Levee Analysis and Mapping Plan
City of Binghamton Levees

City of Binghamton

June 2018

FEMA

RiskMAP
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Acronyms

BFE	Base Flood Elevation
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
LLPT	Local Levee Partnership Team
LOMA	Letter of Map Amendment
LOMC	Letter of Map Change
LOMR	Letter of Map Revision
NAVD 88	North American Vertical Datum of 1988
NGVD 29	National Geodetic Vertical Datum of 1929
NYSDEC	New York State Department of Environmental Conservation
USACE	U.S. Army Corps of Engineers

Definitions

The terms below have been used in this document. Additional terms are provided in FEMA's *Analysis and Mapping Procedures for Non-Accredited Levee Systems* (July 2013) in the Glossary of Levee Terms. This document is available from the FEMA Library at https://www.fema.gov/media-library-data/20130726-1922-25045-4455/20130703_approachdocument_508.pdf.

Base Flood Elevation (BFE) – The elevation of a flood having a 1-percent chance of being equaled or exceeded in any given year.

Levee Analysis and Mapping Procedure Approach* – Levee Analysis and Mapping Procedures include Sound Reach, Freeboard Deficient Procedure, Overtopping Analysis, Structural Based Inundation, and Natural Valley. Details on these approaches can be found in FEMA's *Analysis and Mapping Procedures for Non-Accredited Levee Systems* (July 2013).

Leveed Area – All land areas that would be subject to inundation by the one percent annual chance flood if the levee system was not present.

Levee Reach – Any continuous section of a levee system to which a single analysis and mapping procedure may be applied.

Levee Segment - A discrete portion of a levee system that is operated and maintained by a single entity.

Levee System – A flood hazard-reduction system that consists of one or more levee segments and other features such as floodwalls and pump stations, which are interconnected and necessary to ensure exclusion of the design flood from the associated leveed area, and which are constructed and operated in accordance with sound engineering practices.

Local Levee Partnership Team (LLPT) – A work group that is facilitated by FEMA when a non-accredited levee system in a community or project area will be analyzed and the areas landward of the levee system will be mapped. The primary function of this group is to share information/data and identify options based on stakeholder roles and knowledge.

Non-Accredited Levee System – A levee system that does not meet the requirements in the NFIP regulations at Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44 CFR § 65.10) and is not shown on a FIRM as reducing the base flood hazards.

Zone D – Area of undetermined but possible flood hazard.

*All definitions on this page except for this one are from FEMA's Analysis and Mapping Procedures for Non-Accredited Levee Systems (July 2013)

0 Executive Summary

The Federal Emergency Management Agency's (FEMA's) Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM) for the City of Binghamton, Broome County, New York must be revised to reasonably account for the hazard reduction impacts of non-accredited levees. FEMA's guidance was revised in 2013 to incorporate a new Levee Analysis and Mapping Procedure which provides a suite of flexible procedures to perform flood hazard analysis and mapping (see Section 1). The City of Binghamton has a flood management project where the levee systems are being studied using the Levee Analysis and Mapping Procedures (see Section 2).

In July of 2016, FEMA Region II partnered with stakeholders in the City of Binghamton to form a collaborative Local Levee Partnership Team (LLPT) and worked to determine potential Levee Analysis and Mapping Procedures for the City of Binghamton levee system (see Sections 3 and 4 respectively). The process involved the collection and group evaluation of available data, creation and evaluation of analysis and mapping, and detailed discussions on mapping needs.

The information gained through the extensive coordination of the LLPT is now supplemented by a recently completed "first pass" Levee Analysis and Mapping Procedure analysis (see Section 5). The information collected and the analysis performed allows for the development of this document—a plan outlining potential reach procedures. This document informs the path forward (see Section 6). Two LLPT meetings one in February of 2017 and another in May of 2018 allowed FEMA to present the first pass Levee Analysis and Mapping Procedure analyses and discuss the options for moving forward. Based on the limited information at this time, the City of Binghamton has elected the Natural Valley procedure with the understanding that first pass analysis will be augmented with updated H&H prior to revised mapping. The city has expressed interest, and retains the option to move forward with accreditation or other applicable Levee procedures at any time, should funding become available and sufficient information be provided to meet the applicable data requirements.

This Levee Analysis and Mapping Plan summarizes the discussions and decisions by FEMA and project stakeholders on how best to map the flood hazards landward of the City of Binghamton levee systems.

1 Introduction

Under FEMA's prior levee approach, a levee system that did not meet the National Flood Insurance Program (NFIP) requirements was analyzed and mapped as if it provided no protection during a base (1-percent-annual-chance) flood. This was known as the "without levee" approach.

Some stakeholders expressed concern about the "without levee" approach. Members of both the U.S. House of Representatives and the U.S. Senate echoed this concern and asked FEMA to consider discontinuing the "without levee" approach. Accordingly, FEMA drew on current modeling techniques to refine the identification of flood hazard reduction that non-accredited levee systems provide. This process recognizes that such modeling is never precise.

FEMA, its Production and Technical Services contractor (STARR II) and Community Engagement and Risk Communication contractor (CERC) initiated the Levee Analysis and Mapping Procedures process for the levees in the City of Binghamton. Recent technological advances in data collection

methods and hydrologic and hydraulic modeling were leveraged as part of this process. Levee Analysis and Mapping Procedures is a more refined approach to mapping flood hazards in areas landward of levee systems than the former approach.

The Levee Analysis and Mapping Procedures process also:

- Leverages local knowledge and data, with proactive stakeholder engagement in LLPTs;
- Aligns available resources for engineering analyses and mapping commensurate with the level of risk in the areas impacted by the levee; and
- Considers the unique characteristics of each levee system from an engineering perspective.

The levee systems in the City of Binghamton are not currently accredited. FEMA is using the Levee Analysis and Mapping Procedures process to develop refined flood hazard mapping in areas landward of the levees. Updated regulatory flood hazard mapping is not anticipated in this community for a number of years, so this effort is intended to provide a more realistic representation of levee-related flood hazards in the City of Binghamton for community officials and emergency managers to use in development and preparedness planning.

The Levee Analysis and Mapping Procedures process is conducted in four phases:

- **Phase 0: Flood Structure Identification and Review:** Levee systems are identified and verified as being constructed, operated, and maintained as flood risk reduction structures. An LLPT is established during this phase.
- **Phase 1: Analysis and Mapping Plan Preparation:** LLPT meetings are held periodically to review available data and documentation. Discussions assist in the preparation of an Analysis and Mapping Plan based on the available information.
- **Phase 2: Analysis Preparation and Results Review (if applicable):** Analysis is performed by FEMA and shared with the LLPT to validate results against available data and documentation. Results are compared to effective FISs to update the LAMP Plan, if necessary. Draft maps prepared at this stage may be used as best available data for floodplain management.
- **Phase 3: FIRM Update, Due Process and Effective FIRM Issuance:** FIRM panels are updated with Phase 2 results. Communities and FEMA follow all NFIP regulatory due process procedures, and updated FIRM panels are adopted as the regulatory basis for local floodplain management.

This report describes the Levee Analysis and Mapping Plan for the City of Binghamton levee systems, a result of the collaboration between FEMA, the City of Binghamton, and Broome County, New York State Department of Environmental Conservation (NYSDEC), U.S. Army Corps of Engineers (USACE), and other local stakeholders. This report documents the progress through Phase 1, including the first pass analysis results and data evaluation, as well as the community's selection of the preferred Levee Analysis and Mapping Procedures scenario.

2 Levee System Description

2.1 Flood Protection Measures in the City of Binghamton

The City of Binghamton levee systems (see Figure 1) are comprised of a series of riverine flood control structures designed to reduce the flood risk from the Susquehanna River, Chenango River and Pierce Creek (see Figure 1) in the City of Binghamton, Broome County, New York.

Table 1. City of Binghamton Flood Control Systems Data.

Owner	U.S. Army Corps of Engineers (USACE)
Maintained by	New York State Department of Environmental Conservation (NYSDEC)
Built	U.S. Army Corps of Engineers (USACE)
Flooding Source	Susquehanna River, Chenango River & Pierce Creek
Length	20,786 feet of Levee Structures
Pump Stations	9
Closure Structures	10

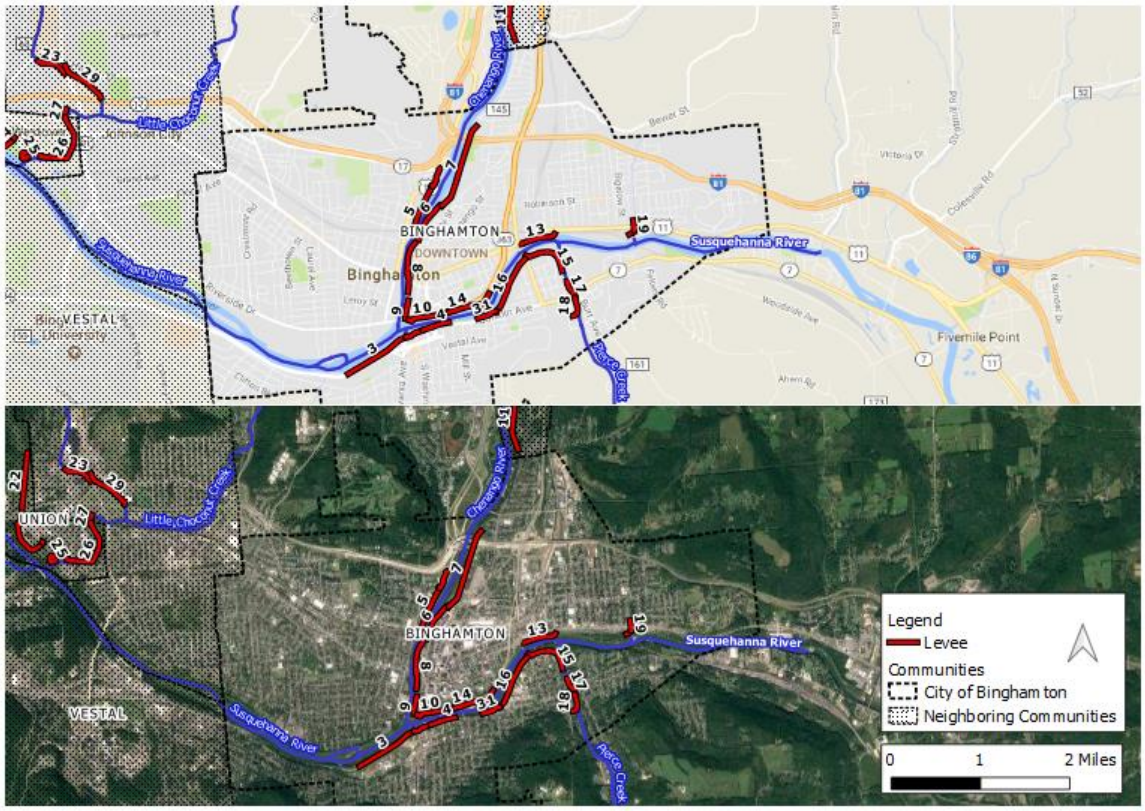


Figure 1: General Location Map

Due to the complexity and extent of the levees in the City of Binghamton, unique identifiers (Levee ID's) were assigned for the purposes of this analysis. The assignment of Levee ID's was determined principally for Geographic Information Services (GIS) considerations and natural

boundaries for use in facilitating Levee Analysis and Mapping Procedures meetings. Pertinent Levee ID for each segment identified in Figure 1 is summarized in Section 5.

