Hancock County Flood Risk Reduction Program: Additional Hydraulic Improvements

Preliminary Design Report

December 4, 2020

Prepared for:

Maumee Watershed Conservancy District

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Executive Summary

Hancock County and the City of Findlay, Ohio (Findlay) experience frequent and significant overbank flooding from the Blanchard River and its major tributaries; often flooding agricultural land and the City's streets, homes, and businesses within the floodplain. The Maumee Watershed Conservancy District (MWCD) contracted with Stantec Consulting Services Inc. (Stantec) in 2016 to develop potential alternative solutions to reduce the risk of overbank flooding. As part of that analysis, Stantec reviewed the hydraulic efficiency of the Blanchard River upstream, downstream, and through Findlay and developed a suite of possible solutions. In April 2017, Stantec submitted the *Hancock County Flood Risk Reduction Program Final Report: Data Review, Gap Analysis, USACE Plan and Alternatives Review, and Program Recommendation*. The report recommended a program consisting of several flood risk reduction components, including a two-phased approach for Hydraulic Improvements along the Blanchard River within Findlay. The first phase of Hydraulic Improvements is nearing the end of construction, and the remaining hydraulic improvements have been broken out into two, stand-alone projects: The Norfolk Southern Bridge Improvement and the Additional Hydraulic Improvements (floodplain bench and constructed riffles) discussed within this report. The Norfolk Southern Bridge Improvement project was previously referred to as Phase II Hydraulic Improvements in the Proof of Concept. MWCD contracted Stantec to perform planning, field services, design, and permitting for the Additional Hydraulic Improvements Project and is currently in design. This document is the *Preliminary Design Report* for the Additional Hydraulic Improvements Project and summarizes the following:

- field reconnaissance and data collected,
- existing conditions,
- design constraints and opportunities,
- the basis of design,
- preliminary concepts,
- drawings consistent with 30% design progression, and
- preliminary opinion of probable construction cost.

Altogether, the Additional Hydraulic Improvements, Phase I Hydraulic Improvements, and the Norfolk Southern Bridge Improvement project are expected to reduce the Blanchard River's 1-Percent-Annual-Chance Exceedance (ACE) water surface elevations (WSEs) by approximately 1.1 feet from the NS bridge to the CSX rail bridge. The ACE WSE reduction at the confluence of Lye Creek and the Blanchard River is approximately 0.9 feet. The ACE WSE reduction at the confluence of Eagle Creek and the Blanchard River is approximately 0.8 feet. Flood risk reduction is anticipated upstream of these areas as well. These improvements will reduce the risk of future flooding impacts for properties along the existing floodplain in the vicinity of the Project Area The proposed constructed riffle structures will also provide for erosion mitigation and benefit the aquatic ecosystem by improving in-stream habitat and water quality.

Impacts, constraints, and construction considerations are identified and included within this *Preliminary Design Report*. Some of the project impacts include construction within a limited number of parcels not

currently owned by Findlay and/or Hancock County, utility relocations and replacements, and potential for excavation of soils containing characteristically hazardous waste.

The preliminary opinion of probable cost of construction for the Additional Hydraulic Improvements is $5.7 Million, including a 20% contingency. Potential permitting delays are the most significant risk to the existing project schedule.

Abbreviations

ACE - Annual Chance Exceedance
AEP - American Electric Power
APE - Area of Potential Effects
BFE - Base Flood Elevation
cfs - Cubic Feet Per Second
CSO - Combined Sewer Overflow
CWA - Clean Water Act
DBH - Diameter at Breast Height
ESA - Endangered Species Act
fps – Feet Per Second
GNS - Generic Numerical Standards
GPS - Global Positioning System
HCFRRP - Hancock County Flood Risk Reduction Program
HDPE - High Density Polyethylene
HEC-RAS - Hydrologic Engineering Center's River Analysis System
HTRW - Hazardous, Toxic, or Radioactive Waste
JD - Jurisdictional Determination
LBL - Live Brush Layering
LIDAR - Light Imaging, Detection, and Ranging
MSG – The Mannik & Smith Group, Inc.
MWCD - Maumee Watershed Conservancy District
NCD - Natural Channel Design
NHPA - National Historic Preservation Act
NS - Norfolk Southern
NWP - Nationwide Permit
OAC - Ohio Administrative Code
ODNR - Ohio Department of Natural Resources
ODOT - Ohio Department of Transportation
OEPA - Ohio Environmental Protection Agency
OHWM - Ordinary High Water Mark
OPCC - Opinion of Probable Construction Cost
PCN - Pre-Construction Notification
PDR - Preliminary Design Report
PEC - Probable Effect Concentration
PVC - Polyvinyl chloride
QHEI - Qualitative Habitat Evaluation Index
ROW - Right of Way
SHPO - State Historic Preservation Office
SWPPP - Storm Water Pollution Prevention Plan
TES - Threatened and Endangered Species
USACE - United States Army Corps of Engineers
USFWS - United States Fish and Wildlife Service
USGS - United States Geological Survey
WOTUS - Waters of the United States
WSE - Water Surface Elevation

Glossary

Bankfull	The incipient point of flooding, or flood stage in a stream or river where it reaches access to its floodplain
Entrenchment Ratio	The ratio of the flood-prone width (width at 2 times maximum depth) to the bankfull width
Manning's n	The roughness coefficient used for calculating discharge in an open channel
Riffle	The shallowest facet in the profile of a natural channel that is the hydraulic control
Riparian	Relating to or inhabiting the area immediately adjacent to a natural course of water
Thalweg	The line defining the lowest points along the length of a riverbed or valley

1.0 INTRODUCTION

The "*Hancock County Flood Risk Reduction Program, Final Report: Data Review, Gap Analysis, USACE Plan and Alternatives Review, and Program Recommendation*" report dated April 3, 2017 and the follow-up report, "*Hancock County Flood Risk Reduction Program – Draft Proof of Concept Update*" dated July 9, 2018, provided a series of recommended flood control improvements within the Blanchard River Watershed to reduce the risk of flooding within the Findlay and extended portions of Hancock County. Recommendations for flood risk reduction included construction of hydraulic improvements along the Blanchard River in downtown Findlay.

Design of the Phase I Hydraulic Improvements began in second quarter of 2017. Phase I included the removal of four (4) inline dam/riffle structures and excavation of a floodplain bench near Swale Park (between Broad Avenue and the Norfolk-Southern (NS) rail bridge) to widen the channel and provide conveyance during high flows. Construction for Phase I of the Hydraulic Improvements project began in the fourth quarter of 2018 and is advancing towards final completion.

In addition, the plan also recommended the Norfolk Southern Bridge Improvement Project (Phase II Hydraulic Improvements) which includes widening of the NS rail bridge over the Blanchard River, for which design is currently underway. Taken together, these two phases of hydraulic improvements are estimated to reduce the 100-year base flood elevation (BFE) within the Blanchard River in downtown Findlay, including a reduction of approximately 1.1 feet at Main Street. Flooding during high flows is still expected to occur, even with the added flood risk reduction benefits.

The community continued to explore options to reduce the impacts and damages associated with flood events, including the acquisition and removal of several structures along the Blanchard River corridor that are understood to have experienced repetitive losses due to flooding. Due to the success of the Phase I Blanchard River Hydraulic Improvements, the MWCD developed conceptual floodplain benching options that would use this corridor for potential widening on the right descending bank of the Blanchard River, upstream of the Phase I Hydraulic improvements and Norfolk Southern Bridge Improvement projects. Figure 1 shows the approximate limits of the study area in relation to the Phase I Hydraulic Improvements.

Introduction

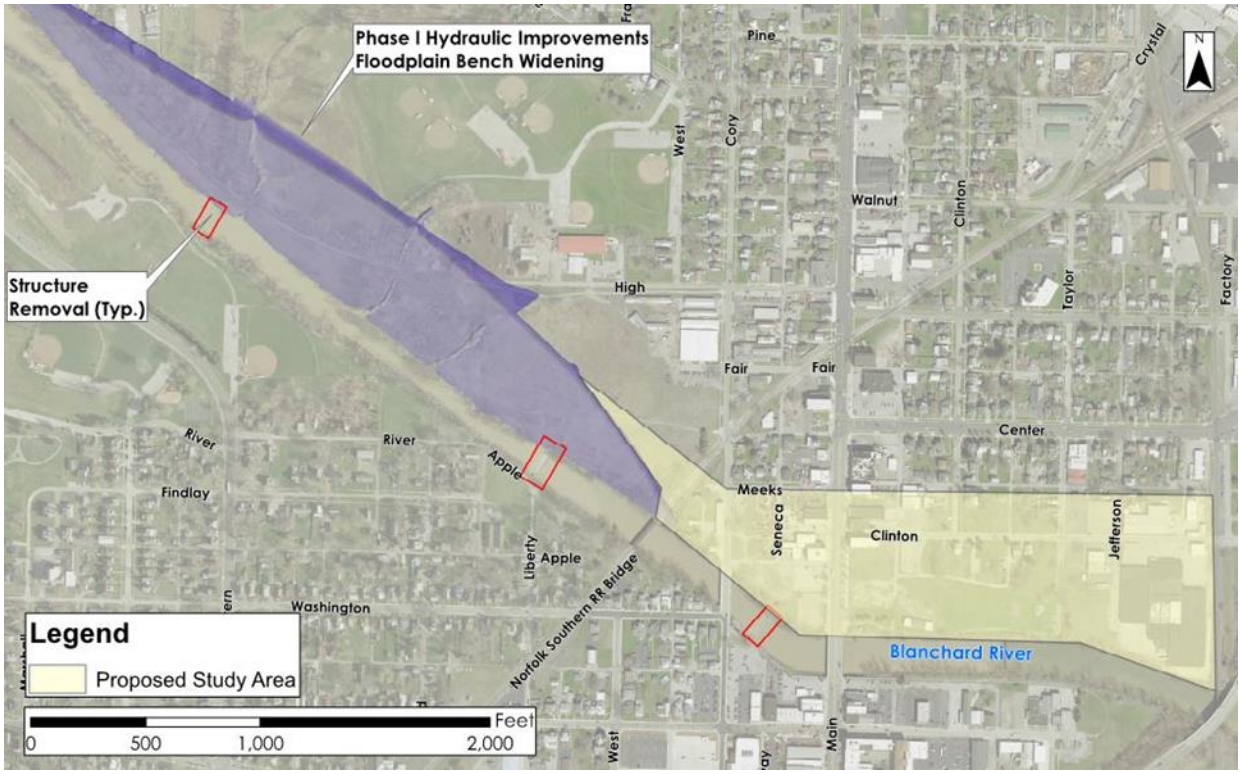

Figure 1. Study Area for Additional Hydraulic Improvements

Seven (7) concepts were developed to tie into the upstream end of the Phase I Hydraulic Improvements to create a continuous floodplain bench. The bench would extend upstream from the Phase I project, from the NS rail bridge, to the CSX Railroad bridge underneath of Dr. Martin Luther King Jr. Way.

Comparison of these concepts is outlined in the memorandum "*Hancock County Flood Risk Reduction Program - Additional Blanchard River Hydraulic Improvements*" (October 2019) and includes a summary of the project background, concept development, hydraulic analysis, and development of preliminary opinion of probable construction costs (OPCC).

The study findings concluded that the proposed additional floodplain benching project would increase the flood carrying capacity of the Blanchard River and reduce water surface elevations (WSEs) adjacent to and upstream of the proposed project areas during high flows and that the outcome of the Additional Hydraulic Improvements would be the reduction of flood risk for the community. The recommended alternative was observed to provide the most cost-efficient flood reduction benefits at Dr. Martin Luther King Jr. Way at the upstream end of the proposed project. Further expansion of the hydraulic improvements at structures such as the Main Street bridge may increase the total flood risk reduction benefits, but at less cost efficiency.

The MWCD moved to further investigate these Additional Hydraulic Improvements and contracted with Stantec to perform preliminary design.

1.1 PROJECT COMPONENTS

The three components of the Additional Hydraulic Improvements project include:

1. Excavation of a floodplain bench on the right descending bank of the Blanchard River between the CSX railroad bridge right-of-way (underneath of Dr. MLK Jr. Way) to the east, Clinton Court to the north, and Cory Street to the west;
2. Addition of two (2) constructed riffles in the Blanchard River, adjacent to the proposed floodplain bench area (one upstream and one downstream of the Findlay Downtown Riverwalk pedestrian bridge);
3. Construction of a bike path to connect the City's existing bike paths to the east and west of the project area.

A fourth component, widening of the NS rail bridge and the associated excavation west of Cory Street, is part of the Norfolk Southern Bridge Improvement project (Phase II Hydraulic Improvements) and is being designed under a separate project.

The project location is depicted in Appendix A, 30% HCFRRP Additional Hydraulic Improvements Drawing Set.

1.2 PRELIMINARY DESIGN REPORT

This document, the *Preliminary Design Report*, summarizes the field reconnaissance and data collected during site studies and describes existing conditions of the Project Area. This Report describes the hydraulic modeling used to support the proposed project and identifies design constraints and opportunities for the project. The Report documents the basis of design, includes drawings consistent with 30% design progression, and provides a preliminary opinion of probable construction costs (OPCC).

2.0 SUMMARY OF EXISTING CONDITIONS

Stantec completed field data collection activities and surveys to support preliminary design efforts related to the Additional Hydraulic Improvements and to inform the necessary permit applications. The field work included topographic and geomorphic survey, geotechnical exploration, and stream, wetland, and habitat assessments within the Project Area. A Phase II environmental assessment and Phase II cultural resource survey are being conducted are in progress at the time of this report issuance. This section provides the results of the field studies and describes existing conditions for the Project Area.

2.1 WETLAND DELINEATION AND WATERBODY ASSESSMENT

Stantec biologists performed pedestrian field surveys for wetlands and waterbodies within the Project Area on July 22, 2020. In addition to wetlands and waterbodies, Stantec documented the locations of upland vegetation communities and land uses within the Project Area. The dominant land uses within the Project Area consisted of maintained lawn, mixed early successional/second growth riparian forest, and industrial habitats. During the wetland and waterbody delineation field surveys, one stream (Stream 1, Blanchard River) was identified within the Project Area. Additionally, no wetlands or other waterbodies were identified within the Project Area.

Due to the proposed addition of two (2) riffle structures within the Blanchard River as part of the Project, MWCD would be required to receive authorization from the USACE and OEPA under Sections 404 and 401 of the CWA prior to initiation of any construction activities. The proposed Project components should receive authorization through the USACE Nationwide Permit (NWP) application process under NWP 27 (Aquatic Habitat Restoration, Enhancement and Establishment Activities) Pre-Construction Notification (PCN). Additionally, MWCD would be required to comply with Section 7 of the Endangered Species Act (ESA) and Section 106 of the National Historic Preservation Act (NHPA) as part of the Section 404 and Section 401 CWA permitting process.

2.1.1 Wetlands

No wetlands were identified within the Project Area. However, two wetland determination sample points (SP01 and SP02) were assessed in areas that displayed hydrophytic vegetation. Northcentral and Northeast Regional Supplement wetland determination data forms for SP01 and SP02 and photographs of the wetland determination sample point locations are provided in Appendix B. The locations of the wetland determination sample points were recorded using a sub-meter accuracy GPS unit (Figure 4, Appendix A of the Wetland and Waterbody Delineation Report, Appendix B).

2.1.2 Streams and Other Waters

One perennial stream (Stream 1, Blanchard River) totaling roughly 2,291.5 feet was identified within the Project Area. Stream 1 achieved a Qualitative Habitat Evaluation Index (QHEI) score of 53 and a narrative rating of “fair” per the QHEI scoring methods (OEPA 2006). The QHEI data form and

photographs of the stream are provided in Appendix B. The location of the stream was recorded by Stantec using a sub-meter accuracy GPS unit (Figure 4, Appendix A of the Wetland and Waterbody Delineation Report, Appendix B). Additional information for Stream 1 can be seen in Table 1 below.

Table 1. Summary of Perennial Stream Findings

Wetland Name	Interpreted Stream Flow Regime	QHEI Score/ Narrative Rating	Approximate Bank to Bank Width (Feet)	Approximate OHWM Width (Feet)	Approximate Stream Length within Project Area (Feet)	Substrates
Stream 1 (Blanchard River)	Perennial	53/Fair	130	145	2,291.5	Boulder, cobble, gravel, sand, bedrock, detritus, muck, silt
Total					**2,291.5**	-

2.2 HABITAT ASSESSMENT

A threatened and endangered species habitat assessment was conducted on July 22, 2020 within the Project Area to determine if the proposed work could potentially impact threatened and endangered species or their habitats. Prior to conducting the site visits, Stantec reviewed the U.S. Fish and Wildlife Service (USFWS) Ohio Ecological Services Field Office website (USFWS 2018) to determine which federally listed threatened and/or endangered species are known to occur, or potentially occur in Hancock County.

