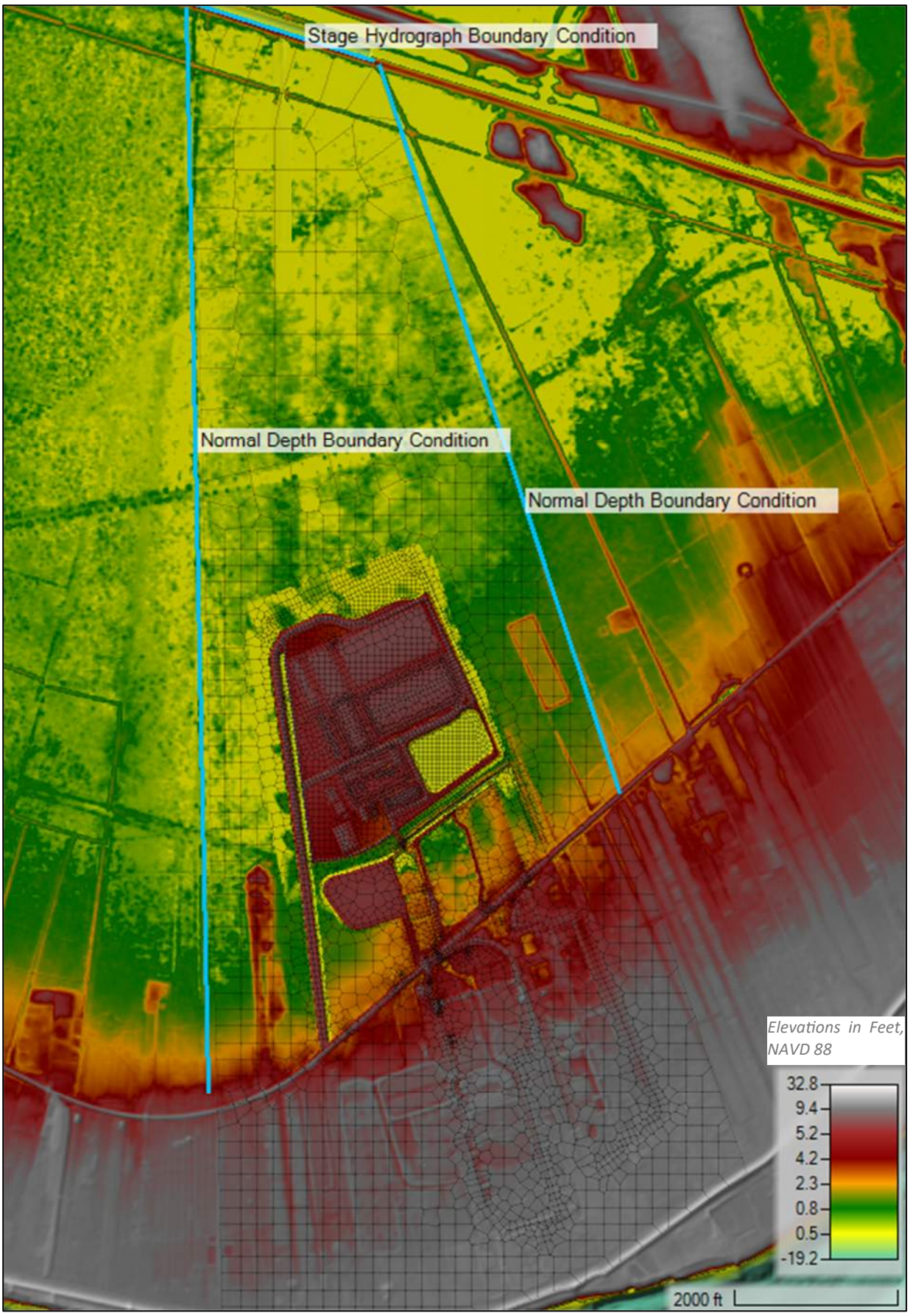

Figure 6. *Proposed Model Terrain*

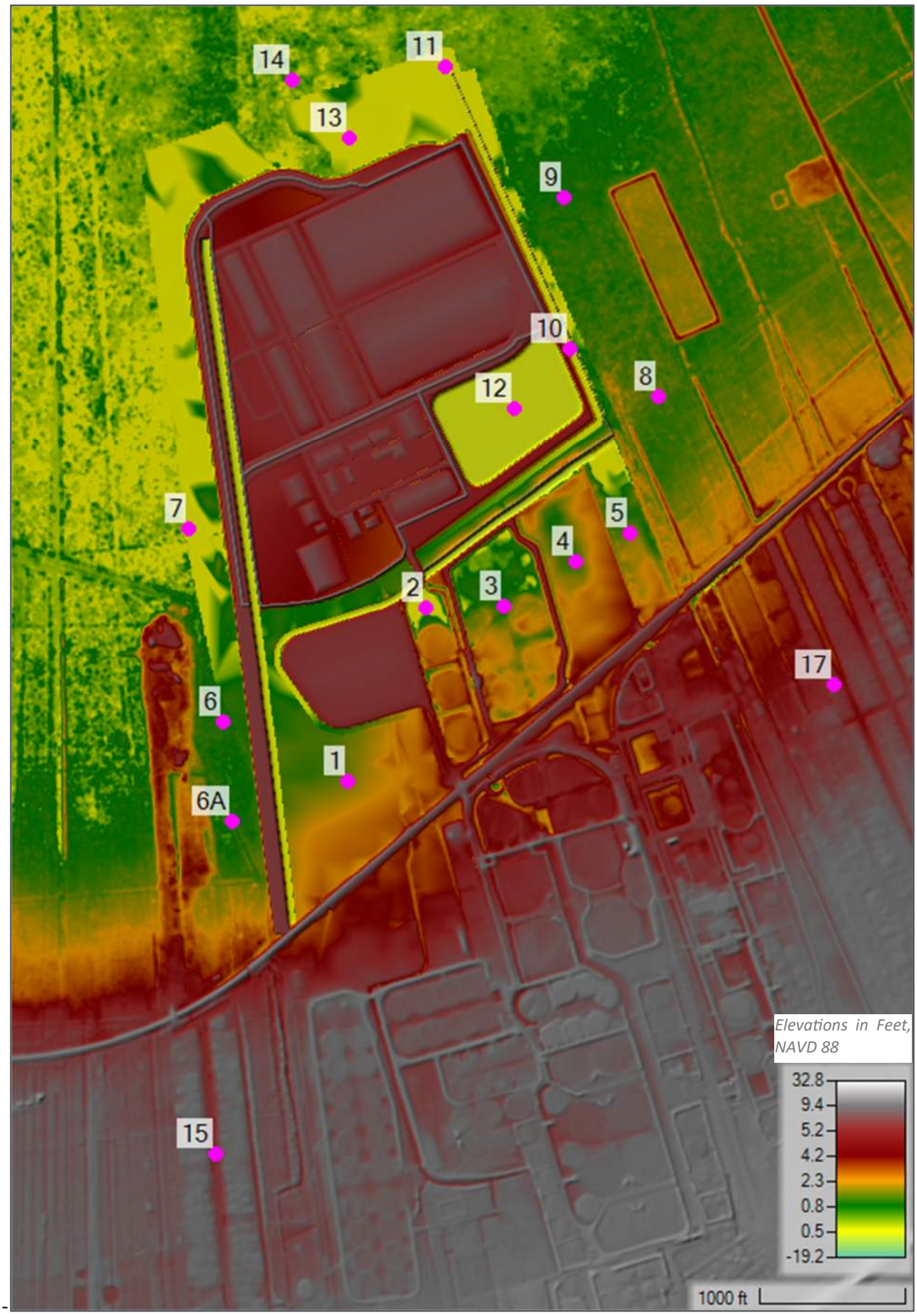

Figure 7. *Maximum WSE Comparison Nodes*

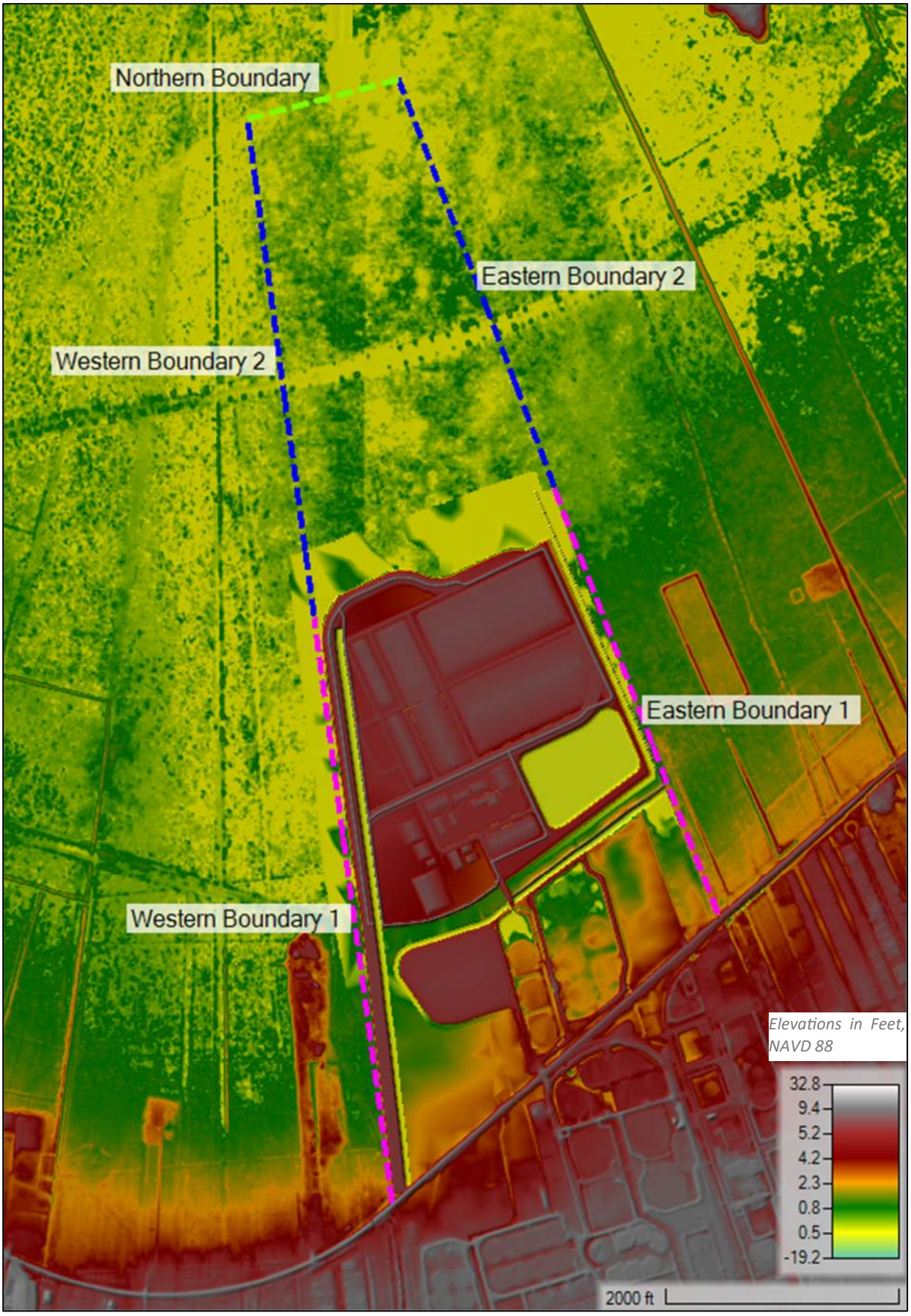

Figure 8. *Flow Comparison Locations*