2.2 Pump Stations

Nine pump stations were identified in the National Levee Database in the City of Binghamton. See Figure 2 for location & Table 2 for identification.

Table 2. Summary of Pump Stations Identified in Project Area

NLD Segment ID	Map ID	Flooding Source	Levee Segment #
2314060008	1579	Chenango River	5
2314060014	1583	Chenango River	5
2314060003	1576	Chenango River	9
2314060012	1582	Susquehanna River	3
2314060009	1580	Susquehanna River	16
2314060010	1581	Susquehanna River	13

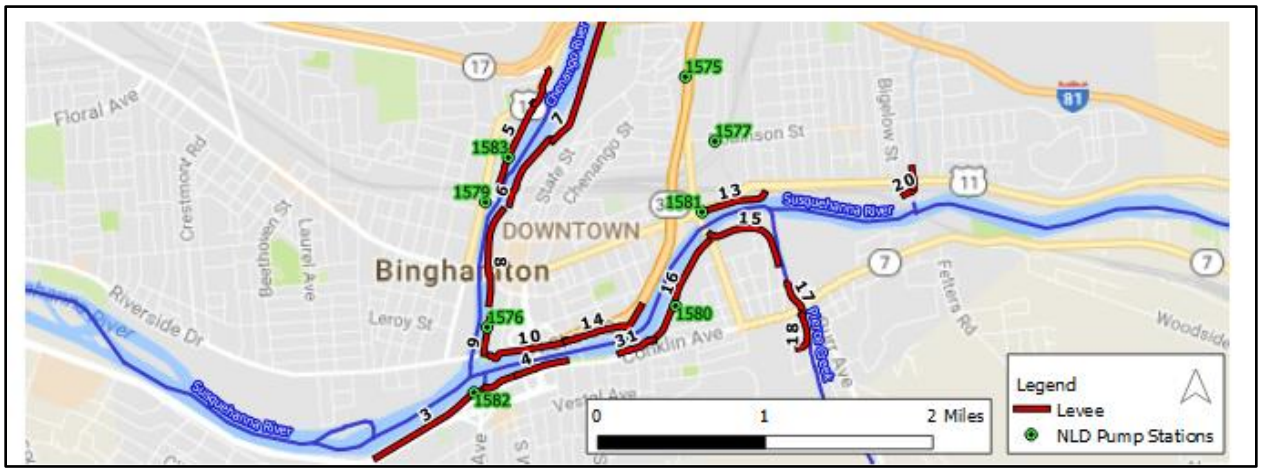


Figure 2: Pump Stations

2.3 Levee Analysis and Mapping Procedures Flood Risk Project

Table 3 and Table 4 summarize the communities' NFIP and FIRM history.

Table 3. Summary of Communities in Project Area

County	Community	Participating in the NFIP?	Approximate Number of Structures Impacted by Levee Systems
Broome County	City of Binghamton	Yes	2367

Table 4. Community Map History

Community Name	Initial Identification	Flood Hazard Boundary Map Revision Date(s)	FIRM Effective Date	FIRM Revision Date(s)
City of Binghamton	April 12, 1974	October 17, 1975 April 23, 1976	June 1, 1977	None

While the effective FIS for the City of Binghamton states that existing local flood protection measures reduce the hazard from Susquehanna River and Chenango River and to a lesser extent Pierce Creeks, recent experience clearly identified the limits of that hazard reduction. The effective FIS states that the protective works provide protection for Binghamton for design discharges of up to 80,000 cfs on the Susquehanna River Reach 1 and 75,000 cfs on the Chenango River. In comparison, based on the Post Tropical Storm (TS) Lee gage analysis, the 1-percent annual exceedance discharge is 73,267 cfs and 64,469 cfs, respectively, which is just below the design storm.

A countywide FIS was issued in preliminary form for Broome County, New York on February 5, 2010. According to the FIS report, a majority of the levee sections on the Susquehanna River and Chenango River did not have adequate freeboard so the floodplain analysis was based on the without-levee scenario. The preliminary maps never went to Letter of Final Determination in Broome County, primarily due to a need for incorporating data from storm events that occurred after the data collection stage in the analysis. The regulatory flood hazard mapping updates will resume once a new comprehensive analysis can be performed

2.4 Levee Analysis And Mapping Procedures Process Tasks

The Levee Analysis and Mapping Procedures process is divided into six distinct tasks: LLPT formation, Field Reconnaissance, Perform Initial Levee Analysis, Flood Risk Outreach, Complete Levee Analysis and Mapping Plan, and Produce Preliminary Products/Issue Preliminary (see Table 5).

Table 5. Project Tasks

Task	Details	Tentative Start/End Dates*
LLPT Compilation (Phase 0)	Identification and outreach to individuals to serve on the LLPT.	12/2/2015 – 12/10/2015
Field Reconnaissance (Phase 1)	LLPT to determine levee reaches to study and potential analysis of those reaches. Perform field reconnaissance of these reaches.	6/27/2016-6/28/2016
Perform Initial Levee Analysis and develop Levee Analysis and Mapping Plan (Phase 1)	FEMA to collaborate with the LLPT to develop analysis based on Field Reconnaissance findings and Levee Analysis and Mapping Plan.	6/27/2016 – 3/31/2017
Flood Risk Outreach (Phase 2)	LLPT to assess results of the Field Reconnaissance and Perform Levee Analysis tasks. LLPT to work at the local level to disseminate findings that could impact local communities.	5/15/2018

Task	Details	Tentative Start/End Dates*
Complete Levee Analysis and Mapping Plan; Finalize Levee Analysis and Mapping Procedures mapping (Phase 2)	FEMA to complete detailed analysis based on chosen approach, develop mapping, and finalize Levee Analysis and Mapping Plan; develop final analysis and mapping.	TBD
Produce Preliminary Products / Issue Preliminary (Phase 3)	FEMA to develop Preliminary Products (including FIRM database) from revised analysis above if that is the direction from FEMA and LLPT.	TBD

*All schedules are tentative and will be adjusted at the pace of the LLPT.

3 Local Levee Partnership Team

Based on the community meeting associated with the 2010 preliminary FIRM issuance, several stakeholders were identified as members of the LLPT (See Table 4). The LLPT was formed to provide FEMA with data and input, including feedback on the procedures to be used for analyzing and mapping the levee reach, based on local levee conditions. The stakeholders who participated in the LLPT for this project are listed in Table 6.

Table 6. Local Levee Partnership Team Participants

LLPT Member	Contact Information
Juliet Berling	City of Binghamton, Director, PHCD
Thomas Costello	City of Binghamton, Code Enforcement
Tim Coyne	City of Binghamton
Richard David	City of Binghamton
Franco Incitti	City of Binghamton
Terry Kellogg	City of Binghamton, DPW Commissioner
Tim Konetchy	City of Binghamton
Ray L. Standish, PE	City of Binghamton
Stephanie Brewer	Broome County Planning
Frank Evangelisti	Broome County Planning
Beth Lucas	Broome County
Andrew Gavin	Susquehanna River Basin Commission

LLPT Member	Contact Information
Benjamin Pratt	Susquehanna River Basin Commission
Kevin Delaney	New York State Department of Environmental Conservation
Dan Fuller	New York State Department of Environmental Conservation
Kerrie O'Keeffe	New York State Department of Environmental Conservation
Ben Gertain Plowe	New York State Department of Environmental Conservation – Kirkwood
Bill Nechamen	New York State Department of Environmental Conservation
Brad Wenskoski	New York State Department of Environmental Conservation
Joann Aufforth	USACE - Baltimore District, PL 84-99
George Bielen	USACE
*Joe Reed	USACE - Baltimore District, Levee Safety Program Manager
Dave Robbins	USACE - Baltimore District
Leon Skinner	USACE - Baltimore District, Construction Representative
Raymond Tracy	USACE - Baltimore District *Took over for Joe Reed when Joe left USACE.
Thomas Mendez	FEMA Region II
Curtis Smith	FEMA Region II
Alan Springett	FEMA Region II
Srikanth Koka	STARR II
Seth Lawler	STARR II
Amber Greene	Community Engagement and Risk Communication (CERC)
Paige Mandy	Community Engagement and Risk Communication(CERC)
Thomas Song	Community Engagement and Risk Communication(CERC)
Cara Spidle	Community Engagement and Risk Communication(CERC)

4 Stakeholder Engagement

4.1 Stakeholder Engagement Meeting #1 (General Meeting, LLPT 1)

A FEMA-led project team engaged with specific communities in Broome County, levee owners/operators, and other stakeholders during the LLPT Meeting #1 on July 26, 2016 in Binghamton, NY. The overall intent of the meeting was to establish contact, explain the Levee Analysis and Mapping Procedures process, and discuss the application of the Levee Analysis and Mapping Procedures to the levee systems in Broome County.

At the initial LLPT 1 meeting (LLPT 1), representatives from FEMA provided an overview to the invited Levee Analysis and Mapping Procedures communities, answered questions concerning FEMA products, terminology, and procedures, and provided a timeline for the Levee Analysis And Mapping Procedures projects. FEMA explained in detail the five procedures outlined in the Levee Analysis and Mapping Procedures Final Approach Document and the major distinctions of Levee Analysis and Mapping Procedures in comparison with earlier levee analyses. FEMA and their contractor led a discussion about the applicability of each procedure to the levees.