Based on review of the USFWS Ohio Ecological Services Field Office website (USFWS 2018), the USFWS lists the Indiana bat (*Myotis sodalis*; federally endangered), northern long-eared bat (*Myotis septentrionalis*; federally threatened), Clubshell mussels (*Pleurobema clava*; federally endangered), and Rayed Bean mussels (*Villosa fabalis*; federally endangered) as occurring in, or having the potential to occur within Hancock County.

In addition to the above federally listed species, the Ohio Department of Natural Resources Division of Wildlife (ODNR) (ODNR 2020) lists the, northern harrier (*Circus hudsonius* – state threatened), western banded killifish (*Fundulus diaphanus menona*; state endangered), plains clubtail (*Gomphus externus*; state endangered), least bittern (*Ixobrychus exilis* – state threatened), black-crowned night-heron (*Nycticroax nycticroax* – state threatened), fawnsfoot (*Truncilla donaciformis* – state threatened), purple lilliput (*Toxolasma lividus*; state endangered), black sandshell (*Ligumia recta*; state threatened), pondhorn (*Uniomerus tetralasmus*; state threatened), and Kirtland's snake (*Clonophis kirtlandii*; state threatened) as occurring in, or having the potential to occur within Hancock County.

Stantec biologists documented potentially suitable foraging and summer roosting habitat for the Indiana bat and northern long-eared bat within the Project Area. Additionally, one potentially suitable roost tree was recorded within the Project Area. Accidental take of the federally listed Indiana bat is prohibited under the ESA. Winter tree clearing (between October 1 and March 31) on any trees with a diameter at

breast height (dbh) ≥ 3 inches would likely be required to prevent potential loss to this species. More details can be found in Appendix C – Threatened and Endangered Species Habitat Assessment Report.

Stantec documented the presence of potentially suitable habitat for listed mussels in the Blanchard River (Stream 1), within the Project Area. The Blanchard River is listed as Group 1 stream system. Therefore, though potentially suitable habitat is present, federally listed mussel species are not known to occur and/or are not expected to occur within the Blanchard River due to historical data. Additionally, though the presence of mussel species were confirmed at various locations within the Blanchard River during Stantec's habitat assessment site visit on July 22, 2020 no listed species were observed. However, freshwater native mussel species are protected in Ohio, by the ODNR. Further coordination and potential mussel relocation efforts could be required by this Project.

2.3 GEOMORPHIC ASSESSMENT

Stantec conducted a geomorphic assessment to develop an understanding of the Blanchard River's behavior following construction of the Phase I Hydraulic Improvements project and to help inform design of additional floodplain benching and constructed riffles. The following sections describe the geomorphic assessment and how it will affect the flood mitigation design.

2.3.1 Data Collection

Stantec conducted a broad level evaluation of current low flow conditions in the Blanchard River. This geomorphic assessment of the project reach was used to assess existing conditions following removal of the four (4) inline dam/riffle structures replaced by constructed riffles and construction of a floodplain bench near Swale Park during the Hydraulic Improvements Phase I project. The geomorphic survey included thalweg, water surface, and bankfull elevation data for approximately 8,900 feet of the Blanchard River and five (5) riffle cross-sections at the constructed riffles where the former inline dam/riffle structures were removed and in the reach where the proposed constructed riffles are being considered. The extent of the survey was approximately 200 feet upstream of the North Blanchard Street Bridge to approximately 500 feet upstream of the Broad Avenue Bridge.

A total of five (5) cross sections were collected at the site of the constructed riffles where the former inline dam/riffle structures were removed: Swale Park (XS1), Karg (XS2 & XS3), Cory Street (XS4), and Centennial Park (XS5). Wolman pebble counts were conducted within the riffle cross-sections at XS2, XS4, and XS5 to provide roughness in the discharge calculations for each riffle. This data was then processed and analyzed with the RIVERMorph software package to classify the reach and provide the basis for the initial preliminary design related to additional benching upstream of the Phase I floodplain bench widening. Additionally, riffle cross-sections (XS101 and XS102) were collected in the reach where new constructed riffles are being proposed. These cross-sections were surveyed to be used as a check for the location of base flow in the aerial. XS101 and XS102 were not used in bankfull calculations. A plan view figure showing the locations of the cross sections can be found in Sheet 09 of the drawing set in Appendix A. Plots of the Blanchard River Longitudinal Profile can be found in Appendix D and plots of the surveyed cross sections in Appendix E.

2.3.1.1 Bankfull Indicators

The bankfull elevation is defined as a river's incipient point of flooding. The primary bankfull indicators in the field are well-developed floodplains, highest active depositional features, and breaks in slope with fine sediment deposition. The discharge associated with this elevation represents the channel forming flow and has a return interval that ranges from 1.1 to 1.5 years, depending on the geomorphic setting. In urban areas in the eastern United States the return interval tends to be between 1.1 and 1.2 years.

During the Phase I Hydraulic Improvements Project, a floodplain bench was excavated near Swale Park (between Broad Avenue and the NS rail bridge) to widen the floodplain and provide conveyance during high flows. To maintain geomorphic stability of the river at the location of the floodplain bench, the floodplain was excavated to its bankfull elevation. This elevation was determined from the geomorphic assessment conducted during Phase I of the project and described in more detail in "*Hancock County Flood Risk Reduction Program Blanchard River Hydraulic Improvements Phase 1 – Preliminary Design Report*" (Stantec 2017).

2.3.1.2 Regional Curves

Regional curves can be used to confirm a field call or hydraulic approximation of bankfull. The regional curves provide the appropriate bankfull cross sectional area of a riffle cross section for a specific drainage area. The Eastern US regional curves are an appropriate reference for the Blanchard River near Findlay. The drainage area delineated to the Broad Avenue bridge is 345 square miles. The drainage area delineated above the confluence with Eagle Creek is 274 square miles. Cross sectional dimensions were derived from the Eastern US regional curves for a 345-square-mile and a 274-square-mile drainage area to confirm the bankfull dimensions calculated using measured cross sections and pebble count data.

During Phase I Hydraulic Improvements, survey data and Eastern US regional curves were used to determine a bankfull velocity of 3.23 feet per second (fps) and bankfull discharge of 2,371 cubic feet per second (cfs). This bankfull discharge was used to inform the elevation of excavation for the Phase I floodplain bench. A gage analysis was also conducted using the United States Geological Survey (USGS) gage, '*Blanchard River gage at Findlay 04189000'*. The gage had a discharge of 2,391 cfs at a return interval of 1.13 years.

2.3.2 Results

2.3.2.1 Bankfull Indicators

Bankfull indicators were identified along the assessment reach for the longitudinal profile and cross-sections. Because the river is incised, the two cross-sections upstream of the Phase I floodplain bench (XS4 and XS5) did not have distinct bankfull indicators. Bankfull indicators were identified for the three cross-sections located along the floodplain bench (XS1, XS2 and XS3). The bankfull indicators are marked on the cross-section plots in Appendix E. The bankfull indicators from the cross sections and profile survey were used to establish the bankfull line in the profile in Appendix D. Water surface and bankfull points depicted in this profile were collected during the July 1, 2020 field survey and thalweg points were collected on August 24, 2020.

2.3.2.2 Bankfull Dimensions

Table 2 compares the three riffle cross sectional dimensions with defined bankfull indicators along the floodplain bench to that of the Eastern US regional curves (described in Section 2.3.1.2).

Table 2. Riffle Bankfull Dimensions

Riffle Cross Section	Cross Sectional Area (ft^2)	Width (ft.)	Mean Depth (ft.)
XS1	771.4	125.0	6.17
XS2	790.3	127.9	6.18
XS3	780.3	160.6	4.86
Eastern US Regional Curves	793.9	135.4	5.90

The bankfull elevation was approximately 7.0 to 7.5 feet above baseflow on the riffle cross sections. XS3 included the concrete wall that was left in place at the former Karg Dam location, and therefore, did not provide the best representation of bankfull channel dimensions. XS2, located at the site of the former Karg Dam, was closest in range to the bankfull parameters of the Eastern US regional curves (Table 3).

2.3.3 Bankfull Parameters and Classification

The bankfull parameters were derived from XS2, located directly downstream of the former Karg Dam site, and used to determine the river classification. Table 3 summarizes the bankfull parameters of XS2.

Table 3. XS2 Bankfull Parameters

Width (ft.)	127.9
Entrenchment Ratio	3.84
Mean Depth (ft.)	6.18
Maximum Depth (ft.)	8.16
Width to Depth Ratio	20.7
Cross Sectional Area (sq. ft.)	790.3
Wetted Perimeter (ft.)	131.7
Hydraulic Radius (ft.)	6.0

The river classified as a C4 in the Rosgen classification system, typified by a meandering, slightly entrenched channel with abundant riffles and pools, and gravel dominated substrates.

Bankfull velocity and discharge were calculated from XS2 bankfull parameters, profile slopes, and particle data using the Rosgen (1996) relative roughness method. First the friction factor/relative roughness ratio was calculated:

$$\frac{U}{U*} = 2.83 + 5.66 \times \log\left(\frac{R}{D_{84}}\right)$$

Where: U = friction factor, U^* = relative roughness, R = channel hydraulic radius, and D_{84} = 84th percentile of particle size distribution of riffle pebble count.

The velocity was then calculated by substituting the friction factor/relative roughness ratio into:

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$$V = \frac{U}{U*}(gRS)^{0.5}$$

Where: *V* = bankfull velocity, *U/U** = friction factor/relative roughness ratio, *R* = channel hydraulic radius, *S* = bankfull slope, and *g* = gravitational constant.

This relationship returns an estimated bankfull velocity of 3.22 fps; multiplying by the assessment riffle bankfull area gives an estimated bankfull discharge of 2,546 cfs.

2.3.4 Bankfull Profile / Slope

The calculated values described above were confirmed by comparison to discharge data from the Eastern U.S Regional Curve and gage analysis to validate that the bankfull discharge has the appropriate return interval for the project reach.

Estimated bankfull discharge and predicted bankfull areas from the Eastern US Regional Curve were used to confirm that the bankfull elevation predicted by the 0.055% slope profile was reasonable at XS4 and XS5. Estimated bankfull elevations at both XS4 and XS5 yielded cross sections within 10% of the bankfull area predicted by the regional curve shown in Table 4. A drainage area of 274 square miles was used for comparison of the surveyed bankfull dimensions at XS5 (former Centennial Dam location) to that predicted by the regional curve.

Table 4. Comparison of Bankfull Design Variables to Regional Curve Values

Riffle Cross Section	Bankfull Elevation (ft.)	Bankfull Area (square feet)	Variance from Regional Curve (%)
XS2 (Former Karg Dam)	763.84	790.3	-0.0
XS4 (Former Cory St. Dam)	764.56	720.1	-9.3
XS5 (Former Centennial Dam)	766.29	760.3	+10.5
US Eastern Regional Curve (274 square miles)	N/A	688	N/A

Calculated bankfull discharge at XS4, based upon the field collected cross section dimension and particle data, was 2,515 cfs. This discharge is approximately 5.2% higher than the bankfull discharge estimated in previous gage analyses. This higher calculated discharge is likely a result of the particle sampling at the site which focused closer to the low flow wetted perimeter of the cross section. This sampling bias occurred due to the lack of clear indicators of bankfull elevation at the cross section to clearly demarcate a limit of data collection. The bias toward particles within the low flow wetted perimeter excluded significantly larger riprap on both banks leading to a lower estimated channel roughness than qualitatively observed at XS4.

The measured bankfull profile along the Phase I benching project, the bankfull elevation determined at XS2, and interpolated bankfull elevations at XS4 and XS5 were used to generate the proposed bankfull profile. The bankfull slope for the assessment reach was determined to be 0.055%.

The bankfull elevations and profile established in the geomorphic survey will be used as design variables for the proposed upstream benching area tie-in as described in Section 3.2.2.1. Bankfull discharge calculations can be found in Appendix F. The pebble count data used for roughness in the discharge calculations can be found in Appendix G.

2.3.5 Profile Analysis for Riffle Design

Stantec collected data during low flow conditions in the Blanchard River to provide support for the proposed riffle design. This geomorphic assessment targeted data associated with the thalweg of the river after removal of the four inline dam/riffle structures. Cross sections in potential riffle construction areas were also collected. Two cross sections were measured. Due to poor connectivity in areas under tree cover, only data below the approximate ordinary high-water mark (OHWM) was collected while in the field. Stantec supplemented this data with data above the OHWM from LiDAR to complete an approximate bankfull cross section. This data was then corrected to existing control and analyzed with the RIVERMorph software package. The thalweg profile data was used to approximate pool-to-pool spacing and compare to pre-construction data. Prior to the dam removal, the pool to pool spacing was inconsistent with a wide range of variability due to the impacts of the inline dam/riffle structures. Since the dam removal, the river has experienced several flow events at and above bankfull and has adjusted bed material distribution and pool-to-pool spacing to the energy distribution controlled by post-construction geomorphic conditions. Pool-to-pool spacing is a critical parameter for determining the appropriate location and length of the proposed riffles. The new profile thalweg data overlaid with the pre-dam removal data showed a new pool scoured near Station 17+20. The pool-to-pool spacing was measured in the reach between XS4 and XS5 where the locations of the proposed riffles are being considered. The average pool-to-pool spacing in this reach is 831 feet. This part of the Blanchard River classifies as a C4 stream type in the Rosgen classification system. Natural Channel Design utilizes dimensionless ratios found from reference reaches of the different stream types. For a C4 stream type the dimensionless ratio of (pool spacing)/ bankfull width should range from 3.5 to 7 with flatter profile slopes leaning toward the high end of the range. Using the newly scoured pool this ratio falls out at 6.5 which is reasonable for a bankfull slope of 0.055%.

2.4 GEOTECHNICAL FINDINGS

Four (4) borings were advanced by Stantec to provide geotechnical data along the alignment of the proposed floodplain bench widening. Below a thin layer of topsoil, soils identified as lean clay and sandy lean clay (CL), silty clayey sand (SC-SM), clayey sand (SC), silty sand (SM), silt (ML), and silty clay with sand (CL-ML) were observed to depths ranging from 15.2 feet to 19.9 feet, where auger refusal was encountered. Ground water was encountered in B-3 at a depth of 17.2 feet while the remaining borings were dry upon completion.

Slope stability analyses were not performed as part of this preliminary geotechnical exploration. Based on the soils encountered and the results of stability analyses performed on the adjacent Phase I Hydraulic Improvements project, 3:1 (H:V) cut slopes are recommended. Prior to final design, it is recommended that slope stability analyses be performed for any slopes exceeding 10 feet in height to confirm adequate

factors of safety against slope failure. Additional borings and laboratory testing will be required to support slope stability analyses.

No raised embankments will be constructed as part of this project. If the final design includes constructing embankments for the bike path or other structures, it is recommended that settlement analyses be performed to confirm that estimated settlement values are within recommended tolerances. Additional borings and laboratory testing will be required to support settlement analyses.

Culverts were considered during this Preliminary Design Phase under Cory Street and Main Street. However, no culverts will be constructed as part of this project. If the final design changes and ultimately includes the incorporation of culverts, the following is recommended:

> Based on the depths to bedrock found during this exploration, culverts may either be soil bearing or rock bearing depending on the size and invert elevation determined in final design. Therefore, it is recommended that additional borings be drilled near the exact locations of proposed culverts, if applicable, in accordance with Section 303.7.2 of "*Ohio Department of Transportation (ODOT) Specifications for Geotechnical Explorations*". For culverts with a planned diameter or span of 10 feet or greater, additional borings should include 5 feet of rock core to confirm the elevation and quality of the bedrock where culverts will be founded. Culverts should be designed in accordance with all applicable ODOT standards and specifications.

The geotechnical report which contains a brief description of the site, geologic conditions, the scope of work performed, and geotechnical recommendations for the project are included in Appendix H.

2.5 SURVEY AND EXISTING UTILITIES

Bockrath & Associates Engineering and Surveying, LLC (Bockrath) performed boundary and topographic survey services to support design and bid document development. Within a series of surveys over the Project Area, planimetric data was collected to identify utility locations, and potential design constraints. Bockrath set benchmarks for use during the field assessments described above. Stantec merged field topographic data with the LiDAR data which was used to develop existing and proposed grading plans and refine the design of the floodplain bench widening. The survey data is referenced to North American Vertical Datum of 1988 (NAVD88) and the North American Datum of 1983 (NAD83) Ohio State Plane North, US Survey Feet (horizontal) coordinate systems.

Existing utilities within the Project Area were identified using record drawings provided by Findlay and confirmed by Bockrath surveyors. Utilities located within the Project Area include sanitary and stormwater sewers, American Electric Power (AEP) utility poles, water lines, gas lines, underground electric lines, telephone/fiber optic communication cable, and traffic communication lines.

Additional analysis and review will be required for utilities not able to be physically located in the field, including the underground electric, telephone/fiber optic communication cable, and traffic communication lines under Main Street.