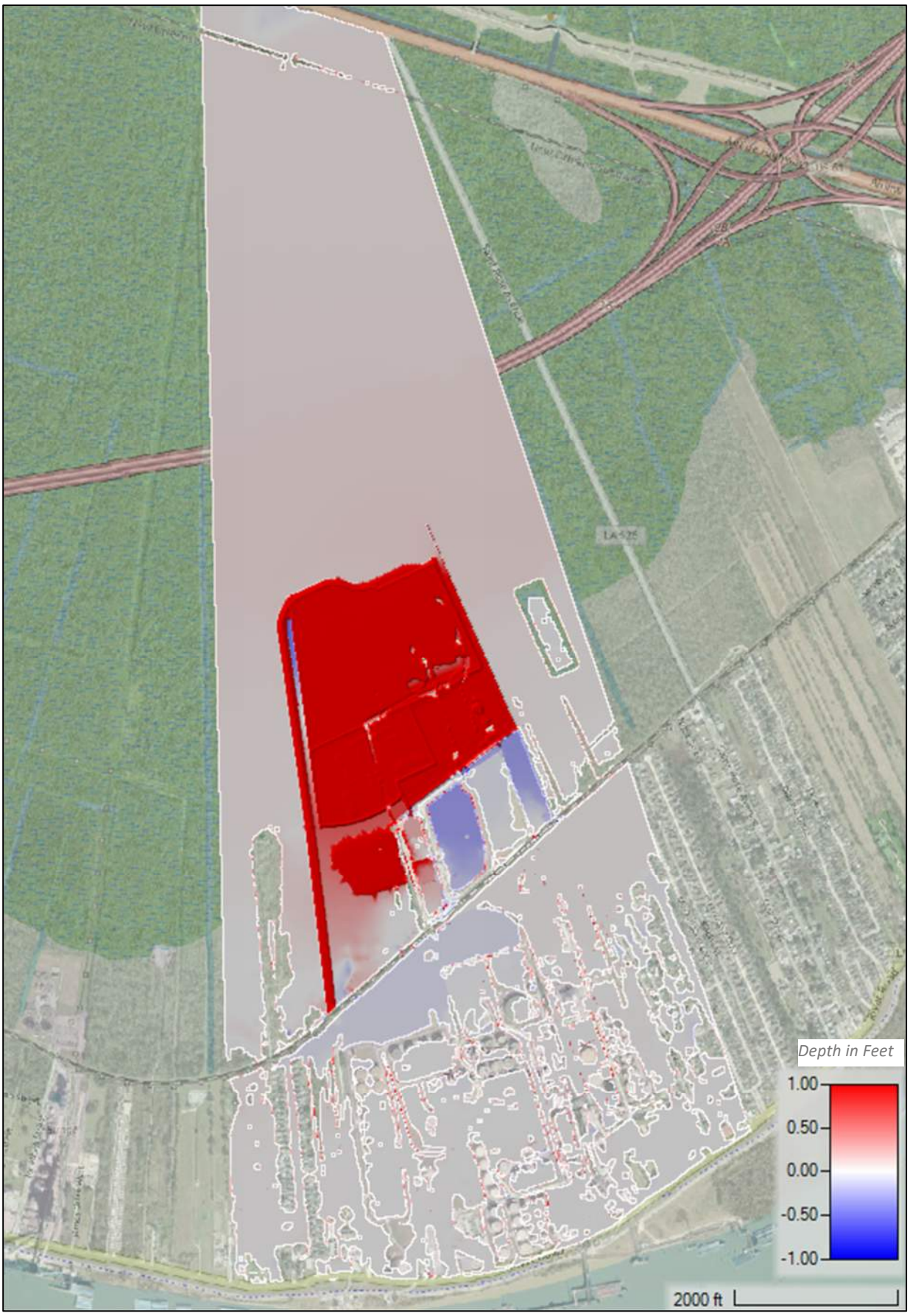

Figure 9. *Maximum WSE Delta between Models (PCM – ECM)*

ATTACHMENT 2: PERMIT MATRIX OF CRITICAL DISCRETIONARY PERMITS FOR ST. CHARLES CLEAN FUELS PROJECT

Agency	Permit
FEDERAL PERMITS	
USACE	404/Section 10 Permit
	Section 408
USCG	Waterway Suitability Analysis
FAA	Notification of Proposed Construction
STATE PERMITS	
LDEQ	Emissions of Air Pollutants from Minor Source
	LPDES Construction Stormwater
	401 Water Quality Certification
	Sanitary Wastewater Discharge
	Hydro Test water discharge
LDNR	Coastal Use Permit
State Fire Marshal	Fire Marshal Plan approval
LDOTD	Permit & Letter of Endorsement
	Access Connection Permit
CPRA	Letter of No Objection
LOCAL	
St. Charles Parish	Letter of No Objection