Representatives from the New York State Department of Environmental Conservation (NYSDEC) outlined current operation and maintenance plans and procedures, covering ownership, inspection, maintenance and coordination with the US Army Corps of Engineers (USACE), and available grant funding for levee related projects. Representatives from USACE provided additional background on the Broome County Levees, and discussed the USACE involvement in the construction, operation and maintenance of the levee systems. (See Appendix A for minutes for the LLPT 1)

4.2 Stakeholder Engagement Meeting #2 (Community Meeting, LLPT 1.1)

Following LLPT 1, a follow-up meeting in City of Binghamton was held (LLPT 1.1) on July 27, 2016. During this meeting, a brief review of levee Analysis and Mapping Procedures was conducted by the FEMA project team, and a discussion pertinent to those sections of levee impacting the City of Binghamton followed. During this discussion, the LLPT reviewed particulars for the components of the levee systems, history of performance, and changes in the levees and impact areas following the major events of 2006 & 2011. (See Appendix A for minutes for the LLPT 1.1) Srikanth Koka and Seth Lawler of FEMA's contractor team, carried out limited field reconnaissance on July 28, 2016 to examine levee features.

4.3 Stakeholder Engagement Meeting # 3 (Community Meeting, LLPT 2)

On February 16, 2017 the LLPT 2 meeting was held to review the first pass analysis and discuss outcomes from the data collection process. During the meeting, the FEMA project team discussed the results of the First Pass Analysis for the Natural Valley Procedure and the Freeboard Deficient Procedure. During the discussion, it was stated that Structural Based Inundation Procedure and the Sound Reach Procedure were less applicable and Overtopping Deficient Procedure was potentially applicable. The community planned to make a final decision regarding which procedure to move forward with in the next month. (See Appendix B for minutes for the LLPT 2)

4.4 Stakeholder Engagement Meeting #4 (General Meeting, LLPT 2.1)

Following the LLPT 2 meetings, Broome County communities collectively expressed an interest in FEMA performing a first pass analysis using the structural-based inundation procedure to compare with the results from the Natural Valley approach. On May 14, 2018 a general meeting was convened to review the results from the additional Structural-based inundation analysis. At this meeting, Shudipto Rahman, FEMA project monitor, provided a summary of the coordination efforts, future mapping activities, and data collected to date.

Seth Lawler and Srikanth Koka presented a high-level overview of the draft results of the structural based inundation analysis for the levee systems. The main points discussed in this overview were:

1. Structural-based analysis results closely mirror the Natural Valley floodplains. The 2-Dimensional modeling analysis was useful in identifying the potential path of a flood wave resulting from a breach event.
2. Individual levee segments in Broome County work together as a system. Any decisions made at individual levee segments should be informed by the connectivity of other segments comprising the leveed area.
3. Due to the shared flood risks that extend beyond political boundaries, the complexity of the flooding sources, and the numerous levee systems in Broome County, communities should work together closely to coordinate efforts.

(See Appendix B for minutes for the LLPT 2.1)

4.5 Stakeholder Engagement Meeting # 5 (Community Meeting, LLPT 2.2)

Following the general meeting on May 14, 2018, FEMA conducted a joint meeting with the City of Binghamton and the Village of Port Dickinson to provide community-specific information, answer questions and discuss in greater detail the flood hazards at levee systems and individual levee segments. During this discussion, results from the freeboard analysis were reviewed and the flood risk shared by both communities were addressed. (See Appendix B for minutes for the LLPT 2.2)

4.6 Stakeholder Engagement Meeting # 6 (Community Meeting, LLPT 3)

On June 20, 2018 the LLPT 3 meeting was held to review the first phase of the Levee Analysis and Mapping Procedure. During the meeting, the FEMA project team discussed the results of the first phase and the approximate timeline moving forward. (See Appendix B for minutes for the LLPT 3)

5 First Pass Analysis

FEMA developed a First Pass Analysis, which is an approximate analysis using a relatively low level of detail, to approximate the floodplain boundary for each relevant Levee Analysis and Mapping Procedures approach. This informed the discussions in LLPT Meeting 2.

5.1 Natural Valley Procedure

The Natural Valley Procedure allows flow to be conveyed on both sides of a non-accredited levee. Figure 3 illustrates the results of the Natural Valley First Pass Analysis using HEC-RAS 5.0 (1-Dimensional, steady-state flow) with areas in shaded in dark blue indicating communities within

the City of Binghamton. For those levees along tributaries in areas where flooding can occur as a result of backwater or flooding from the tributary itself, both scenarios were modeled. All resultant inundation maps show the dominant flood hazard.

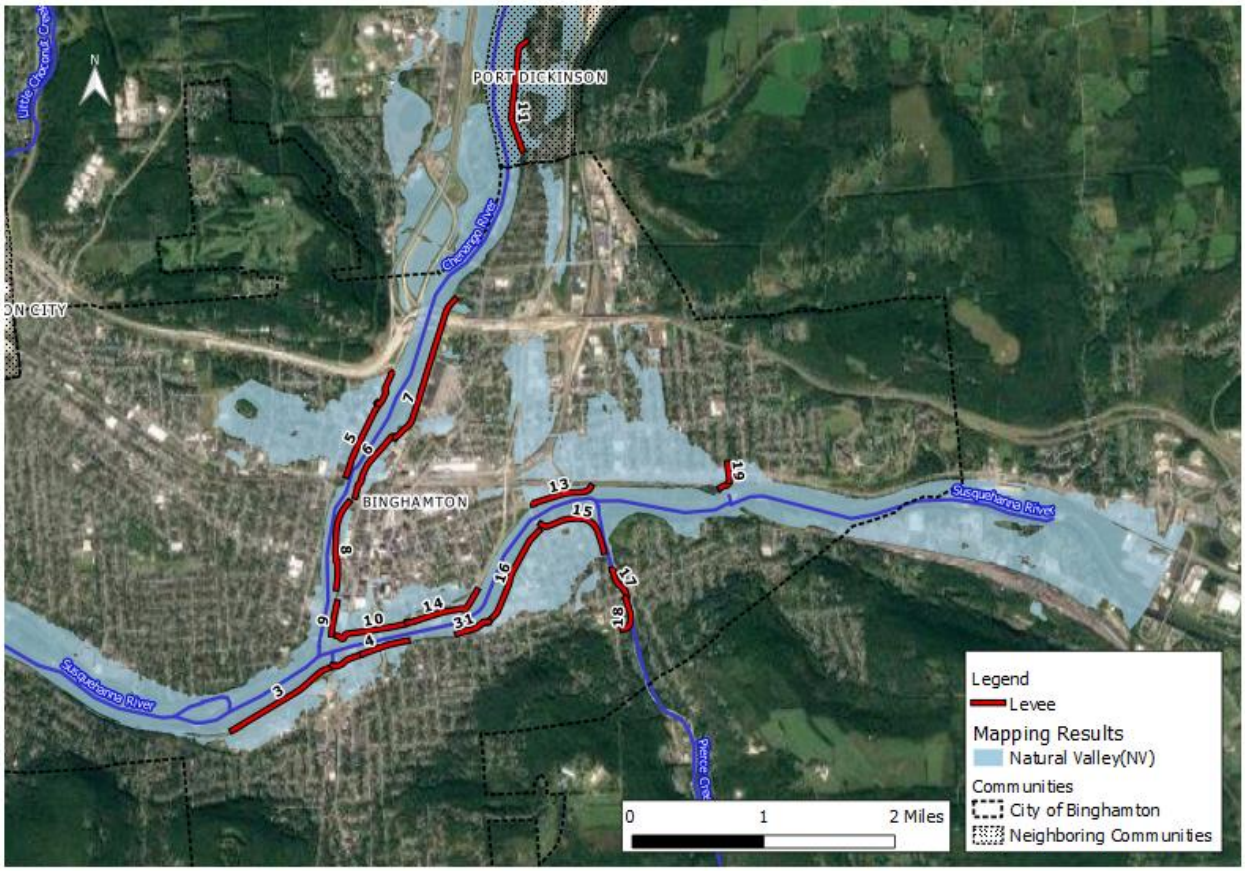


Figure 3: Natural Valley Procedure Mapping

5.2 Structural-based Inundation

First Pass Analyses (2-dimensional flow) were developed for levee breaching scenarios using HEC- RAS 5.0.3. The results of these analyses are mapped Figure 4. The procedural guidance outlined in the Levee Analysis and Mapping Procedure requires multiple breaches be applied to each levee system. When applied to the City of Binghamton, this procedure results in extents consistent with the Natural Valley Procedure. Details regarding the technical procedures can be found in Appendix XX Technical Memo.