Proposed utility adjustments and replacements are detailed in Section 5.0 and within the 30% HCFRRP Additional Hydraulic Improvements Drawing Set attached in Appendix A.

2.6 ENVIRONMENTAL SAMPLING AND ANALYSIS

The Mannik and Smith Group, Inc. (MSG), performed preliminary environmental testing in August of 2020. The preliminary results identified soils with elevated hexavalent chromium concentrations at the former Superior Plating facility that categorize the material as characteristically hazardous.

2.7 PHASE II CULTURAL RESOURCES INVESTIGATION

MSG continued upon a previously completed Phase I cultural resources investigation and performed a Phase II cultural resources investigation.

This survey focused on three archaeological sites and one historic/architectural resource site that were identified by MSG in the previous Phase I investigation and recommended for additional study. MSG's Phase II report will be provided following the completion of this report and utilized to refine the scope of the Project in the following phase.

3.0 ADDITIONAL HYDRAULIC IMPROVEMENTS DESIGN SUMMARY

This section describes the preliminary design of the Additional Hydraulic Improvements projects. As part of this Project, additional floodplain benching is being proposed upstream of the existing Phase I and II Hydraulic Improvements projects to provide greater flood risk reduction benefit. Constructed riffles are also proposed adjacent to the proposed floodplain bench. The design of the channel modifications and floodplain bench relies on the bankfull discharge and profile slope determined in the geomorphic evaluation. The Natural Channel Design (NCD) approach, as defined by D. L. Rosgen (*Applied River Morphology – 1996 and Watershed Assessment of River Stability Supply (WARSSS)* – 2006), was established as a method to restore streams and rivers to a natural stable form which involves re-establishing dynamic stability that integrates the processes responsible for maintaining the dimension, pattern and profile of river channels. The preliminary design balances flood mitigation benefit with incorporation of NCD principles including the placement of the excavated bench at the bankfull discharge to emulate naturally occurring river features and enhance the associated geomorphic, hydraulic, and habitat functions.

Utilizing the bankfull discharge and other natural stable features such as woody and herbaceous vegetation in the riparian zone will allow for implementation of an NCD approach. The bankfull discharge can be applied to the constructed riffle design and establish bankfull elevations for excavation of the floodplain benches. Because a complete NCD of the Blanchard River project site is not feasible, a separate reference reach survey was not conducted to use for design. Instead, stable reference conditions within the Blanchard River project were measured and applied to the design.

3.1 RIFFLE DESIGN SUMMARY

3.1.1 Channel Restoration Goals and Objectives

The primary goal of this Project is to reduce the risk of flooding along the Blanchard River in Findlay. In addition to flood risk reduction, the restoration associated with the natural channel and riffle design will improve river stability, water quality and habitat. Riffle design will incorporate principles of NCD, in which stable natural analogs (reference reaches) are used to develop design criteria based on measured morphological relationships associated with the bankfull discharge. These analogs must be derived from reaches formed by similar geomorphic, hydraulic, hydrologic, and sediment transport processes as the proposed restoration reach. Following this approach, proposed constructed riffle slope mimics the stable riffle slopes observed in the geomorphic assessment. Stable riffles were measured and used as a reference for the proposed riffle slopes.

The proposed riffle cross sections will include an inner berm feature that occurs in naturally stable streams. The inner berm feature allows for more flow depth of the baseflow during drought conditions and provides sediment transport during high flows. Above the baseflow elevation, the upper banks of the riffle design will use the existing stable densely vegetated side slopes of the riverbanks and only disturb the

banks for access to construct the riffles. The upper banks in the disturbed areas will use a bioengineering technique called live brush layering (LBL). This technique is used to construct the banks in one-foot soil lifts wrapped in coir blanket. Live branches are placed in between the lifts and the face of the lift is seeded with native herbaceous species. Over time the root mass of the native woody and herbaceous vegetation establishes and stabilizes the bank while the coir blanket decomposes.

3.1.1.1 Proposed Project Impacts to Aquatic Habitat

Impacts to the Blanchard River aquatic habitat include a change in channel width and morphology, and the development of new terrestrial areas on the banks. The intent is to move the Blanchard River towards a more natural channel shape and morphology. The channel width will decrease, and the channel will be a low flow, shallow channel. The stream channel habitat is expected to increase in functional value with an increase in channel development (pool, glide, riffle, run complex).

According to the ODNR Mussel Survey Protocol, the Blanchard River within the project reach is a Group 1 stream. The protocol specifies that projects on Group 1 streams do not require mussel surveys prior to construction, but requests that sufficient staffing be available to recover stranded mussels. Stranded mussels will be relocated as part of the restoration design. The construction access areas and exposed sediment areas will be planted with live stakes and seeded. New floodplain vegetation communities are anticipated to develop on the exposed banks.

3.1.2 Structure Locations

The profile analysis discussed in Section 2.3.5 provided three potential locations for constructed riffles. A figure showing the locations of the potential riffle locations relative to the existing riffles and project area can be found in Appendix I. After review, only two (2) riffle locations will be considered for further design. The following sections discuss the recommendation to construct two (2) of the three (3) evaluated riffles. The riffle designs on Sheet 10 and Sheet 11 of the preliminary design plan set in Appendix A are primarily for presenting the feasible locations for constructed riffles based on the river's geomorphology. The design variables were kept similar and consistent with Phase I of the project and described in more detail in "*Hancock County Flood Risk Reduction Program Blanchard River Hydraulic Improvements Phase 1 – Preliminary Design Report*" (Stantec 2017). After deciding on riffle locations, the design variables will be refined appropriate for each location selected.

3.1.3 Riffle Design Details

In the following sections, the site characteristics will be described for each of the proposed locations. Each of the locations have unique site characteristics which will affect quantities and aesthetics. The riffle locations are named from upstream to downstream as Riffle 1 and Riffle 2

For the OPCC, the approximate quantities for rock placement, in-channel grading, and adjacent bank stabilization were based upon best available information and field observations made during the August 2020 thalweg survey. Placement of imported rock was assumed to be necessary for the extents of the "low flow" channel, below the inner berm. Due to a lack of bathymetric data, an approximation of the low flow channel was made based upon the wetted perimeter visible in aerials. This approximation of rock

extents was then verified against the typical riffle cross section and field collected cross sections 101 and 102. Based upon this comparison, the aerial imagery provides a reasonable approximation of rock placement for this preliminary design stage. A depth of 2 feet of rock placement was assumed for the extent of the estimated riffles. Areas requiring additional rock placement depth to fill existing deep spots in the river channel were not identified in this approximation. The upstream glide and downstream run, which tie the riffle to the adjacent pools, will require a lesser thickness of rock placement but were assumed, for this conservative estimation, to also require 2 feet of material placement. The estimated rock extents are shown in the riffle plan view on Sheet 09 of the drawing set in Appendix A.

The horizontal extents and rock placement thickness required to achieve stable riffles will be refined in future iterations of design, once better topographical and bathymetrical data has been collected at the site. The quantities and associated costs presented in this preliminary design report represent a conservative estimate of quantities required to construct the riffles using the best available data.

3.1.3.1 Riffle 1

Riffle 1 is located approximately midway between the Dr. Martin Luther King Jr. Way bridge and the Findlay Downtown Riverwalk pedestrian bridge. In this reach the riverbed is composed of native boulder, cobble and gravel. Additional survey at this site could determine how much native material may be used in the constructed riffle to offset material and provide the aesthetics of a native riffle. This riffle would be visible from the pedestrian bridge. Figure 2 is a view of the Riffle 1 location looking downstream.

Figure 2. Riffle 1 Location

3.1.3.2 Riffle 2

Riffle 2 is located approximately 150 feet downstream of the Findlay Downtown Riverwalk pedestrian bridge. This reach was observed to have bedrock at various locations along the thalweg and inner berm. The proposed riffle is positioned between bedrock points in the thalweg where it is also positioned to comply with the natural pool to pool spacing. By being positioned between the protrusions of bedrock, riffle material would not be needed for the run and glide at the ends of the riffle. Additional survey at this site could determine the bedrock elevation through the surface of the riffle location and potentially reduce the riffle material quantities. Figure 4 is a view of the Riffle 2 location looking upstream.

Figure 3. Riffle 2 Location

3.1.3.3 Riffle Design Summary

Upon request of the MWCD, Stantec conducted in-stream survey and data analysis to determine if riffle structures could be installed within the stream as part of the Additional Hydraulic Improvements project. From the survey and data analysis, Stantec determined three potential locations for constructed riffles that would agree with the river's geomorphology. After developing conceptual designs for each of the three riffle locations, Stantec further evaluated these locations for meeting the goals of the Project, focusing on proximity to the proposed floodplain bench area, public visibility, and natural aesthetics.

Locations proposed for Riffle 1 and Riffle 2 meet the goals of the project. Both locations are adjacent to the proposed floodplain bench area and would be visible from the existing pedestrian bridge. Both locations have unique characteristics that could provide natural aesthetics and potential reduction in material cost. Additional survey would be required to determine how much existing native boulder, cobble, and gravel would be available within the low flow channel of Riffle 1 that could be used in the constructed

riffle design. Additional survey would also determine the location of bedrock at the Riffle 2 location. Bedrock outcrops could be used as natural features in the proposed riffle and reduce material cost at those locations. It should be noted that both potential riffles are included in the opinion of probable construction costs detailed in Section 7.3 and individually range from roughly $300,000 to $370,000. As noted above, detailed survey to understand what existing material may be utilized in their construction will impact the construction costs.

A third riffle location was evaluated midway between the South Blanchard Street bridge and the Dr. Martin Luther King Jr. Way bridge. The downstream end of the potential riffle is approximately 30 feet upstream of the confluence with Eagle Creek. Tributaries typically scour a pool as they discharge into the main channel so the confluence provides a constraint on how far downstream the riffle could be located. The Stantec field team observed mostly silt in this reach of the river which would not provide native alluvium for filling voids in the riffle material. The voids would need to be filled with size 57 stone increasing cost and not providing the aesthetics of native alluvium. This riffle would not be adjacent to the proposed floodplain bench area and would not be as visible to the public as the other two riffle locations. Installation of bed material at this potential riffle location also is likely to be cost prohibitive given the large volume of silt that would need to be excavated, hauled off, and replaced with imported boulder, cobble, and gravel material. Therefore, this riffle location is not being considered for further design.

Constructed riffles are designed from natural analogs of stable stream types in similar geomorphic settings, and reflect the aesthetics of those systems; however, they typically need a period of time after construction for natural bed material sorting, sedimentation, and revegetation to fully achieve their potential. To increase aesthetic appeal immediately post-construction, additional in-channel features could be added to the riffle designs. Both options focus on installing natural materials in the channel bed to increase bedform and flow diversity. One option would be to incorporate boulder clusters in the riffle bed as shown in Figure 4, and another option for an aesthetic feature would be a combined boulder and log riffle as shown in Figure 5. Stantec recommends using these smaller-scale enhancements to manage installation cost and to not adversely affect channel hydraulics, flow conveyance, or debris transport. Further, Stantec recommends placing the structures in the channel margins along the inner berm of the low flow channel to minimize potential interference with recreational boating and sediment transport.

Figure 4. Boulder Clusters in a Constructed Riffle

Figure 5. Boulder and Logs in a Constructed Riffle

3.1.4 Bank and Channel Stabilization

Currently, the riverbanks adjacent to the proposed riffle locations are stable and densely vegetated with both herbaceous and well-established woody vegetation. The riverbanks will be left undisturbed except for bench excavation and access for riffle construction. The banks disturbed from access will be reconstructed with LBL tying into the existing banks.

3.2 PRELIMINARY FLOODPLAIN BENCH DESIGN SUMMARY

3.2.1 Floodplain Benching Goals and Objectives

The primary goal of this Project is to provide additional flood risk reduction in the vicinity of the Blanchard River through Findlay. By expanding the floodplain, the bench widening project may provide minor benefits to aquatic ecosystems by reducing the magnitude of physical forces working on the riverbed. Additional opportunities for wetland and stream restoration are available at this site through the opportunities of plantings and natural habitat formations. Riparian vegetation is discussed in Section 5.3.

Additionally, the excavation and disposal of potentially contaminated soils within the Project Area may facilitate future recreation opportunities providing community value beyond the flood risk reduction benefits.

3.2.2 Design Variables

Several impacts, constraints, and construction considerations were identified during preliminary design of the floodplain bench. In addition to bankfull elevation considerations, the design considered varying bench widths, excavation depths, slopes, and potential culvert sizes to reduce impacts associated with privately owned parcels, utilities, roadways, small pockets of trees, and allow for potential for future open space re-use.

3.2.2.1 Floodplain Bench Design Variables

The geomorphic survey assessment detailed in Section 2.3.2 yielded a proposed bankfull profile design slope of 0.055%. Using the bankfull elevations as the starting point for the floor of the floodplain bench provides the greatest amount of conveyance capacity and hydraulic benefit while allowing the river to maintain its form and function (geomorphic stability), and sediment transport capabilities based on the NCD principles. The bankfull profile assumes the elevations along the green, dashed line shown on Figure 6.

3.2.2.2 Culvert Design Variables

To provide bike path access and additional flow capacity during flooding events, a single culvert at Cory Street and Main Street were considered as part of the design. Two culvert sizes were considered, 20-foot by 10-foot culvert and a 61-foot by 10-foot culvert. Concepts 1, 2, and 3 were modeled with the 20-foot by 10-foot culvert and Concepts 1, 2, and 3-O-Series1161 were modeled with the 61-foot by 10-foot culvert. Concept 1 was also considered with no culvert under Cory Street or Main St.

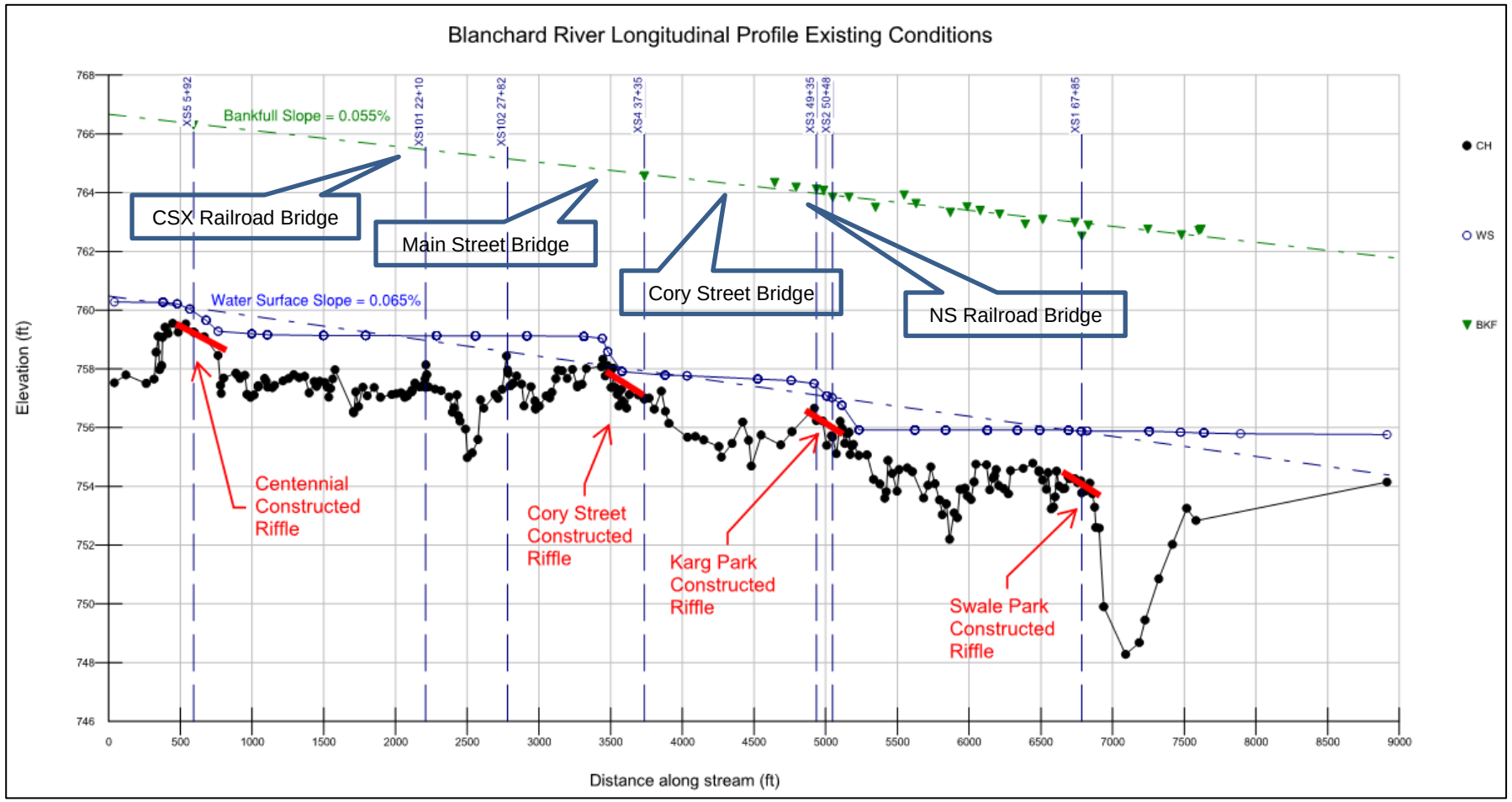


Figure 6 – Bankfull Slope and Elevations Calculated as part of the Additional Hydraulic Improvements Design

A base concept was selected following the submittal of the Additional Hydraulic Improvements Conceptual Design memorandum. Concept 8 from that memorandum (Figure 7) was chosen as the basis for the preliminary design footprint. Design variations were considered relative to the floodplain bench slopes and number of floodplain bench tiers to find a hydraulically efficient and economically feasible option that also incorporated Findlay's future plans for the open space.

The preliminary design of the floodplain bench area considered three different concepts in the hydraulic model with the same general footprint of Concept 8 from the Conceptual Design memorandum.

Concept 1 includes a lower tier bench adjacent to the Blanchard River that slopes up at a 0.5% grade from the initial bankfull elevation. The width of the lower tier bench is typically consistent at approximately 125 feet. After sloping up three feet at a 4H:1V slope, a second tier was designed. This second tier would slope up at 1% grade until tying back into existing ground near Clinton Court at a 4H:1V slope. A plan view of Concept 1 is shown in Figure 8 and the section view is shown in Figure 9

Concept 2 also included a lower tier bench at a 0.5% slope; however, this bench was designed to be approximately 200 feet wide. After sloping up three feet at a 4H:1V slope, a second tier was also included to slope up at 1% grade until tying back into existing ground near Clinton Court at a 4H:1V slope. A plan view of Concept 1 is shown in Figure 10 and the section view is shown in Figure 11.

Concept 3 slopes up at 1% grade from the bankfull elevation as one continuous bench until tying back into existing ground near Clinton Court at a 4H:1V slope. A plan view of Concept 1 is shown in Figure 12 and the section view is shown in Figure 13.

Bench floor slopes were evaluated to provide adequate drainage while attempting to increase hydraulic benefits. Stantec assumed a 0.5% slope on the lower tier of the Concept 1 and Concept 2 floodplain bench from north to south to allow for drainage towards the Blanchard River. Approximate excavation volumes for the three concepts are provided in Table 5. Approximate excavation depths are shown in Figure 14, Figure 15, and Figure 16.

Table 5. Approximate Excavation Volumes by Concept

Name	Cut (Cu. Yd.)
Concept 1	114,659
Concept 2	139,347
Concept 3	159,129

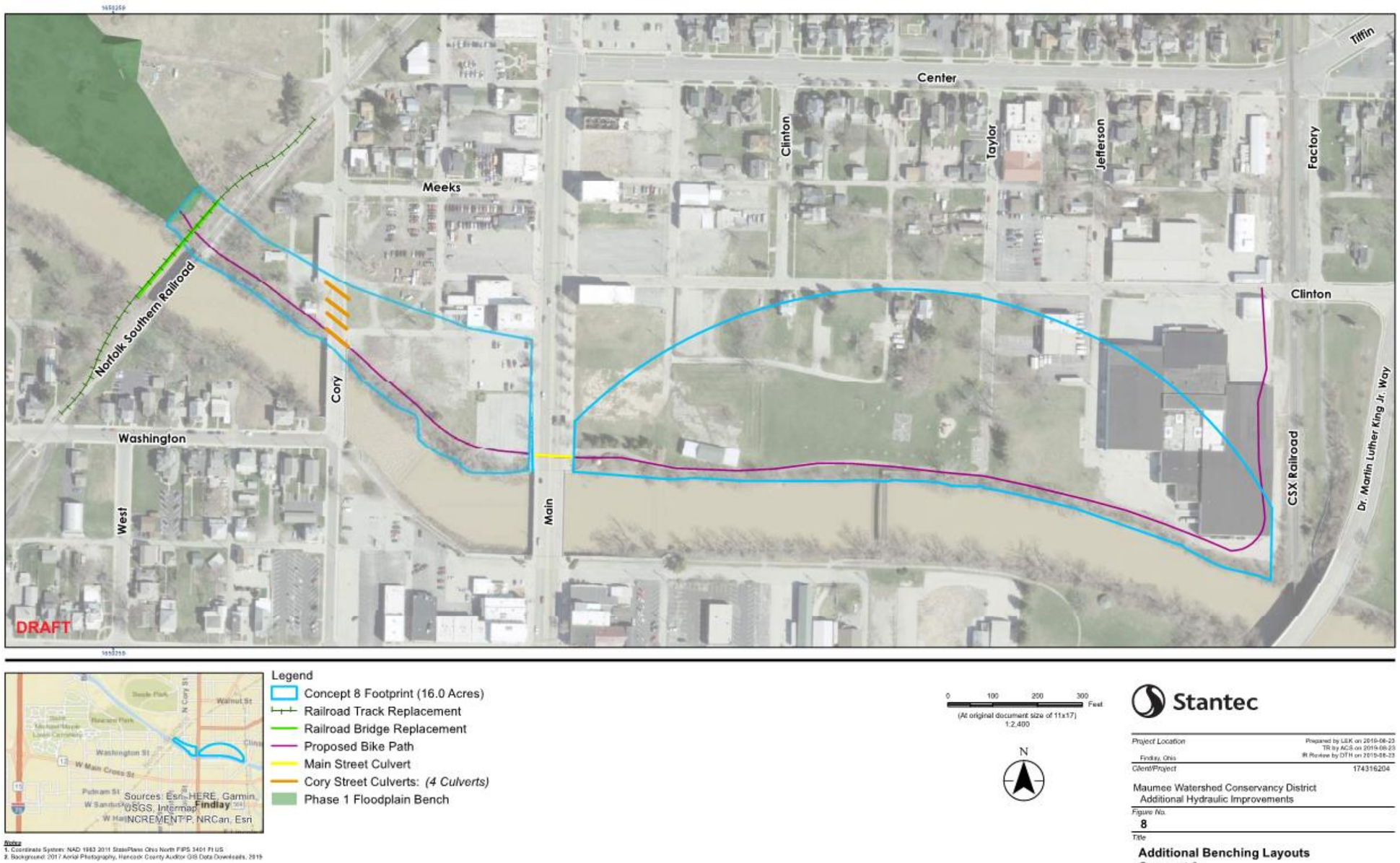


Figure 7 – Concept 8 from the Additional Hydraulic Improvements Conceptual Design Memorandum