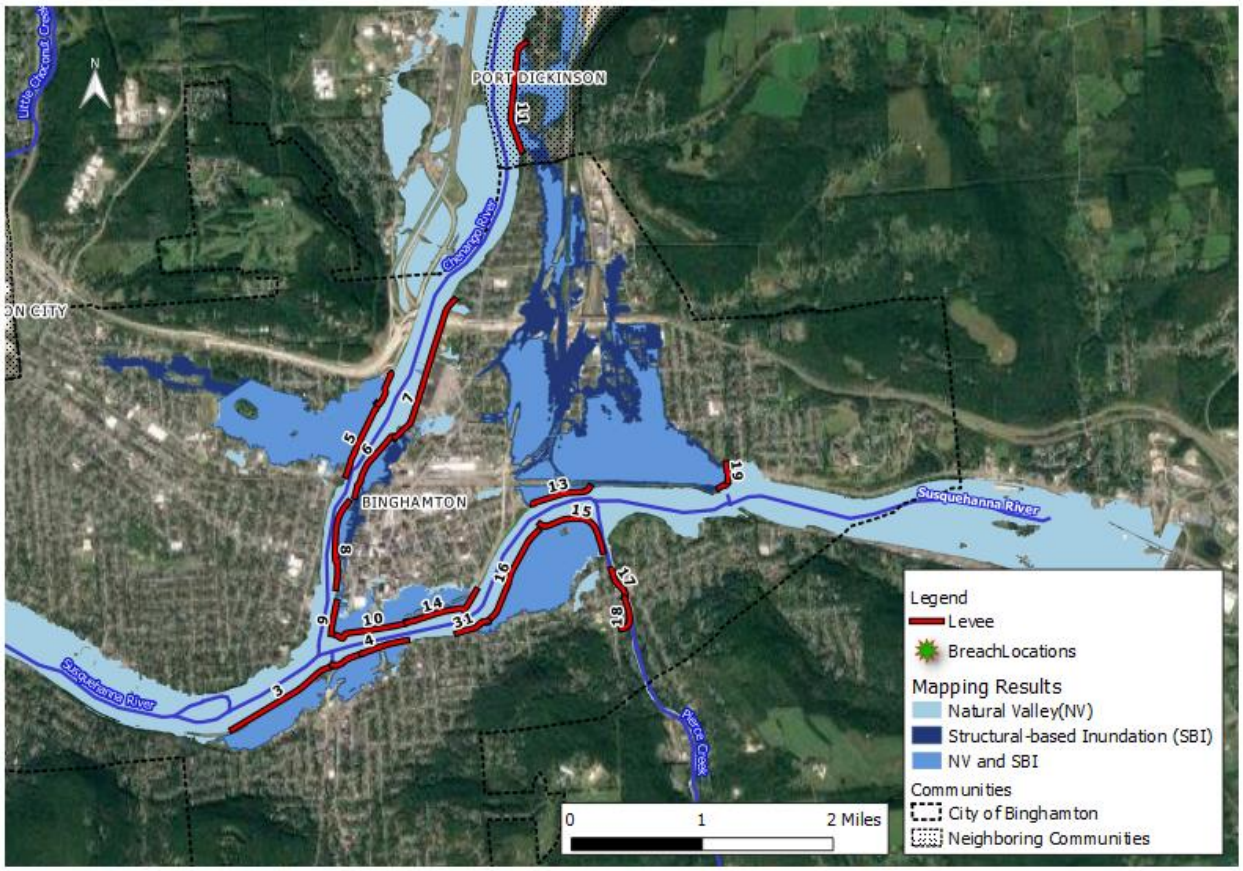


Figure 4: Structural-based Inundation Procedure Mapping

5.3 Freeboard Deficient Procedures

For the freeboard deficient analysis, points were taken along the levee crests for all sections included in this study. Where possible, elevations were taken directly from the USACE National Levee Database. The top of levee profile was compared to the 44 CFR§65.10 required freeboard profile for each segment of the levee systems covering areas within the City of Binghamton. The freeboard analyses for the levees on Chenango River, and Susquehanna River, and Pierce Creek are presented in Figure 6 -Figure 14.

5.4 Review of First Pass Analyses

Summary results from the first pass analysis are included in Table 7 and Figure 5. (See Appendix B for LLPT 2-2.2 Meeting Notes):

Table 7. Results from the First Pass Analysis

Levee Analysis and Mapping Procedures Levee ID #	Approximate Length of Levee Segment (ft)	Flooding Source(s)	Approximate # Structures Impacted	Comments: Natural Valley Procedure	Comments: Freeboard Analysis	Comments: Structural-based Inundation	Comments: General	USACE Activity/Notes
5	2,885	Chenango River	606		There is freeboard for majority of the reach.	A breach at any of the individual segments will impact a shared leveed-area, and must be assessed at a system level.	This may meet all freeboard requirements, so this is an area where accreditation could be possible. Benefit cost analysis should be undertaken before beginning the accreditation process.	
6	1,960		15	Flood depths at the downstream portion of the levees are dominated by backwater from the Susquehanna River.	There is freeboard for majority of the reach except at the two downstream bridges		The National Department of Transportation has identified that FEMA is not allowed to use road systems as restrictions to flow in mapping for flood inundation, unless that particular section of road was designed as a levee.	
7	3,867		0		There is freeboard for the entire reach.			
8	2,311		10	Flood depths are dominated by backwater from the Susquehanna River.	The majority of points along this levee section are just between BFE and minimum freeboard.		USACE hasn't done any of the levee risk assessments in this area.	
9	823		22		The majority of points along the levee section are below or near the BFE.			
3	3,059	Susquehanna River	38		The majority of points along this levee section are just between BFE and minimum freeboard.		FEMA suggests the most logical options are Natural Valley 2-D analysis, Structural-Based Inundation or Freeboard Deficient Procedures.	
4	2,033		109		The majority of points along the levee section are below the BFE.			
10	1,940		70		The majority of points along the levee section are below the BFE or between the BFE and minimum freeboard.			

Levee Analysis and Mapping Procedures Levee ID #	Approximate Length of Levee Segment (ft)	Flooding Source(s)	Approximate # Structures Impacted	Comments: Natural Valley Procedure	Comments: Freeboard Analysis	Comments: Structural-based Inundation	Comments: General	USACE Activity/Notes
13	1,580		305		The majority of points along the levee section are below the BFE.		This is a common knowledge area where people perceive the levee may breach but there's no facts to support this.	
14	2,100		100		The majority of points along the levee section are below the BFE or between the BFE and minimum freeboard.			
15	2,162		250	Flood depths are dominated by backwater from the Susquehanna River.	The majority of points along this levee section are just between BFE and minimum freeboard except for a large spike in levee elevation.			
16	2,679		150		The majority of points along this levee section are just between BFE and minimum freeboard except for a two large spike in levee elevation.			
17	870		4		The majority of points along the levee section are below the BFE or between the BFE and minimum freeboard.			
18	918		0		There is freeboard for majority of the reach.			
19	470		675		The majority of points along the levee section are between BFE and minimum freeboard.		The city is concerned about these levees because of the potential inundation and their insurance levels and ability to maintain in this area.	
20	238							

Levee Analysis and Mapping Procedures Levee ID #	Approximate Length of Levee Segment (ft)	Flooding Source(s)	Approximate # Structures Impacted	Comments: Natural Valley Procedure	Comments: Freeboard Analysis	Comments: Structural-based Inundation	Comments: General	USACE Activity/Notes
31	891		13		The majority of points along the levee section are below the BFE.		This levee is not included in the National Levee Database.	

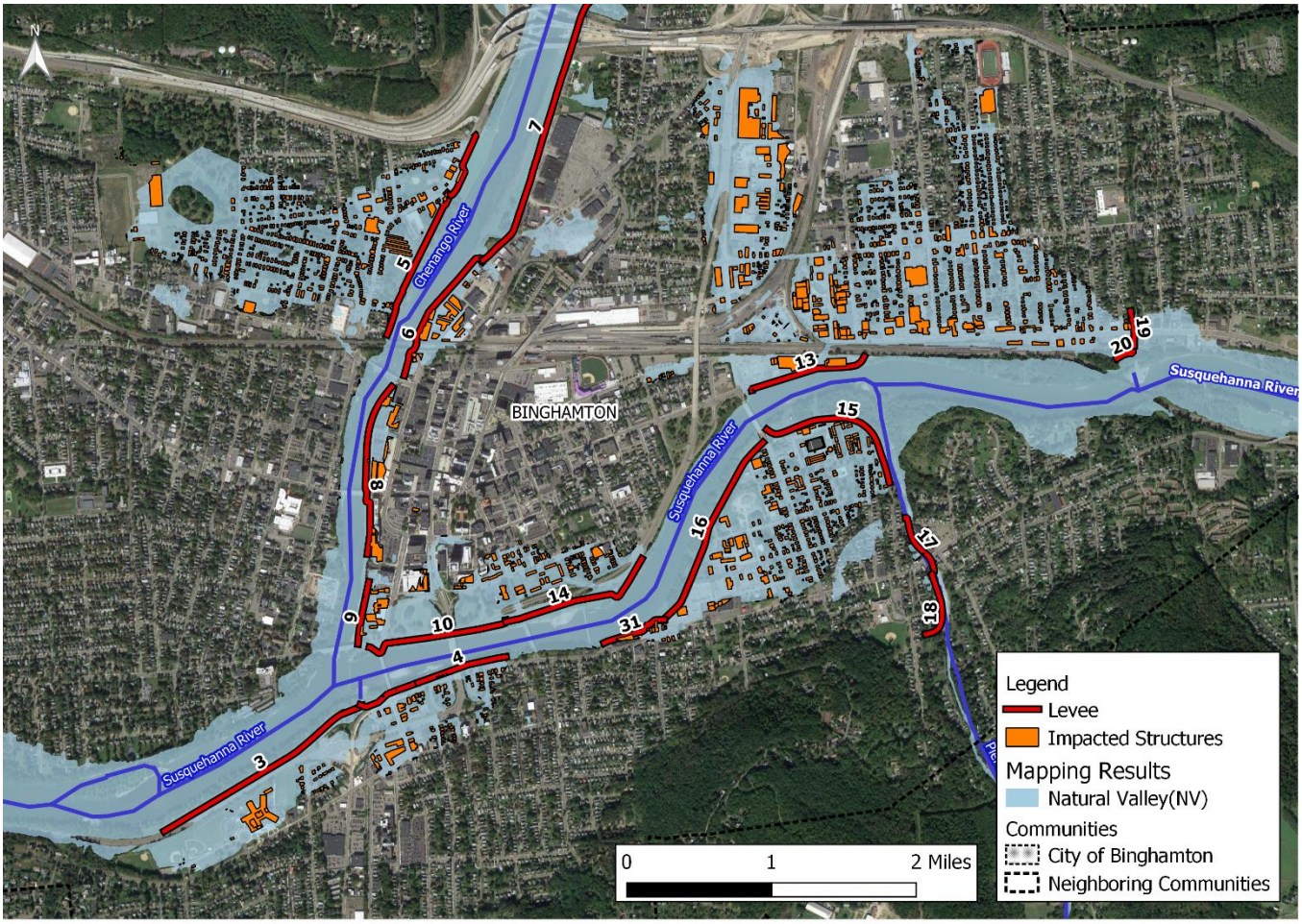


Figure 5: First Pass results for Binghamton Levees with Structures Impacted from Natural Valley Mapping