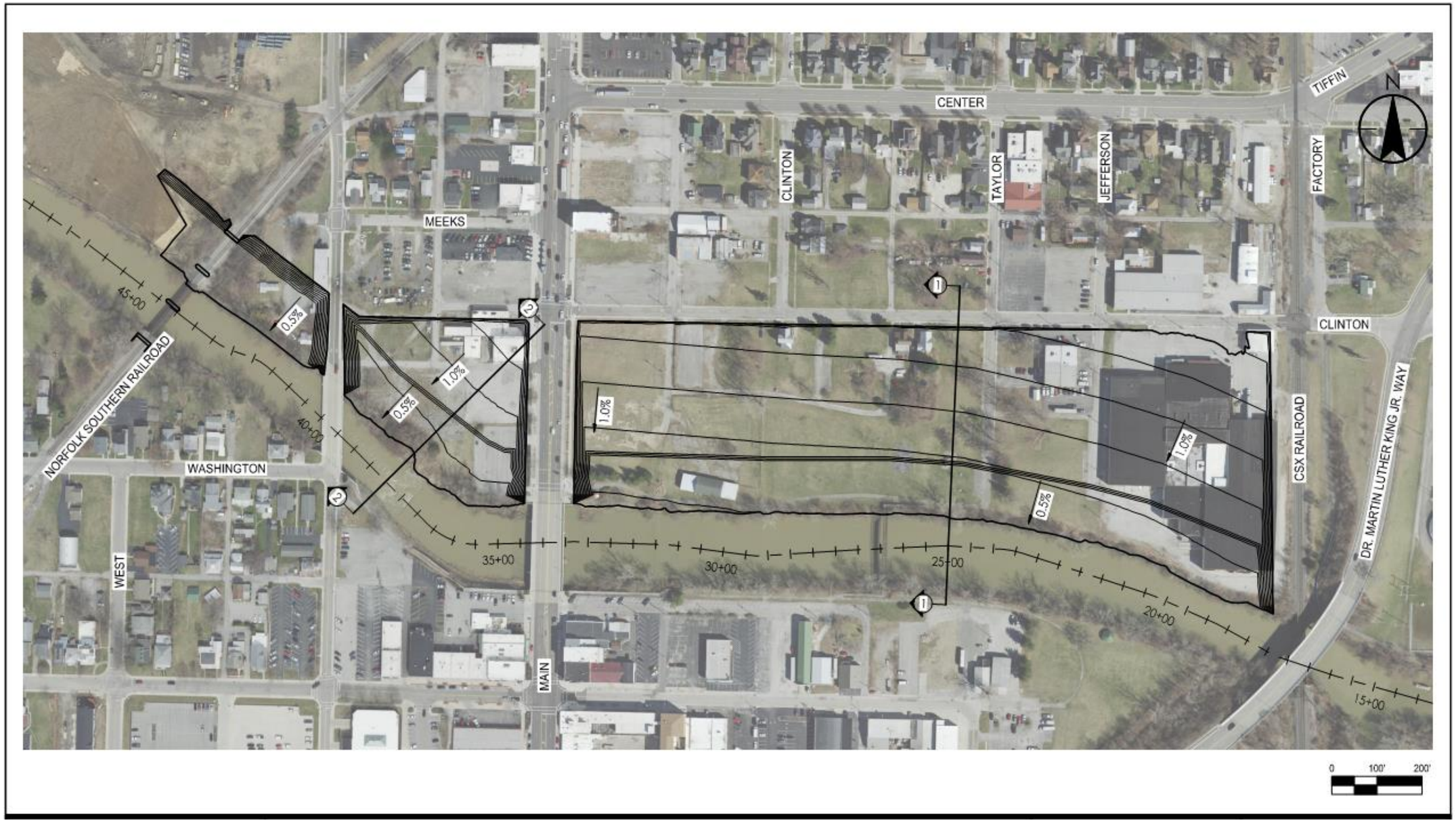


Figure 8 – Preliminary Design Concept 1 – Plan View

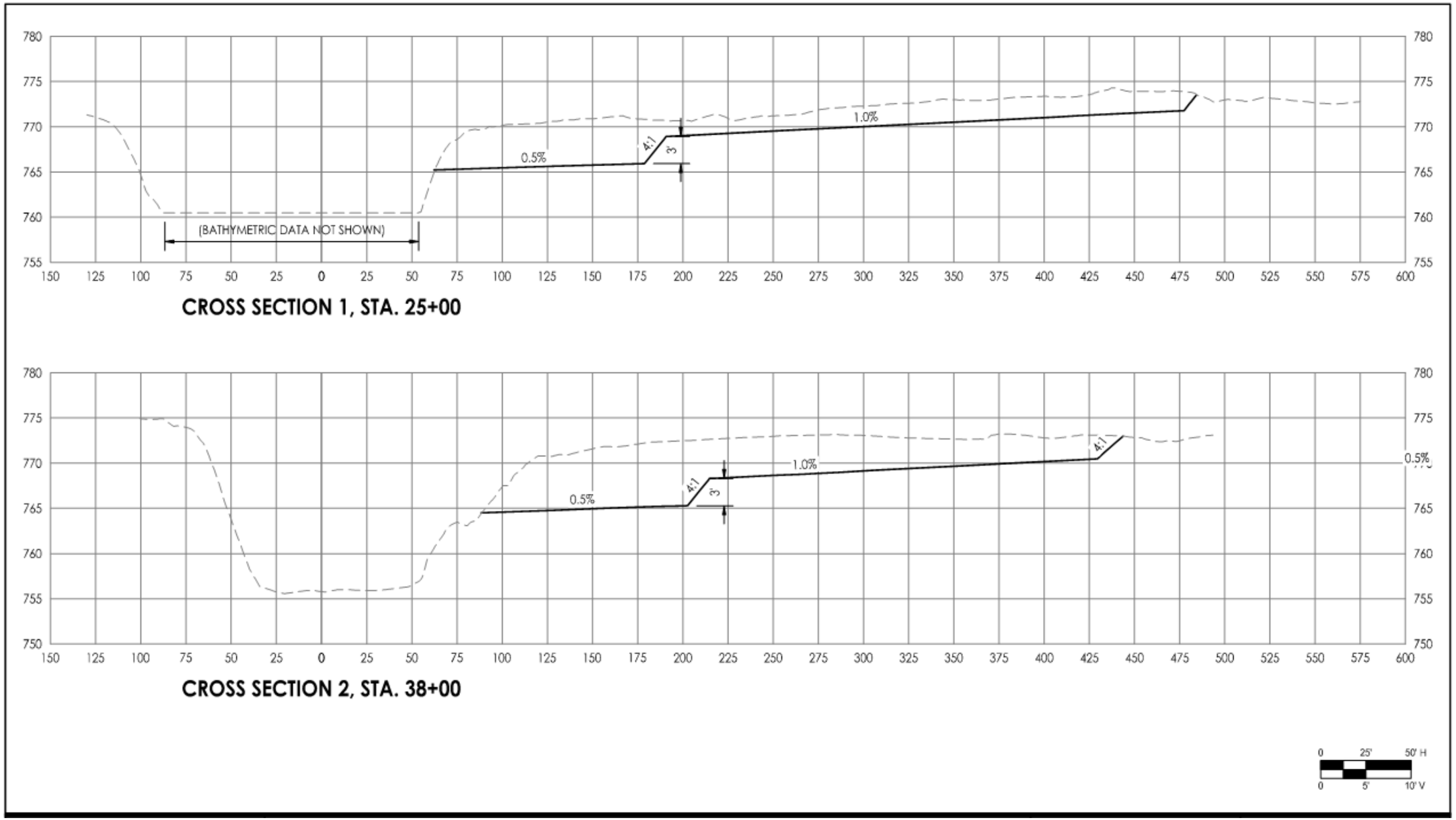


Figure 9 – Preliminary Design Concept 1 – Section View

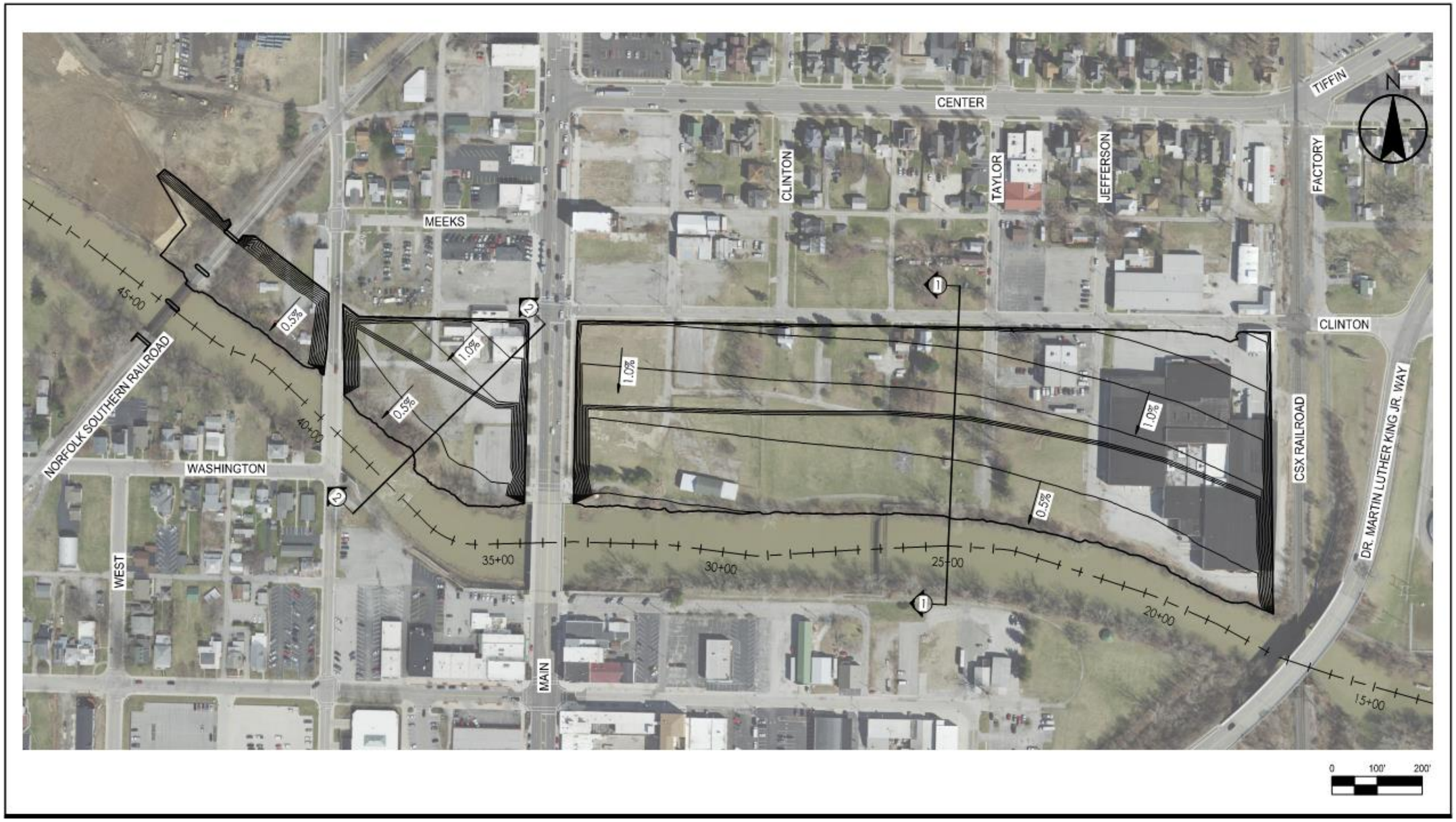


Figure 10 – Preliminary Design Concept 2 – Plan View

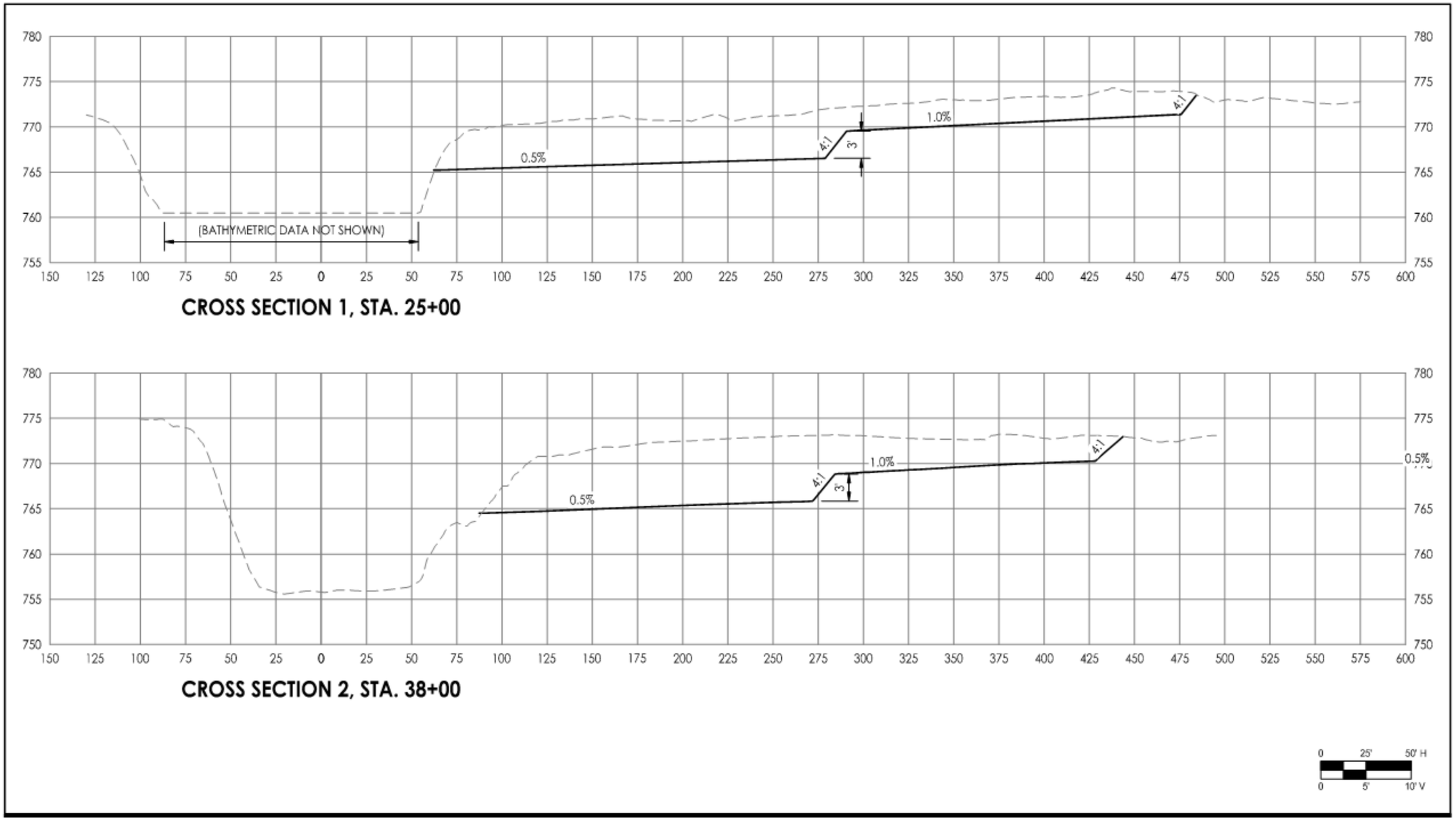


Figure 11 – Preliminary Design Concept 2 – Section View

Additional Hydraulic Improvements Design Summary

Figure 12 – Preliminary Design Concept 3 – Plan View

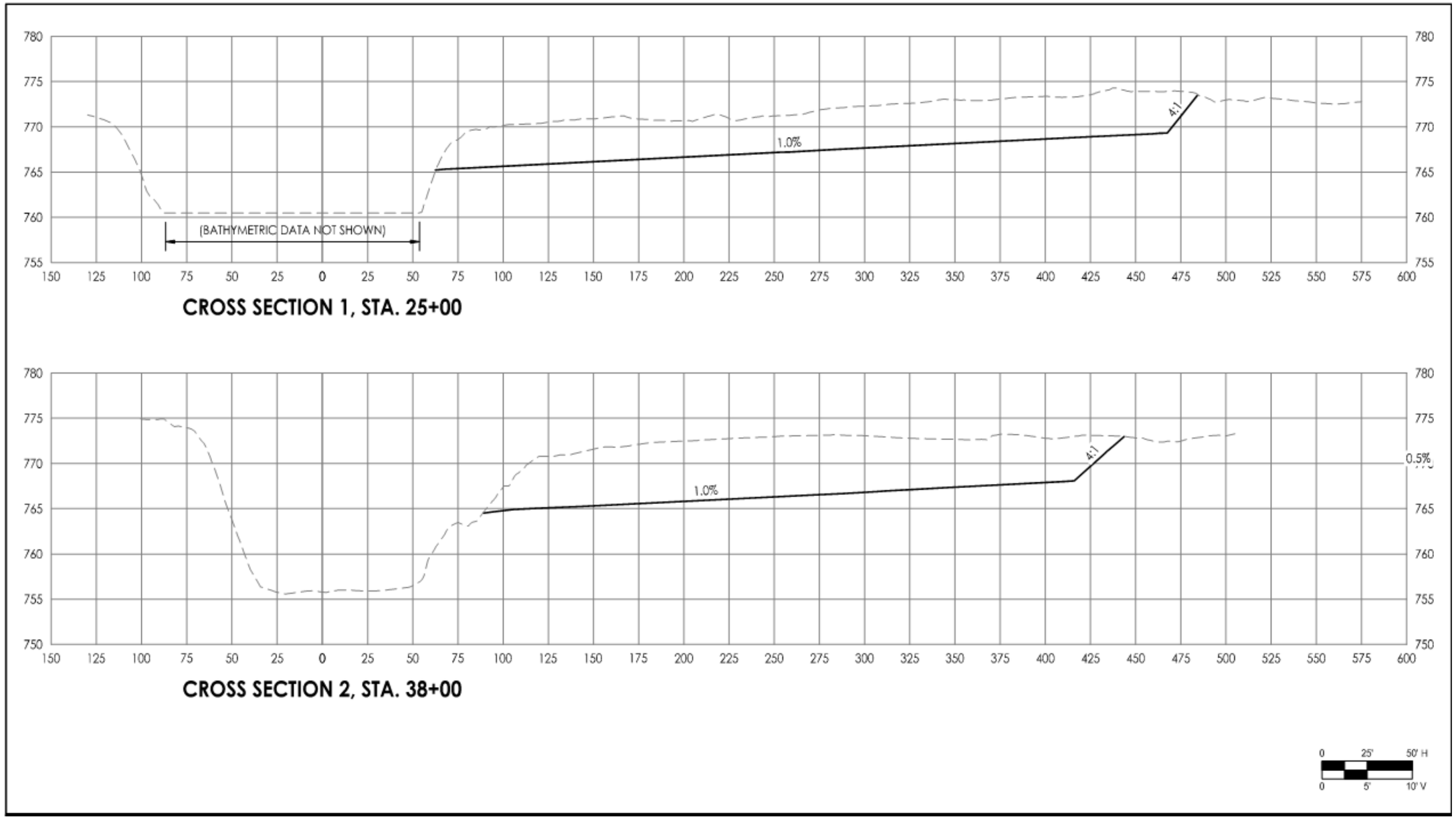


Figure 13 – Preliminary Design Concept 3 – Section View

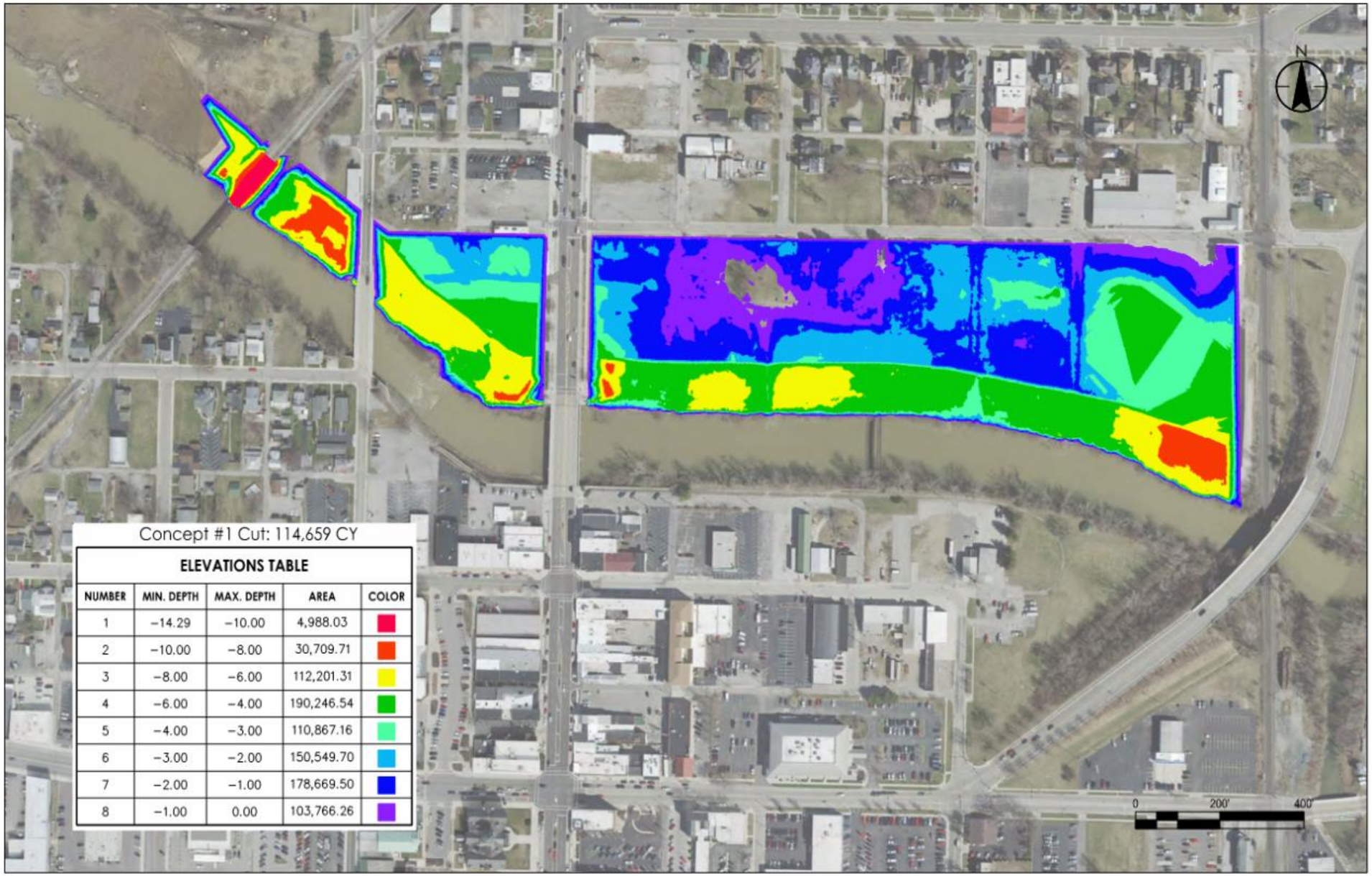
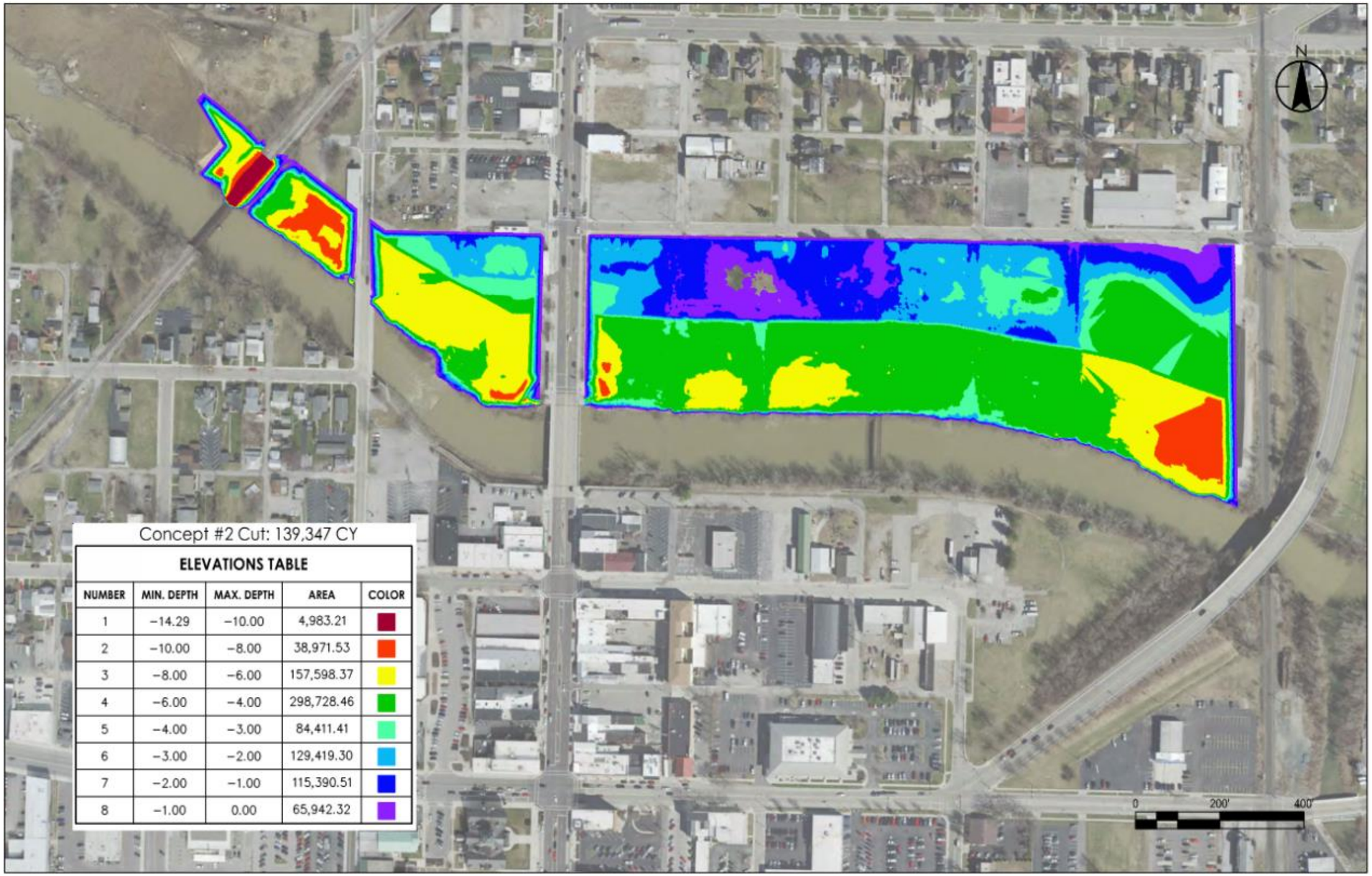


Figure 14 – Preliminary Design Concept 1 – Approximate Excavation Depths



Concept #2 Cut: 139,347 CY

ELEVATIONS TABLE

NUMBER	MIN. DEPTH	MAX. DEPTH	AREA	COLOR
1	−14.29	−10.00	4,983.21	
2	−10.00	−8.00	38,971.53	
3	−8.00	−6.00	157,598.37	
4	−6.00	−4.00	298,728.46	
5	−4.00	−3.00	84,411.41	
6	−3.00	−2.00	129,419.30	
7	−2.00	−1.00	115,390.51	
8	−1.00	0.00	65,942.32	

Figure 15 – Preliminary Design Concept 2 – Approximate Excavation Depths

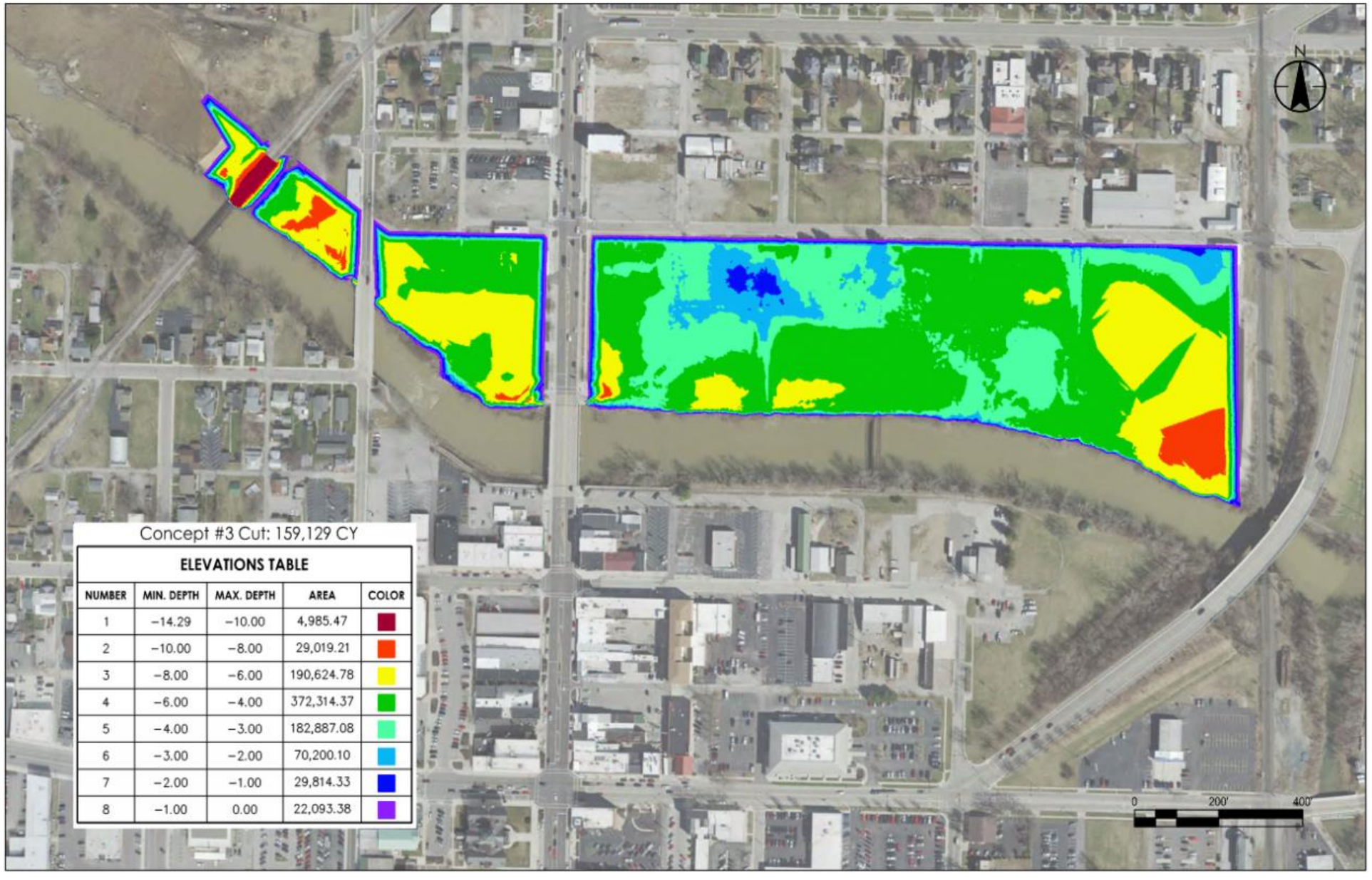


Figure 16 – Preliminary Design Concept 3 – Approximate Excavation Depths

3.2.3 Hydraulic Analysis

The three floodplain bench concept variations and three culvert options were evaluated using a hydraulic model to identify potential WSE reductions (total of seven simulations). Stantec simulated the seven (7) scenarios using a version of the unsteady Hydrologic Engineering Center River Analysis System (HEC-RAS – Version 5.0.7) model developed and revised as part of the HCFRRP Proof of Concept phase (Stantec, April 2017).

Stantec incorporated the proposed grading/topographic modifications of the floodplain bench based on the bankfull elevations calculated as part of the geomorphic assessment. Excavation was assumed to begin at existing grade near Clinton Court and continue down to the bankfull elevations of the Blanchard River as described for each Concept in Section 3.2.2.1. The modeled bankfull elevations are shown in Table 6 for each hydraulic model cross section near the Project Area. The elevations ranged from 764.5 feet at the downstream end to 765.6 feet at the upstream end of the bench.

Table 6. HEC-RAS Cross Sections and Associated Bankfull Elevation Tie-in

HEC-RAS Cross Section	Bankfull Elevation (ft.)
297564 (CSX RR)	771.40
297532	
297400	765.60
297260	765.53
296618	765.17
296602 (Civitan Park Pedestrian Bridge)	
296572	765.15
296168	764.92
295930	764.78
295854 (Main Street)	
295802	764.72
295603	764.60
295545	764.57
295489	764.54
295320	764.50
295285 (Cory Street)	
295216	764.50
294986	764.50
294939	764.50
294851 (NS RR)	
294783	764.50

Stantec assumed 50-feet of vegetation would be planted along the floodplain bench on the right descending bank of the Blanchard River for stabilization. This was simulated by an increased Manning's n roughness coefficient compared to the natural flood resistant vegetation that was assumed for the floodplain bench.

The model was used to estimate the hydraulic benefit of the Additional Hydraulic Improvements. Stantec compared the 1% Annual Chance Exceedance (ACE) (100-Year) WSE results from the proposed conditions models to the pre-project conditions model. For continuity, the Norfolk Southern Railroad Bridge Improvements (Phase II Hydraulic Improvements) were included for hydraulic benefit evaluations based on that project's 30% design concept. Stantec analyzed the results in comparison to both Existing Conditions and assuming the Phase I Hydraulic Improvements have reached final completion.

Table 7 shows the 1% ACE WSE results at notable locations along the Blanchard River for Existing Conditions, Phase I Hydraulic Improvements, and for each of the seven (7) scenarios considered for the Additional Hydraulic Improvements. Flood reduction benefits from each option extend approximately 4.25 miles east of the CSX RR bridge. The 1% ACE WSEs along the Blanchard River are shown in graphical format in Figure 17.

The modeled 1% ACE WSE floodplain extents for Concept 1 were compared to Existing Conditions and to the Phase I Hydraulic Improvements and are shown in Figure 18. The associated approximate total WSE reductions (in addition to the Phase I Hydraulic Improvements included) are also shown on Figure 18. The approximate total WSE reductions at notable locations along the Blanchard River compared to Existing Conditions (in addition to the Phase I Hydraulic Improvements included) are shown in Table 8 for each concept. The Additional Hydraulic Improvements are expected to provide as much as an additional 0.4 feet WSE reduction (in addition to the Phase I Hydraulic Improvements benefits) during a 1% ACE flood event at a location near the CSX rail bridge / Dr. Martin Luther King Jr. Way bridge. The WSEs are generally consistent between each of Concepts 1, 2, and 3 and their two culvert options, however, model results show that Concepts 2 and 3 do provide an increased WSE reduction of up to 0.05 feet at the confluence of both Eagle Creek and Lye Creek.

The larger 61-foot by 10-foot culvert reduces the WSEs by an additional 0.03 feet at several locations upstream of the culverts compared to the options with the 20-foot by 10-foot standard culvert. The 61-foot culvert utilized within the model is s a precast culvert by Contech, the O Series-1161. The 7th option shows that there is a slight reduction in benefits (approximately 0.04 feet) with the removal of the proposed culverts under Cory Street and Main Street.

Table 7 – Summary of WSEs at Notable Locations along the Blanchard River

	Blanchard River 1% Annual Chance Exceedance (100-Year) Water Surface Elevations (Feet)								
	U/S of NS Bridge	**U/S of Cory St.**	**U/S of Main St.**	**U/S of Dr. MLK Jr. Way**	**U/S of N. Blanchard St.**	**U/S of Riverside Dam**	**U/S of Bright Rd.**	**U/S of OH-568**	**D/S of TR241**
HEC-RAS Cross Section	**294939**	**295320**	**295930**	**297591**	**298448**	**301255**	**308920**	**314100**	**323760**
Existing Conditions	776.5	776.7	777.2	777.8	777.9	778.5	779.3	781.2	786.1
Phase I Hyd. Impr.	775.9	776.1	776.4	777.2	777.4	778.0	779.0	781.1	786.1
Concept 1 – 20'x10' Culverts	775.5	775.8	776.1	776.9	777.1	777.8	778.8	781.0	786.1
Concept 2 – 20'x10' Culverts	775.5	775.8	776.1	776.9	777.0	777.8	778.8	781.0	786.1
Concept 3 – 20'x10' Culverts	775.5	775.8	776.1	776.9	777.0	777.8	778.8	781.0	786.1
Concept 1 – O-Series1161	775.5	775.8	776.0	776.9	777.1	777.8	778.8	781.0	786.1
Concept 2 – O-Series1161	775.5	775.8	776.1	776.9	777.0	777.7	778.8	781.0	786.1
Concept 3 – O-Series1161	775.5	775.7	776.1	776.9	777.0	777.7	778.8	781.0	786.1
Concept 1 – No Culverts	775.5	775.8	776.1	777.0	777.1	777.8	778.8	781.0	786.1

*Concepts 1 through 3 all assume the Phase I Hydraulic Improvements Project is complete
**Base Concepts 1, 2, and 3 use the 20-foot by 10-foot culvert through Cory Street and Main Street.

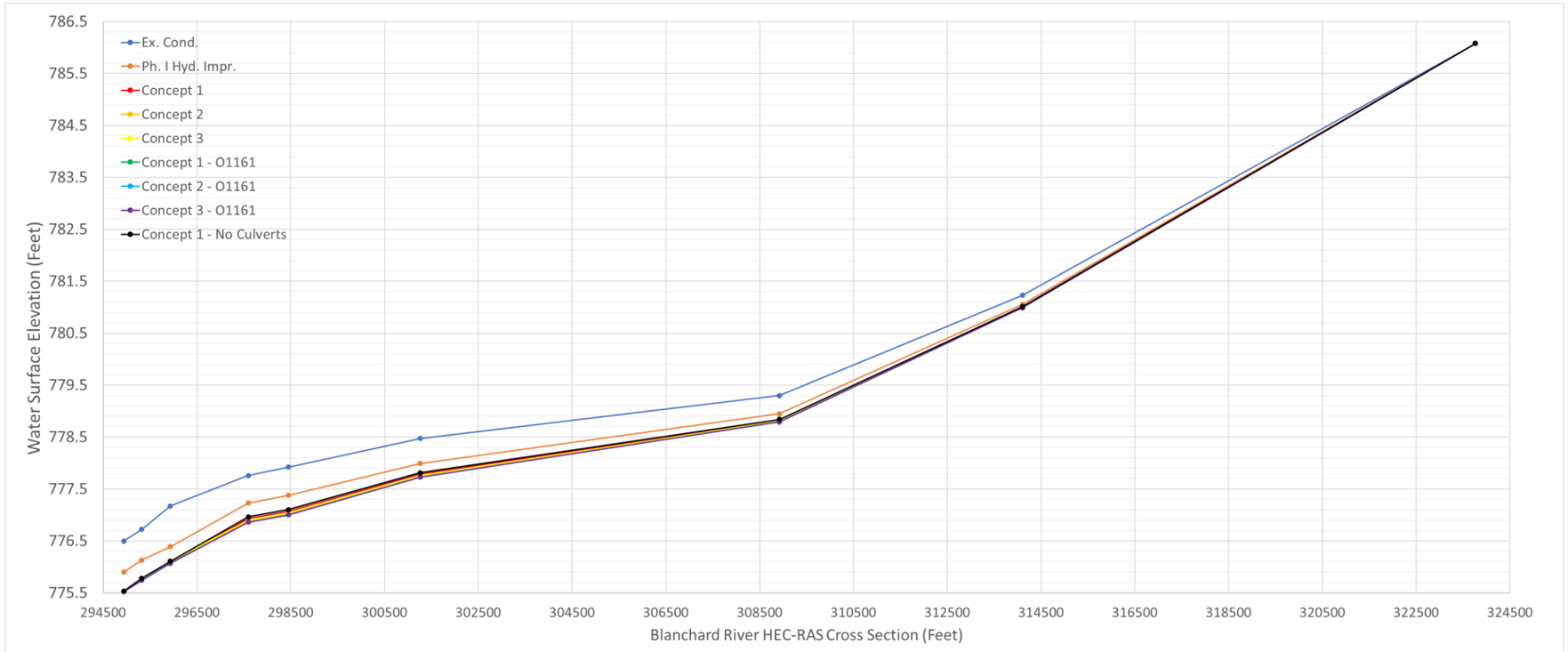


Figure 17 – 1% ACE WSEs along the Blanchard River (See Table 7 for Location Descriptions)

Additional Hydraulic Improvements Design Summary

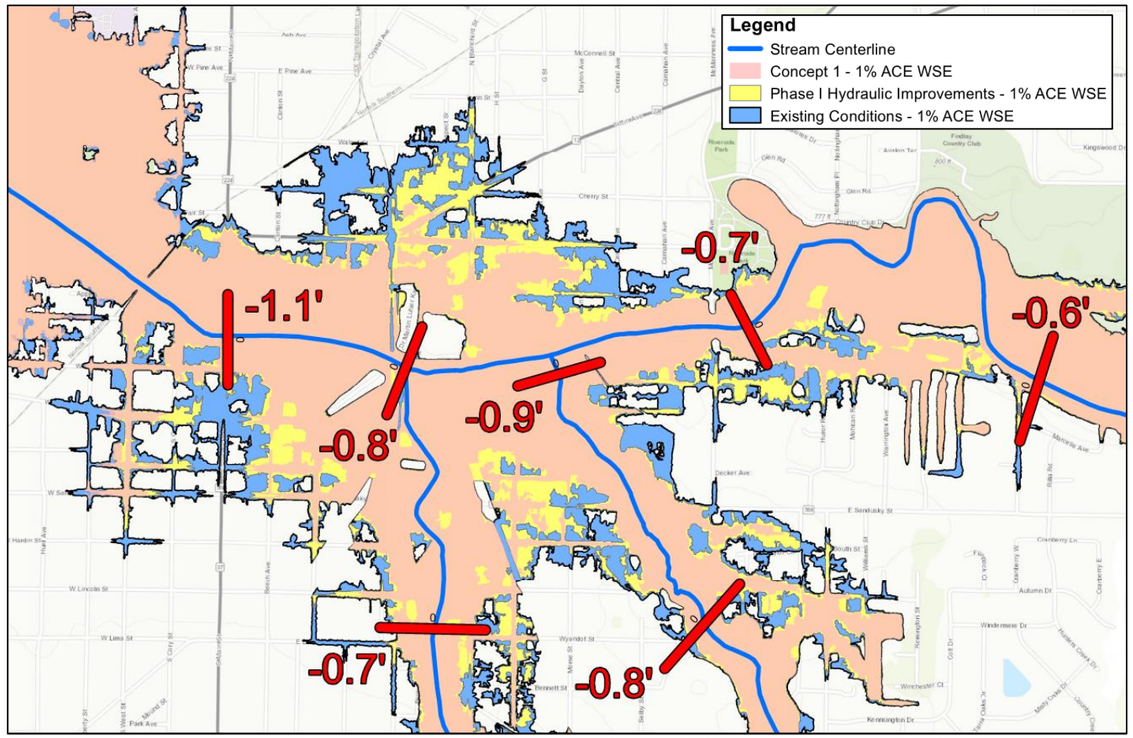


Figure 18 – Concept 1, 1% ACE Floodplain Extents and Change in WSEs compared to Existing Conditions and Phase I Hydraulic Improvements

Table 8 – Summary of WSEs Reductions at Notable Locations along the Blanchard River

	Blanchard River 1% Annual Chance Exceedance (100-Year) Water Surface Elevation Reductions (Feet)								
	U/S of NS Bridge	**U/S of Cory St.**	**U/S of Main St.**	**U/S of Dr. MLK Jr. Way**	**U/S of N. Blanchard St.**	**U/S of Riverside Dam**	**U/S of Bright Rd.**	**U/S of OH-568**	**D/S of TR241**
HEC-RAS Cross Section	**294939**	**295320**	**295930**	**297591**	**298448**	**301255**	**308920**	**314100**	**323760**
Existing Conditions	-	-	-	-	-	-	-	-	-
Phase I Hyd. Impr.	0.6	0.6	0.8	0.5	0.5	0.5	0.3	0.2	0.0
Concept 1 – 20'x10' Culverts	1.0	1.0	1.1	0.8	0.8	0.7	0.5	0.2	0.0
Concept 2 – 20'x10' Culverts	1.0	1.0	1.1	0.9	0.9	0.7	0.5	0.2	0.0
Concept 3 – 20'x10' Culverts	1.0	1.0	1.1	0.9	0.9	0.7	0.5	0.2	0.0
Concept 1 – O-Series1161	1.0	1.0	1.1	0.9	0.9	0.7	0.5	0.2	0.0
Concept 2 – O-Series1161	1.0	1.0	1.1	0.9	0.9	0.7	0.5	0.2	0.0
Concept 3 – O-Series1161	1.0	1.0	1.1	0.9	0.9	0.7	0.5	0.2	0.0
Concept 1 – No Culverts	1.0	0.9	1.1	0.8	0.8	0.7	0.5	0.2	0.0

*Concepts 1 through 3 all assume the Phase I Hydraulic Improvements Project is complete

Stantec analyzed both the modeled discharge in the Blanchard River and the associated WSEs compared to the proposed floodplain bench elevations. Stantec developed the graphics shown in Figure 19 and Figure 20 using past gage analysis results to determine the approximate flood frequency expected for the Project Area.