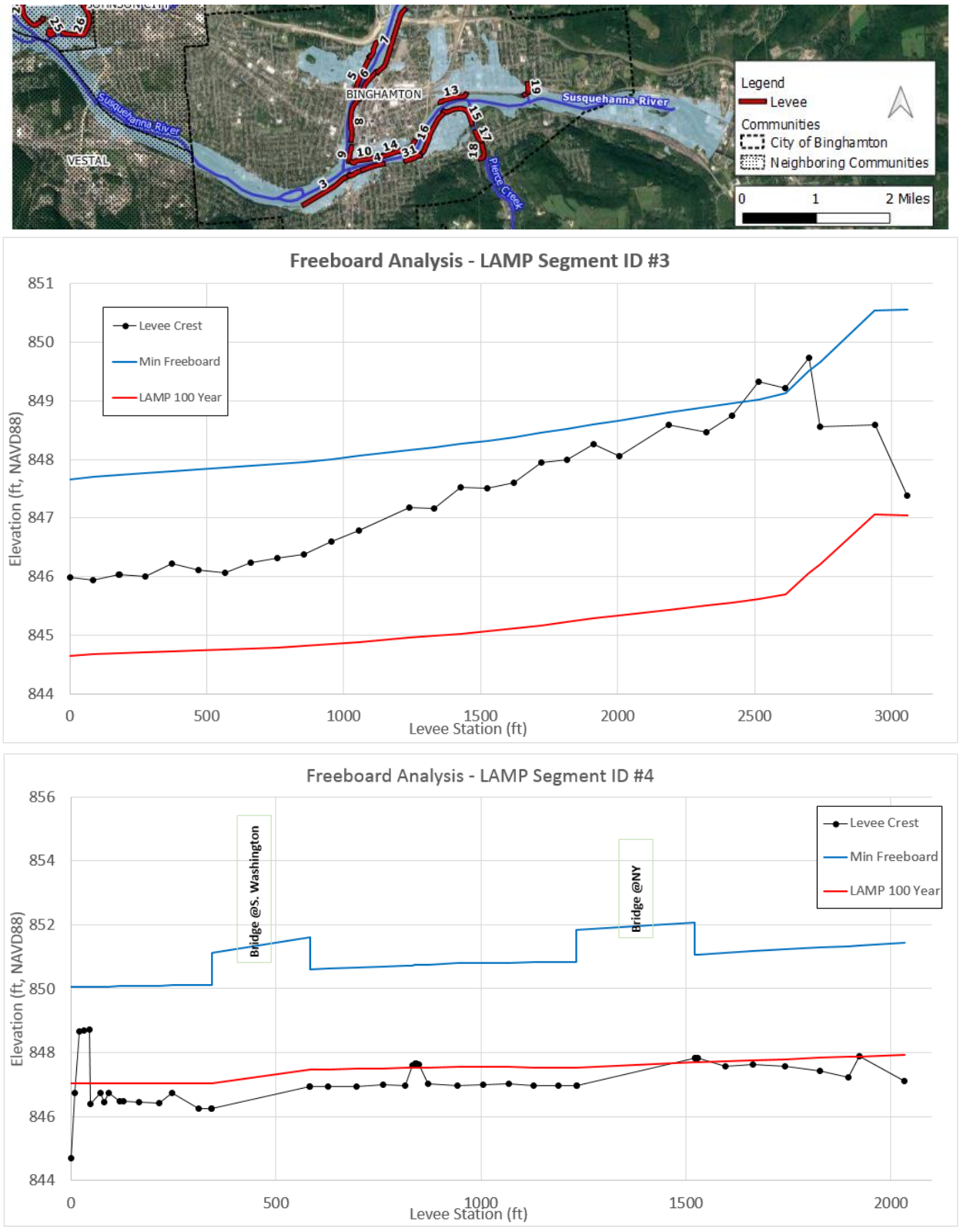


Figure 6: Freeboard Analysis for Levee Segment ID #3 and #4

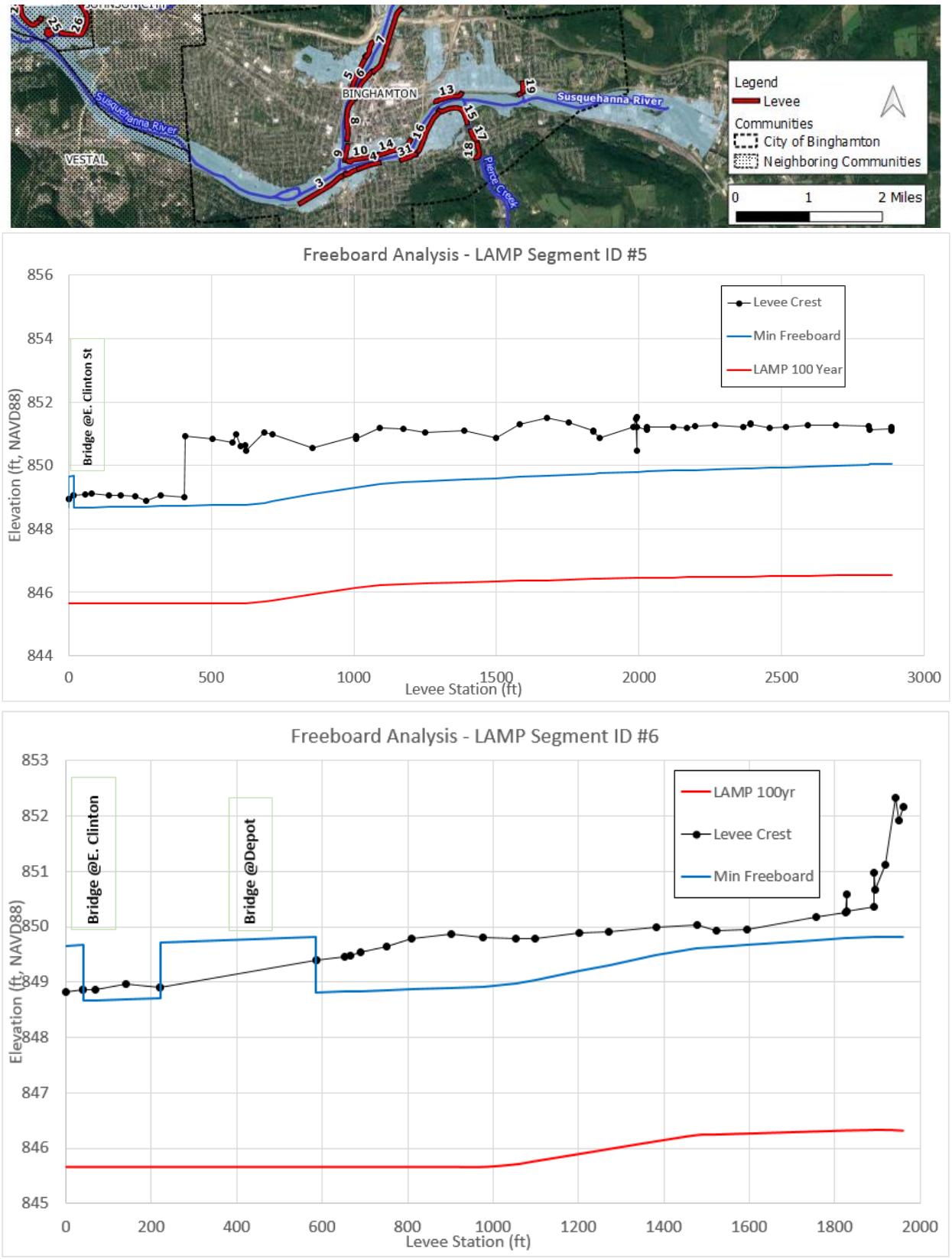


Figure 7: Freeboard Analysis for Levee Segment ID #5 and #6