The same WSE reduction benefits observed at Dr. MLK Jr. Way generally extend upstream into Eagle Creek and Lye Creek as backwater from the Blanchard River controls. For Concept 1, a WSE reduction of 0.8 feet is observed along Eagle Creek from the confluence with the Blanchard River to about a half-mile upstream.

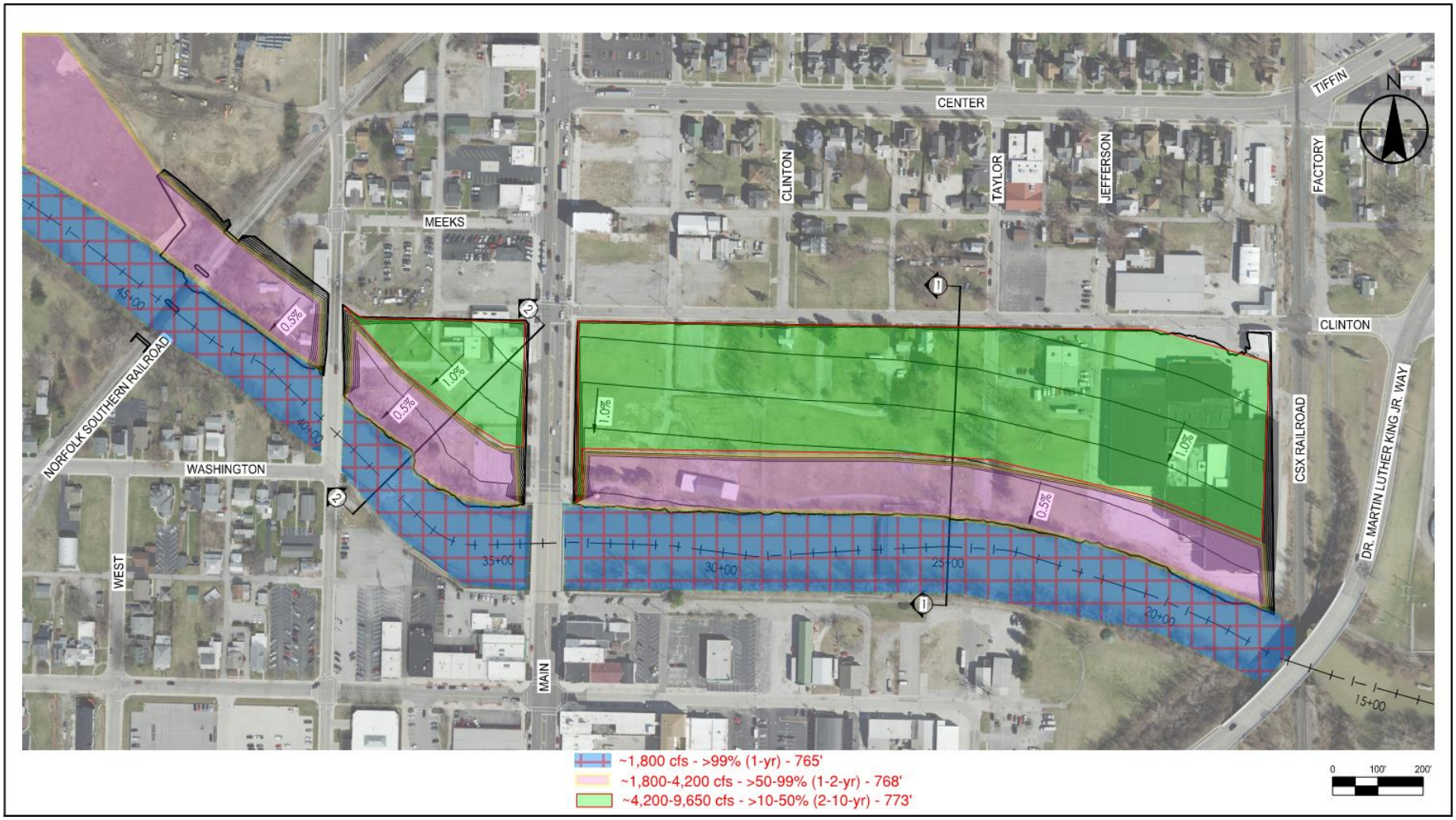


Figure 19 – Plan View of Concept 1 Anticipated Flood Extents and the associated Blanchard River Discharge / Recurrence Interval

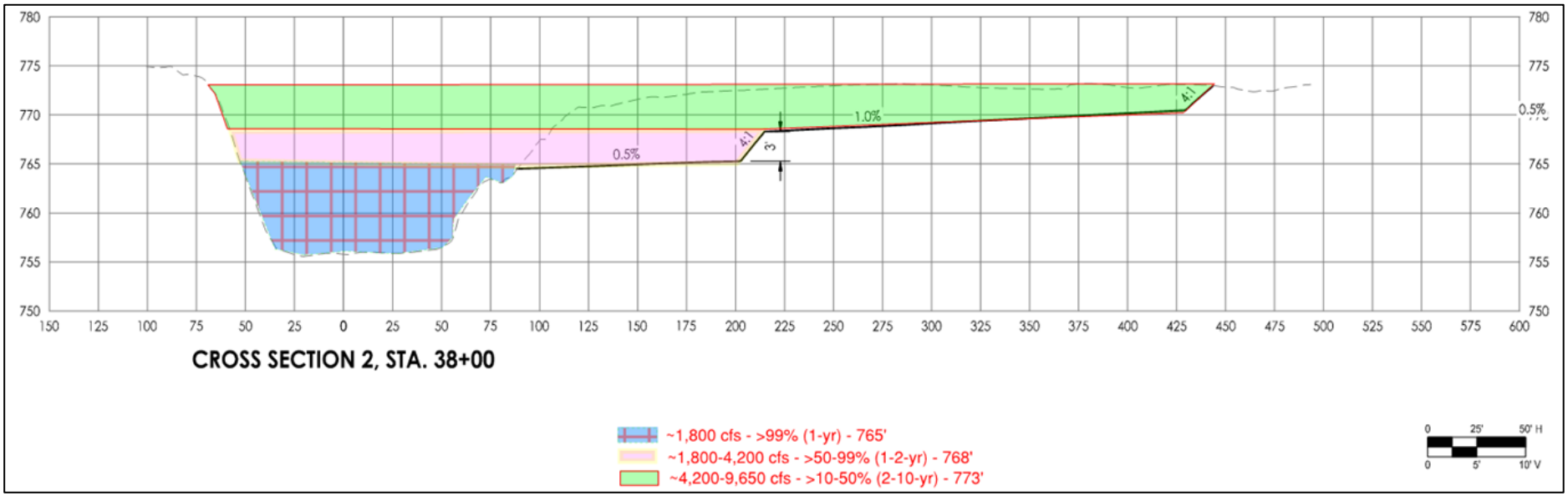


Figure 20 – Cross Section of Concept 1 Anticipated Flood Extents and the associated Blanchard River Discharge / Recurrence Interval

Additional Hydraulic Improvements Design Summary

The modeled 1% ACE WSE floodplain extents along Eagle Creek for Concept 1 are shown in Figure 21 compared to Existing Conditions and the Phase I Hydraulic Improvements floodplain extents. The approximate total WSE reductions at notable locations along Eagle Creek compared to Existing Conditions (in addition to the Phase I Hydraulic Improvements included) are shown in Table 9. Figure 22 shows the WSE reductions for Concept 1 compared to Existing Conditions and the Phase I Hydraulic Improvements WSEs graphically.

There is generally an additional benefit observed along Eagle Creek for about 1.5 miles upstream of the confluence. In this region, Blanchard River backwater typically controls for most flood events across the watershed. The reduction in WSE is due to both the Phase I Hydraulic Improvements and the proposed Additional Hydraulic Improvements downstream. Beginning around 6th Street and further upstream, the flows through Eagle Creek control the floodplain extents for the 1% ACE flood event as shown in Figure 21.

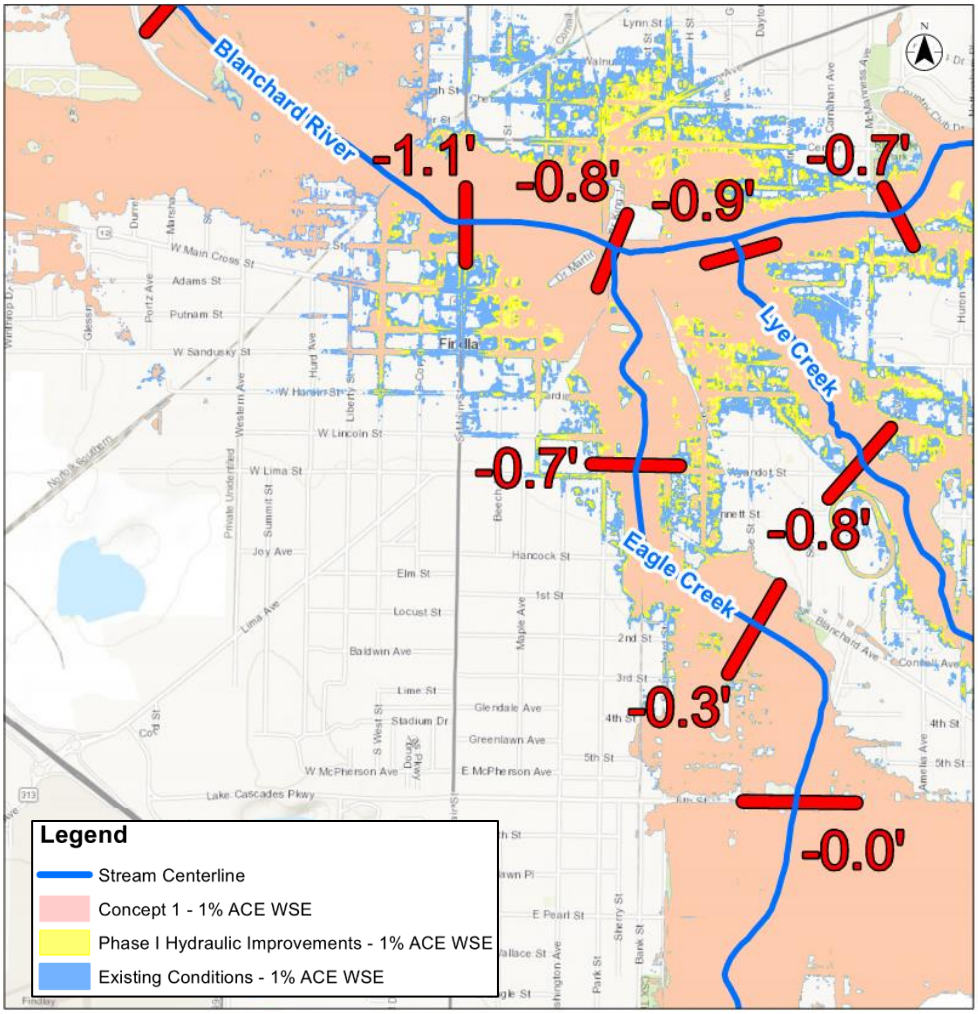


Figure 21 – Concept 1, 1% ACE Floodplain Extents and Change in WSEs compared to Existing Conditions and Phase I Hydraulic Improvements Along Eagle Creek

Table 9 – Summary of Change in Water Surface Elevations at Notable Locations along Eagle Creek compared to Existing Conditions

	Eagle Creek 1% ACE (100-Year) Change in Water Surface Elevations Compared to Existing Conditions WSEs (Feet)					
	Confluence with the Blanchard River	**Upstream of E. Main Cross St.**	**Upstream of E. Sandusky St. (OH-568)**	**Upstream of E. Lincoln St.**	**Upstream of S. Blanchard St.**	**Upstream of 6th St.**
HEC-RAS XS	**0**	**563**	**1554**	**2605**	**4345**	**8203**
Ex. Conditions	0.0	0.0	0.0	0.0	0.0	0.0
Phase I Hyd. Impr.	-0.6	-0.5	-0.5	-0.5	-0.4	0.0
Concept 1 – No Culverts	-0.8	-0.8	-0.7	-0.7	-0.4	0.0

*Concept 1 assumes the Phase I Hydraulic Improvements Project is complete

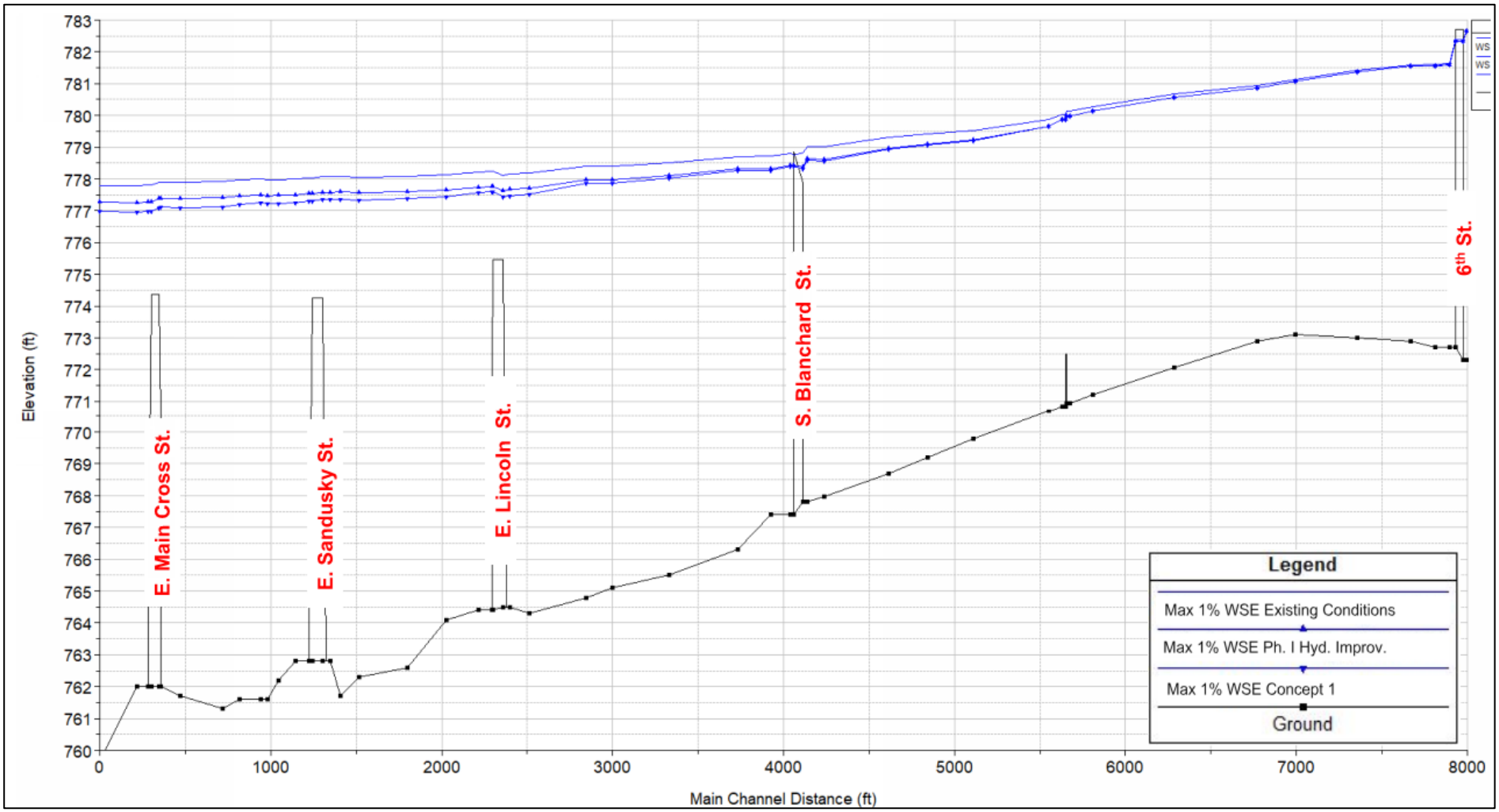


Figure 22 – 1% ACE WSEs along Eagle Creek (See Table 9 for WSE Reductions)

3.2.4 Design Variables Selection

The hydraulic modeling analysis resulted in comparable WSE reductions for each of the three concepts. In order to proceed with the Preliminary Design, MWCD advised Stantec to use the general footprint of Concept 1 with no culverts under Cory Street or Main Street. This selection balances flood risk reduction benefits with future use of the open space on the upper tier bench. Stantec has varied the Concept 1 option slightly for the preliminary design drawings and OPCC. The revisions include:

- A 4-foot step up at 4H:1V slope from tier 1 to tier 2 as opposed the 3-foot step up shown in the concept figure in the body of this report.
- A flatter tie-in to existing grade at Clinton Court (approximately 10H:1V)

Concept 2 is observed to produce slightly lower WSEs (up to 0.05 feet) compared to Concept 1. Stantec understands there is a balance for both flood risk reduction benefits and open space for re-use planning. Coordination will continue through final design to determine the community's desired lower tier bench width which will likely be between the 125 feet used for Concept 1 and the 200 feet used for Concept 2.