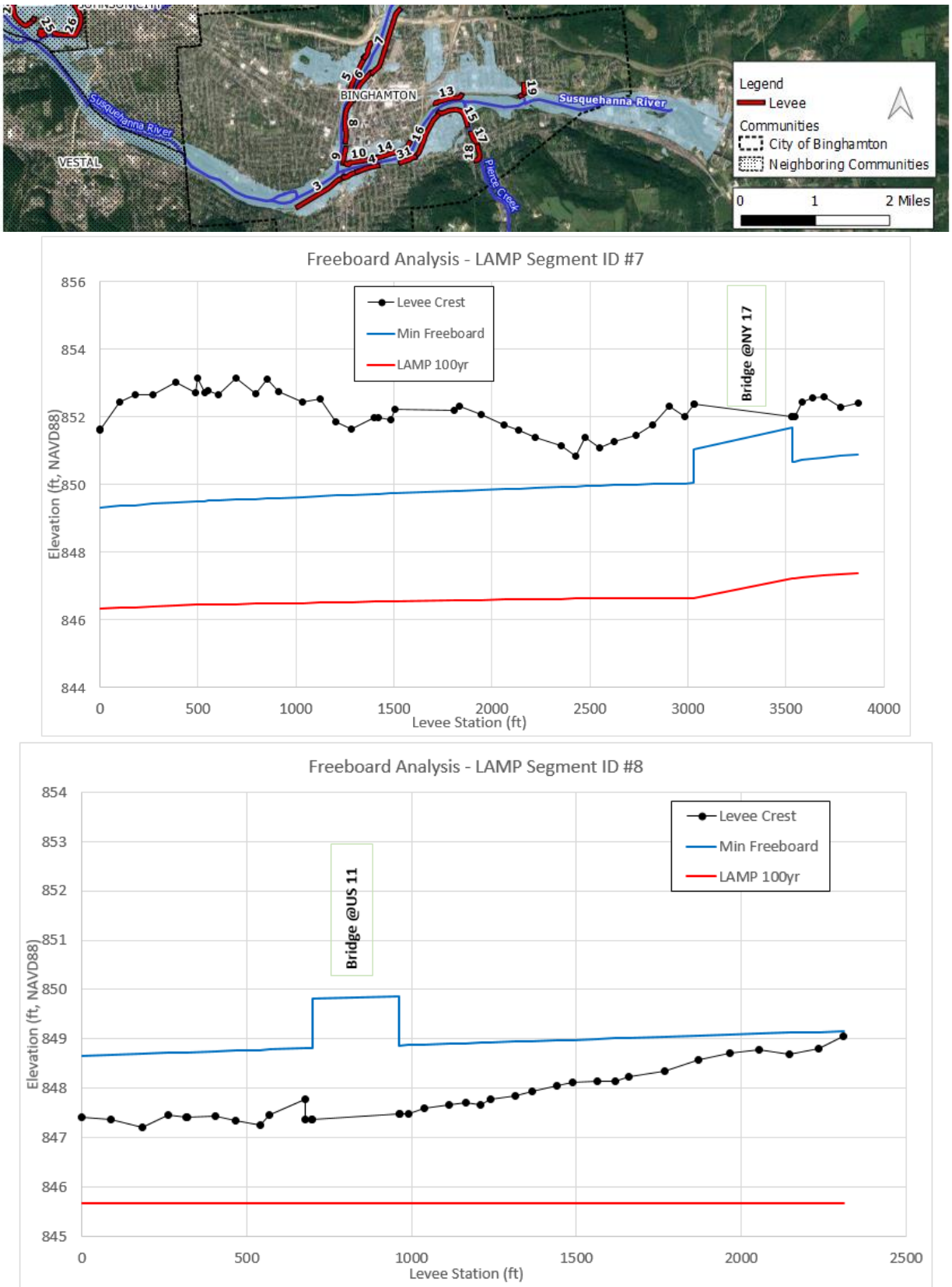


Figure 8: Freeboard Analysis for Levee Segment ID #7 and #8

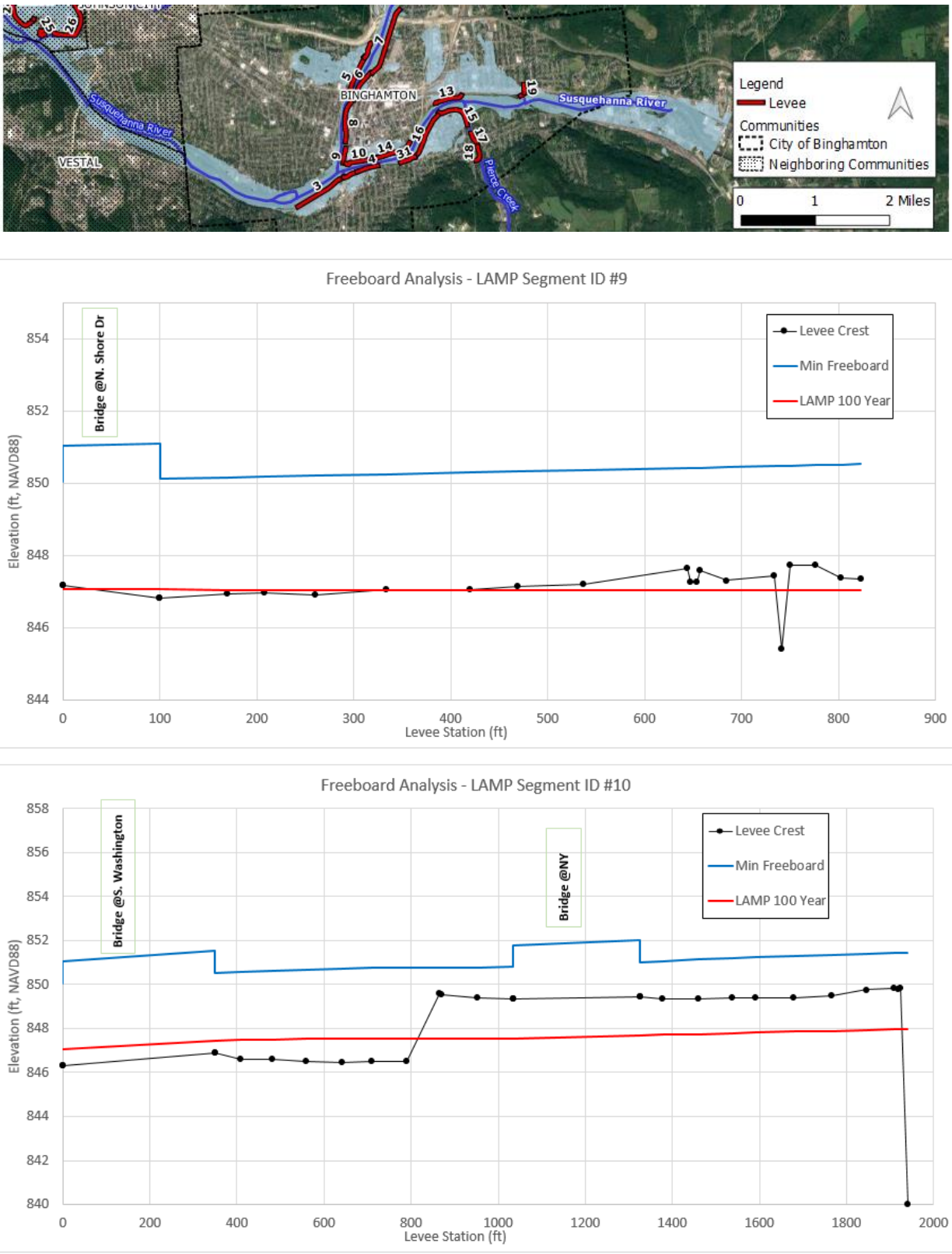
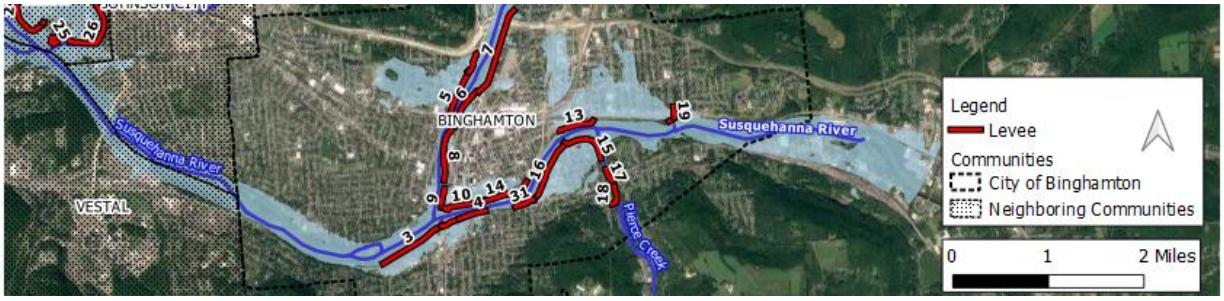
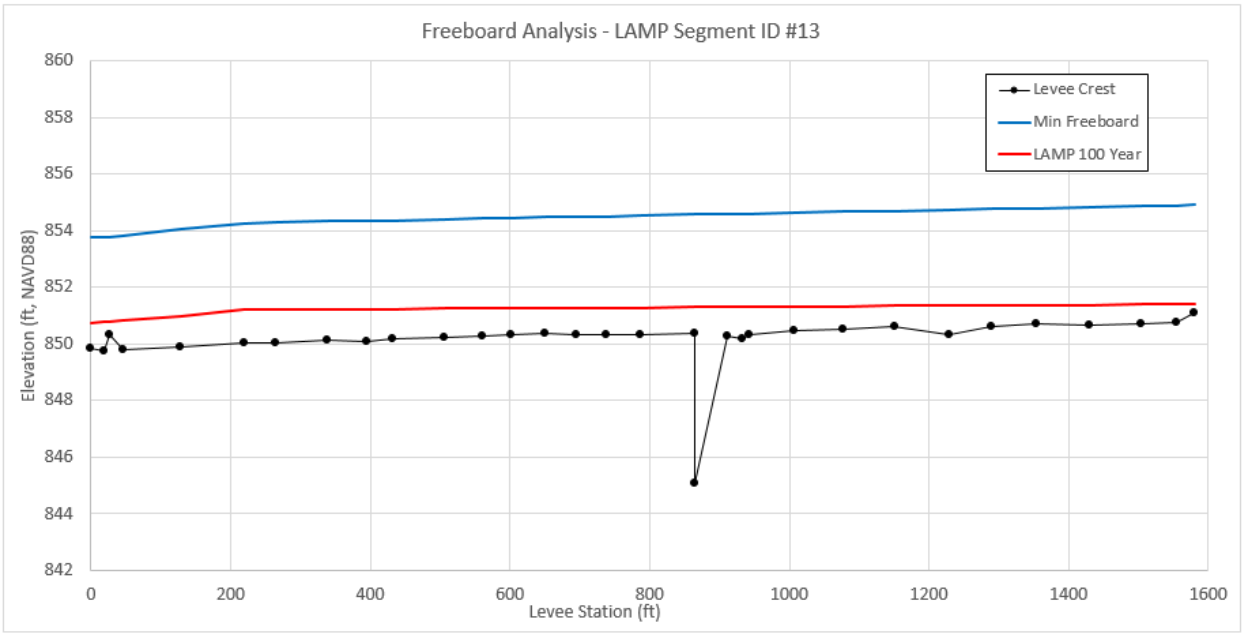


Figure 9: Freeboard Analysis for Levee Segment ID #9 and #10





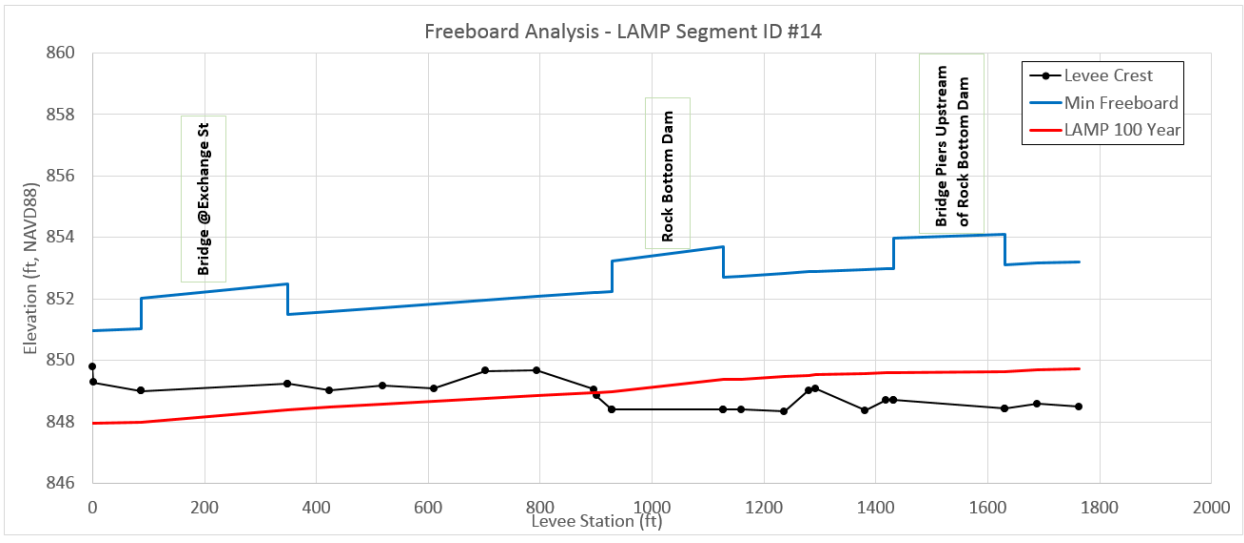


Figure 10: Freeboard Analysis for Levee Segment ID #13 and #14

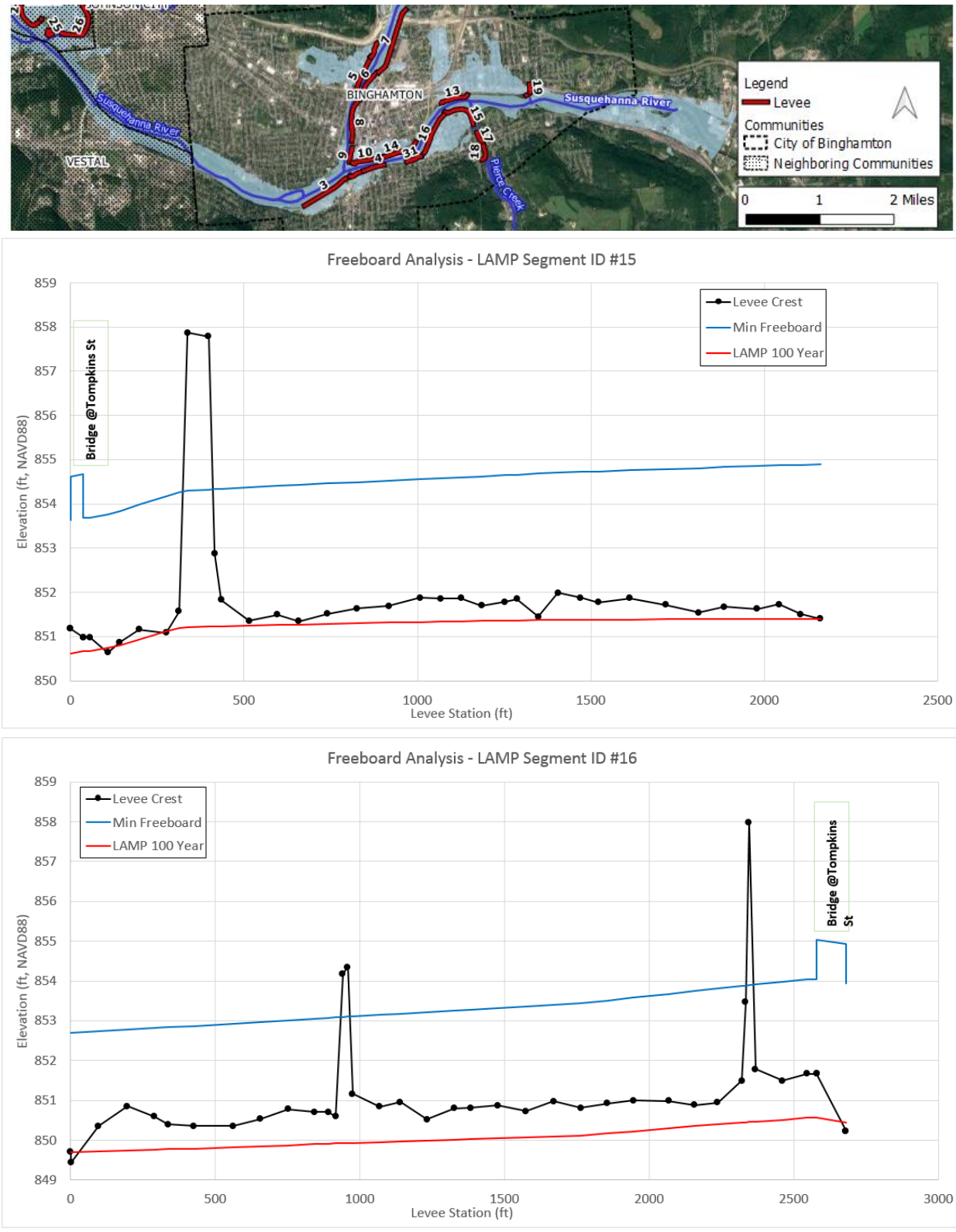
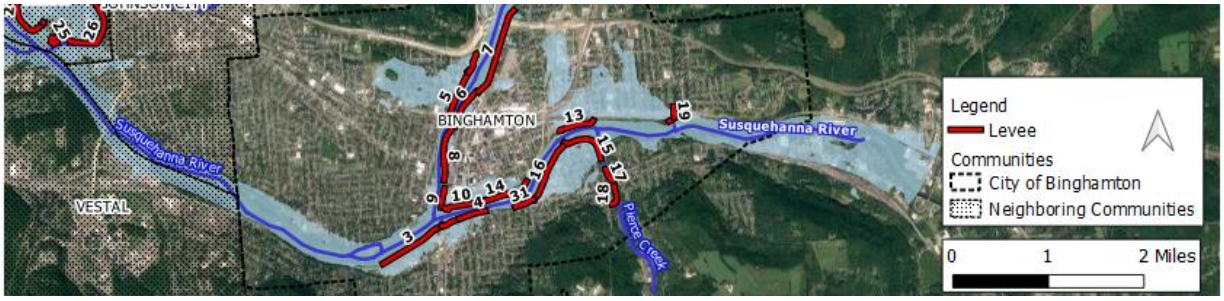
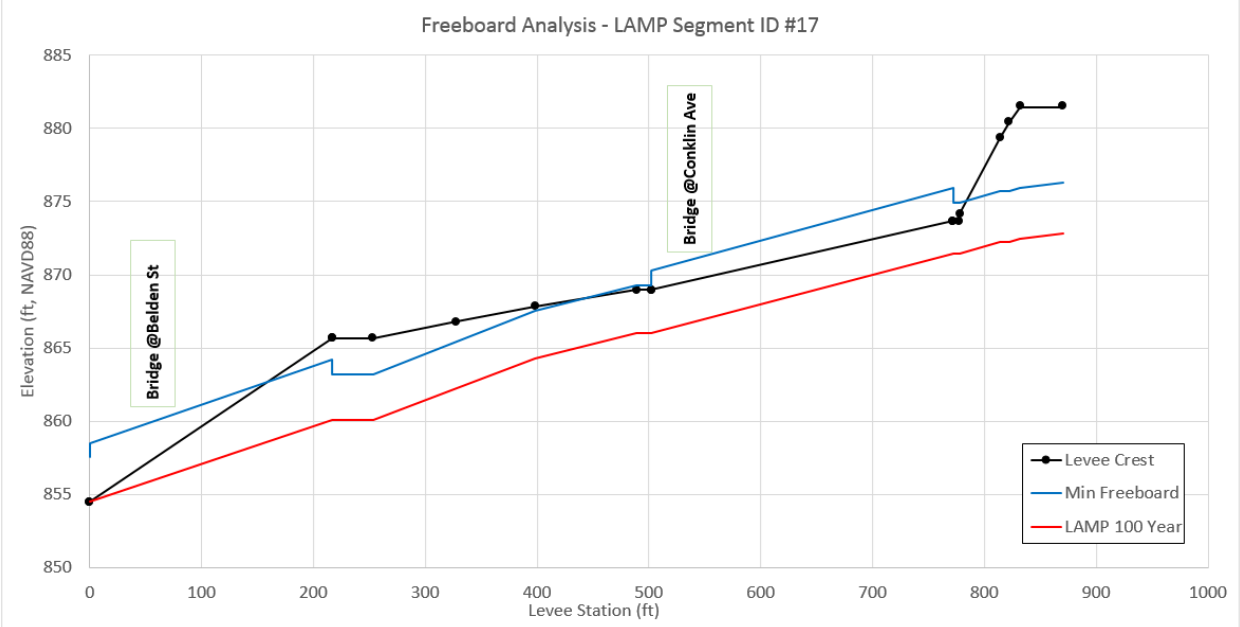


Figure 11: Freeboard Analysis for Levee Segment ID #15 and #16





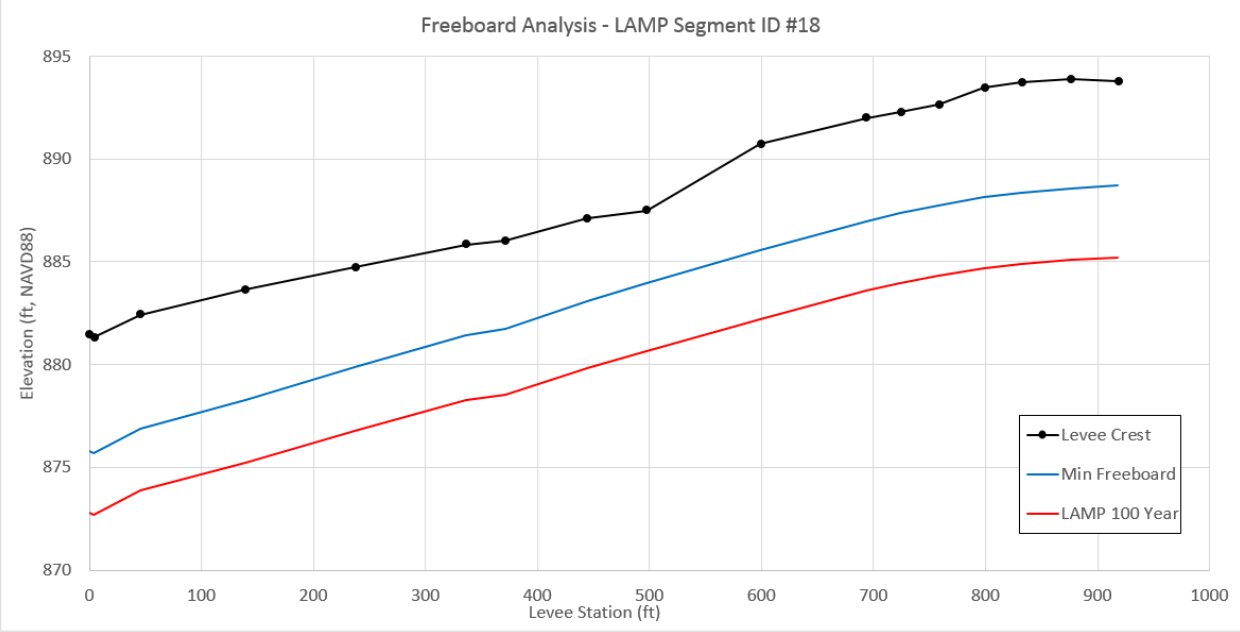


Figure 12: Freeboard Analysis for Levee Segment ID #17 and #18

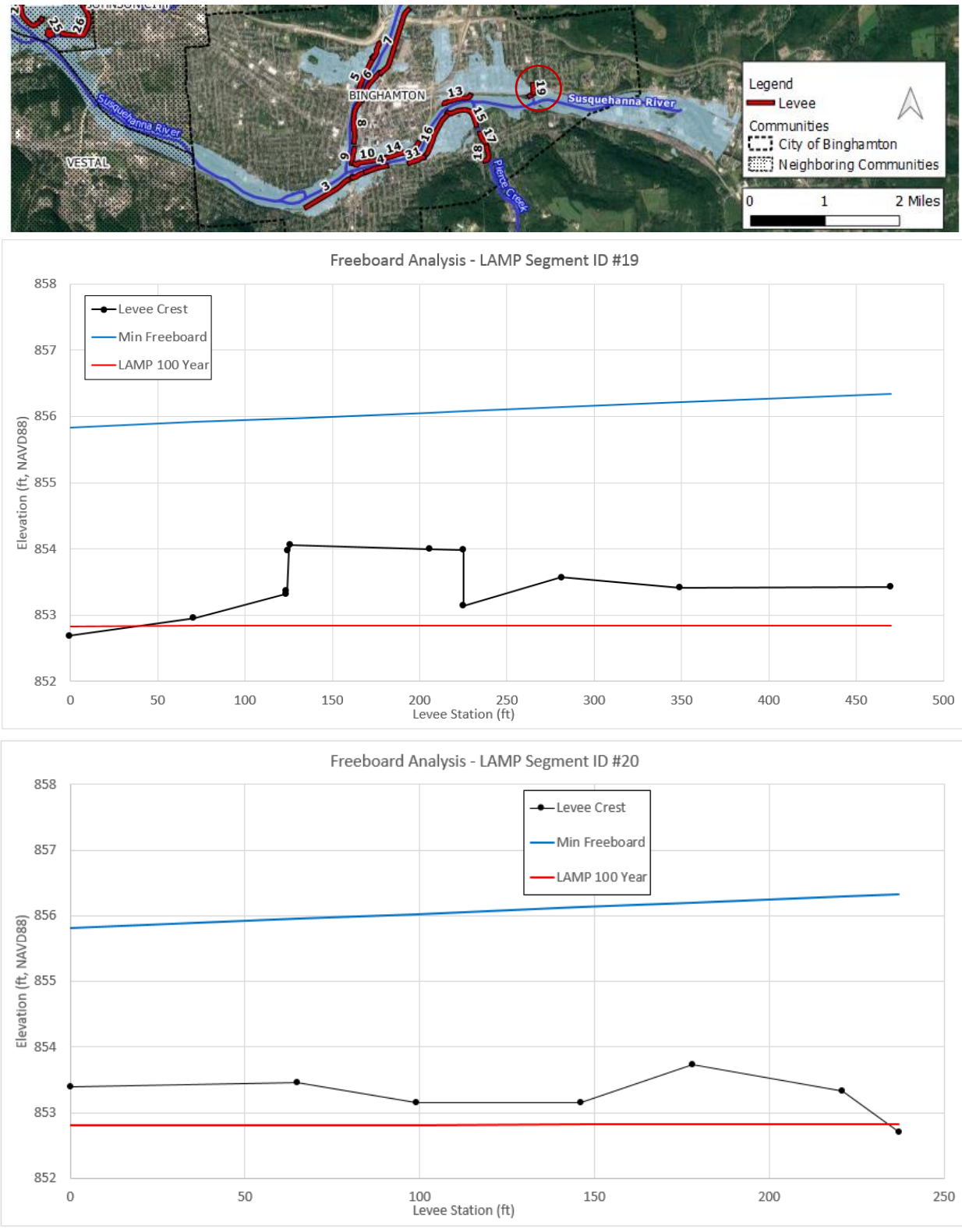


Figure 13: Freeboard Analysis for Levee Segment ID #19 and #20 (located within circle on top figure)

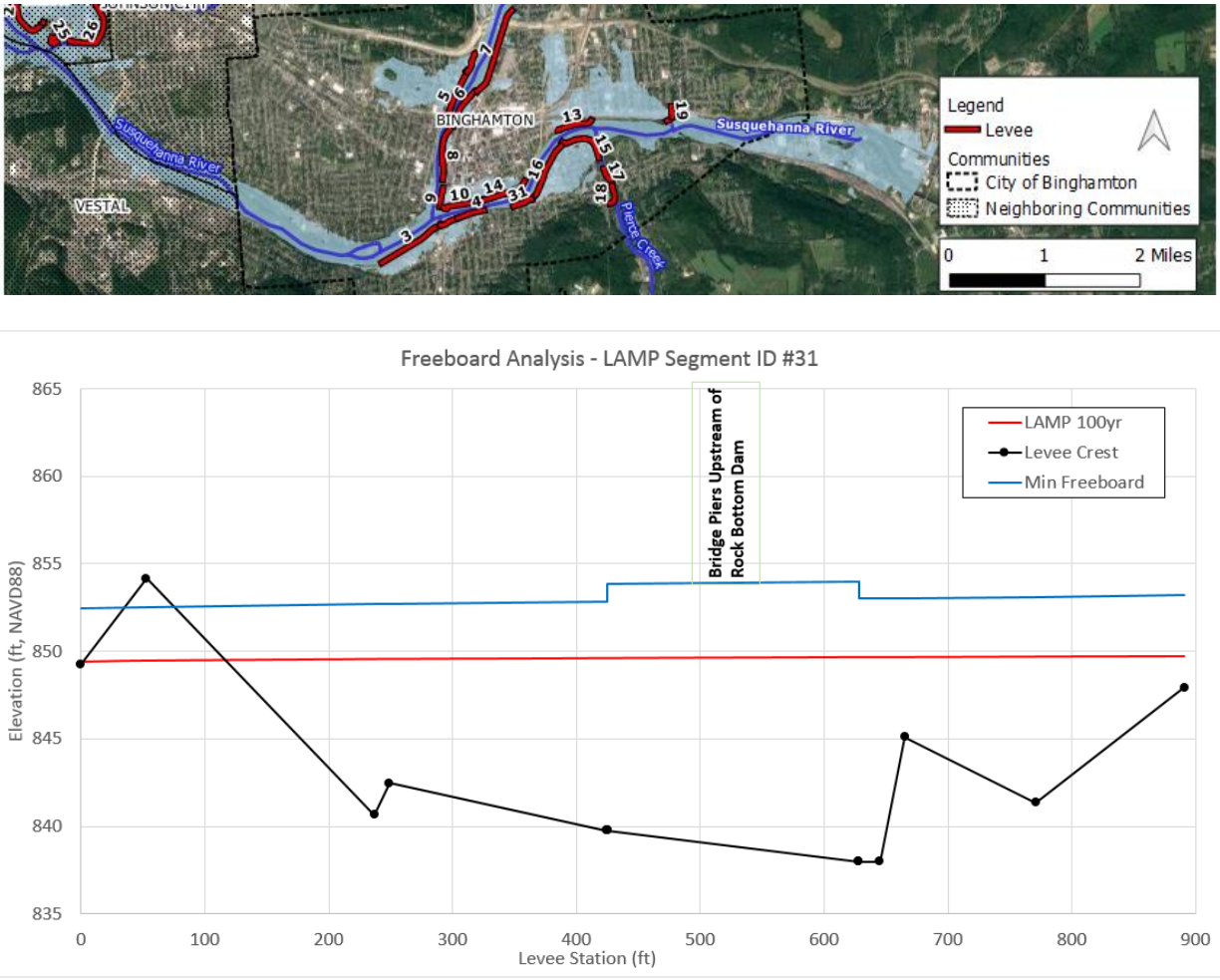


Figure 14: Freeboard Analysis for Levee Segment ID #31

6 Path Forward

6.1 Levee Analysis and Mapping Procedures Phase 2 Analysis

The levees included in this study are shown as accredited on the current FIRMs but have not been accredited as a result of 44 CFR§65.10 review, therefore FEMA will undertake a Levee Analysis and Mapping Procedures Phase 2 and Levee Analysis and Mapping Procedures Phase 3 study to take into account the hazard reduction impacts of the non-accredited levees when the regulatory flood hazard mapping for this community is updated Minimum freeboard for accreditation would be two feet with a favorable risk assessment by a federal agency with the authorization to design and construct such structures.

Where feasible, the Levee Analysis and Mapping Procedures Phase 2 analysis will focus on refining community identified procedures. The models and source data will be reviewed and refined with any updated information (e.g. updated discharges, recent surveyed cross sections, updated land cover data, and topographic data).

A subsequent Levee Analysis and Mapping Procedures Phase 3 study will incorporate the Phase 2 results into the regulatory NFIP products, namely the FIS and FIRM. This will likely become part of the data utilized during a restudy of the county-wide Flood Insurance Study at an as-yet unidentified future time.

6.2 Levee Accreditation

The City of Binghamton has indicated an interest in pursuing accreditation for levees for levees if funding can be obtained to perform the physical improvements and engineering review required. If the systems can be brought into compliance with 44 CFR§65.10, the levees can be shown as accredited in the Broome County FIS and on the FIRM. Should this occur, FEMA would not proceed with the Levee Analysis and Mapping Phase 2 and 3 efforts. If the FIRM and FIS have already been updated by the time of accreditation, FEMA will revise the maps via a Letter of Map Revision or Physical Map Revision.

FEMA's Levee Accreditation Checklist has been included in Appendix C for reference.

7 References

FEMA: Non-Accredited Levee Analysis and Mapping Guidance, September 2013

USACE, National Levee Database (GeoDatabase Version 3.0 dated 07-28-2015), 2015.

Appendix A
Stakeholder Engagement - LLPT Meeting #1-1.1 Information

Appendix B
Stakeholder Engagement - LLPT Meeting #2-2.2 Information

Appendix C
Levee Accreditation Checklist

Appendix D
Modeling and Mapping files