4.0 PROCUREMENT OF PROPERTIES

Stantec identified easements needed to support the construction, operation, and maintenance of the floodplain bench widening. Most of the Additional Hydraulic Improvements Project Area is municipally owned by Findlay or the Hancock County Commissioners, however, a limited number of privately owned parcels will be affected.

Permanent easements total approximately 19 acres. This area is comprised of the properties encompassed by the floodplain bench widening area on the northern side of the Blanchard River downstream of the CSX railroad bridge to Cory Street.

Documentation in Appendix J identifies the affected parcels.

5.0 ANTICIPATED ROADWAY, UTILITY, AND TERRESTRIAL IMPACTS

5.1 ROADWAY IMPACTS

Minimal roadway impacts and traffic disruptions are anticipated as a result of project activities. No roadways are proposed to be modified, but local roads will be used as haul routes for the disposal of excavated materials.

5.2 UTILITY IMPACTS

Existing utilities within the Project Area include sanitary sewers, storm sewers, gas lines, water lines, electric utility poles, telephone/fiber optic cable, underground electric, and traffic control lines. Impacted utilities are detailed within the 30% HCFRRP Additional Hydraulic Improvements drawing set in Appendix A.

Columbia Gas distribution lines are present within the project footprint. Approximately 1,130 feet of 2-inch line is proposed to be removed. All work to modify the natural gas infrastructure is anticipated to be performed by Columbia Gas. It is assumed that Columbia Gas will cap the lines at the project extents and the project's contractor will remove the lines.

Storm sewer throughout the project site drains north to south and is located on Jefferson Street, Taylor Street, and west of Main Street. Because the Project Area is proposed to be utilized as a community space, it is assumed that no storm sewer will discharge onto the floodplain bench but will be routed to the Blanchard River. 17 feet of 4-inch PVC and 60 feet of 6-inch PVC west of Main Street does not connect into the greater stormwater infrastructure of Findlay and is proposed to be removed. On Taylor Street, 100 feet of 12-inch corrugated HDPE pipe, 85 feet of 14-inch concrete pipe is proposed to be removed. 285 feet of 18-inch storm sewer appear to serve as a stormwater discharge into the Blanchard River and is proposed to be removed and replaced with 18-inch HDPE. On Jefferson Street, 15 feet of 27-inch concrete pipe and 349 feet of 30-inch concrete pipe serve as a stormwater discharge to the Blanchard River and is proposed to be removed and replaced with a 30-inch HDPE line and outfall.

Sanitary sewer within the Project Area is remnant from abandoned or previously demolished buildings and one former combined sewer overflow. Impacts to the sanitary sewer include 80 feet of 8-inch concrete pipe, 1,105 feet of 10-inch concrete pipe, 440 feet of 12-inch concrete pipe, and 100 feet of 18-inch concrete sewer pipe proposed to be removed. Five (5) manholes within the Project Area are proposed to be removed. Two (2) abandoned sanitary sewer outfalls are located at Taylor Street and are to be removed.

Stantec has identified 1,020 feet of 2-inch and 670 feet of 4-inch water line that no longer service customers within the Project Area and are proposed to be removed.

Stantec has identified 17 AEP poles that no longer service any residential or industrial customer, these 17 poles are proposed to be removed. Nine (9) poles located within the proposed floodplain bench are proposed to be relocated to maintain the existing distribution configuration. Stantec will coordinate with AEP to relocate the nine (9) poles.

5.3 TERRESTRIAL HABITAT IMPACTS

Project impacts to terrestrial habitats include tree removal within the floodplain bench widening area and Blanchard River access for each proposed riffle structure (Table 10). The habitat assessment includes a description of the forest habitat, detailing the presence of dead trees, split branches, and exfoliating bark. These tree conditions provide roosting habitat for federally listed bat species Indiana bat and northern long-eared bats. Seasonal clearing as discussed in Section 2.2 will be incorporated into the design to reduce the impacts to these species.

Table 10. Proposed Project Tree Removal Areas

Construction Area	Tree Removal Areas (Acres)
Floodplain Bench Widening Footprint	1.0
Probable In-Stream Riffle Access	0.25
Total	1.25

The proposed project floodplain bench is planned to have a 50-foot wide buffer of trees planted adjacent to the Blanchard River from the CSX RR right-of-way to the Phase I Hydraulic Improvements extents. These trees are assumed to be planted in a 10-feet by 10-feet grid pattern. Channel bank restoration can be performed along the Project Area through these plantings and natural habitat formations. The riparian vegetation will provide bank stabilization, some storm water runoff filtration, shading with temperature control, and leaf litter producing organic matter for the aquatic food web. The structural habitat will also be improved from the trees, sticks, and cover.

6.0 GREENSPACE PLANNING INTEGRATION

To increase the potential for community use, the proposed floodplain bench will be constructed in two tiers: an upper and lower tier. The upper tier will be separated from the lower by a mid-bench embankment. The lower tier is expected to be inundated during the 99% (1-year) and 50% (2-year) ACE storms while the upper tier remains usable for community activities. The proposed concept will likely be revised as the design progresses to balance the availability of community space while maintaining hydraulic efficiency.

The proposed design is intended to maintain Clinton Court's existing elevation, then slope to the south to form the upper tier. The slope will provide adequate drainage for precipitation events while providing the public with access to the upper tier of the floodplain bench.

The existing bike path to the east of the CSX railroad currently terminates at Clinton Court. The proposed bike path will extend the existing route by crossing the railroad at Clinton Court, then turning to the south and west to run adjacent to the southern limit of the upper tier of the floodplain bench. The proposed bike path will turn north to meet the intersection of Main Street and Clinton Court, then continue west on Clinton Court and continue west to Cory Street.

Final design of the community space will be determined after discussion with interested stakeholders.

7.0 ESTIMATE OF PROBABLE COSTS FOR CONSTRUCTION

7.1 PROJECT CONTINGENCIES

A 20% contingency was assumed for each line item in the preliminary OPCC. While past project bidding and similar local costs were used to develop the estimate of probable cost, the 20% contingency covers unforeseen administrative and legal fees as well as obstacles that may arise throughout detailed design and construction phases.

7.2 MOBILIZATION, DEMOBILIZATION, AND PREPARATORY WORK

A rate of 5.0% was applied to construction costs to account for mobilization and demobilization. Additional costs were included for preparatory work such as survey staking and construction layout.

7.3 OPINION OF PROBABLE COST

Table 11 details the preliminary OPCC for the Additional Hydraulic Improvements as described in this PDR. The OPCC does not include the Norfolk Southern Railroad Bridge Improvements project (Phase II Hydraulic Improvements). The Additional Hydraulic Improvements include floodplain bench widening and the installation of two (2) in stream riffle structures.

Table 11. Opinion of Probable Cost

Additional Hydraulic Improvements - Opinion of Probable Costs		
Description	**Amount**	
Construction Costs		
In-Stream Improvements	$	677,000
Floodplain Bench Widening Improvements	$	2,521,000
Utility Relocations	$	84,000
Bikepath Relocation and Pedestrian Bridge Modifications	$	105,000
CONSTRUCTION SUBTOTAL	$	3,387,000
Contingency (20%)	$	640,200
CONSTRUCTION TOTAL	$	4,027,200
Other Costs		
AEP Relocations	$	925,000
Cultural Resources Preservation	$	60,000
Threatened and Endangered Species Mitigation	$	72,000
Engineering and Design	$	340,000
Construction Administration	$	283,000
OTHER SUBTOTAL	$	1,680,000
TOTAL PROJECT COSTS	$	5,707,200

Assumptions made to form the Opinion of Probable Cost:

- AEP power poles crossing the Blanchard River will be replaced to span the floodplain bench and dead-end distribution poles will be removed. These costs are included in the above estimate.
- Columbia Gas Company is responsible for the decommissioning of all gas lines, the project will assume costs for the removal and disposal of pipe. The cost of decommissioning is excluded from the above estimate.
- The foundations of existing and previously demolished buildings are considered construction and demolition debris. The cost of excavating construction and demolition debris approximately 6 feet deep within the footprint of the warehouse located at the east end of the site is included in the above estimate.
- Characteristically hazardous material is limited to the impacted soils defined within the Phase II ESA. Cost for excavation, hauling, and disposal of hazardous material is included in the above estimate.

8.0 REGULATORY CONSIDERATIONS

8.1 CLEAN WATER ACT SECTIONS 401 AND 404

Impacts to jurisdictional waters (e.g., streams, wetlands, etc.) are regulated in the State of Ohio by the USACE and OEPA. Discharges of dredged or fill material into waters of the United States (WOTUS), including streams and wetlands, require permit approval from the USACE under the provisions of Section 404 of the Clean Water Act (CWA). In addition, filling in streams and wetlands also requires Water Quality Certification (WQC) from the OEPA under the provisions of Section 401 of the CWA. Regulatory authority over impacts to these waters lies with the USACE and OEPA in Ohio. Under the new "Navigable Waters Protection Rule" (effective June 22, 2020) ephemeral streams and wetlands that have no surface water connection to a traditional navigable water (TNW) (isolated wetlands) are not considered WOTUS, and therefore are not regulated by the USACE. In Ohio, ephemeral streams and isolated wetlands are considered waters of the State and are therefore regulated by the OEPA. Per new regulatory guidance, impacts to ephemeral streams and level 1 isolated wetlands in Ohio will now require issuance of a general permit from the OEPA. Additionally, any impacts to isolated wetlands categorized above a level 1 (level 2 or level 3) will require an Isolated Wetland Permit from the OEPA. Hancock County and Findlay may also have local regulatory authority over certain types of wetlands and waterbodies.

No wetlands or other waterbodies were identified within the Project Area. However, due to the proposed addition of two riffle structures within the Blanchard River as part of the Project, MWCD would be required to receive authorization from the USACE and OEPA under Sections 404 and 401 of the CWA prior to initiation of any construction activities. The proposed Project components will likely qualify for authorization through the USACE Nationwide Permit (NWP) application process under NWP 27 (Aquatic Habitat Restoration, Enhancement and Establishment Activities) Pre-Construction Notification (PCN). Additionally, MWCD would be required to demonstrate compliance with Section 7 of the Endangered Species Act (ESA) and Section 106 of the National Historic Preservation Act (NHPA) as part of the Section 404 and Section 401 CWA permitting process.

8.2 MUSSEL PERMITTING AND RELOCATION

Based upon previous surveys conducted in the area, Stantec assumes that freshwater mussels are present at the locations of the additional constructed riffles and mussel relocation will be required to avoid impacts from fill placement. The Project will require a freshwater mussel rescue and relocation plan to be submitted to ODNR for approval. Mussel survey methods must follow Ohio Mussel Survey Protocols (2020) for Group 1 streams. A Group 1 stream is a small river where freshwater mussels are expected but Federally Listed species are not. Mussel salvage in construction areas will occur prior to any in-water work and within the work window specified by Ohio Mussel Survey Protocols of May 1st to October 1st. Salvaged mussels will be relocated to relocation sites identified as suitable during prior mussel surveys completed for dam removals.

8.3 PERMITTING OVERVIEW

Table 12. Permitting Matrix

Permitting Matrix for HCFRRP Additional Hydraulic Improvements				
Task Name	**Proposed Task Lead**	**Estimated Duration**	**Estimated Project Phase**	**Comments**
ODNR and USFWS Coordination	Stantec	60 days	Final Design	The Project will require compliance with Section 7 of the Endangered Species Act (ESA) as part of the Clean Water Act's Section 404 permitting process. To demonstrate compliance under the ESA, Stantec will coordinate with the USFWS and ODNR on the Projects potential to impact federal and state-listed species. Coordination request for review letters will be sent out to the respective agencies for their concurrence on the Project. Furthermore, due to native listed and non-listed mussel species known to occur within the Blanchard River (Stream 1), Stantec anticipates a mussel relocation will be required to avoid the accidental take or impact of mussel species by the Project. These assumptions are based on knowledge of existing listed and non-listed native mussel species within the Blanchard River (Stream 1) and most likely occurring within the Project Area. Coordination with the ODNR and USFWS will be initiated upon acceptance of the final project design and notice to proceed from MWCD. Additionally, as conditions of the OEPA NWP process, there should be no in-stream work between 4/15 and 6/30 to avoid impacts to other aquatic species.
Ecological Surveys	Stantec	1 day	Preliminary Design	Stantec performed wetland and waterbody delineation surveys and threatened and endangered species habitat assessment surveys for the Project on July 22, 2020.
Mussel Relocation	Stantec	1 week	Pre-Construction	A mussel relocation will take place during the same calendar year and prior to the commencement of any construction activities within the Blanchard River (Stream 1) for the Project. The mussel relocation will follow protocols outlined in the *Ohio Mussel Survey Protocol* (USFWS/ODNR 2018). Stantec assumes relocation areas previously identified from the Phase I Hydraulic Improvements Project can be used for this relocation effort. Prior to the relocation effort taking place, Stantec will provide the ODNR and USFWS with a study plan, outlining the mussel relocation effort and protocols being followed for their approval.

Permitting Matrix for HCFRRP Additional Hydraulic Improvements				
Task Name	**Proposed Task Lead**	**Estimated Duration**	**Estimated Project Phase**	**Comments**
Cultural Resources Field Surveys	Cultural Resources Consulting Firm	1 week	Preliminary Design	Completion of a Phase II archeological survey of the Additional Benching Project Area was performed on previously identified locations that have the potential to be considered for listing in the National Historic Register. This will further initiate coordination with the State Historic Preservation Office (SHPO) for their concurrence on the Project and demonstrate compliance with Section 106, as required by the CWA Section 404 permitting process. Based on findings from the Phase II survey (week of September 28), further coordination between the ACOE and SHPO could be warranted to mitigate impacts to potential significant findings that are potentially eligible for listing in the National Historic Register.
Wetland and Waterbody Report and T&E Species Habitat Assessment Report Prep	Stantec	4 weeks	Preliminary Design	Stantec has completed the wetland and waterbody delineation report and threatened and endangered species habitat assessment report that are acceptable for use as part of the Section 404 permitting package. The reports are summarized in Sections 2.1 and 2.2 of this PDR. Updates to these reports will most likely occur during the final design phase of the Project to ensure the most accurate information is provided as part of the Section 404 NWP PCN submittal package. Prior to final reports being submitted as part of the permit package, the reports will be issued to MWCD for their review and mutual agreeance on comments prior to any submittal to the respective regulatory bodies.
Cultural Resources Surveys Report Prep	Cultural Resources Consulting Firm	4 weeks	Preliminary Design	A Cultural Resources Survey Report was generated and submitted to SHPO to demonstrate compliance with Section 106.
Prepare a U.S. Army Corps of Engineers Section 404 Nationwide Permit Pre-Construction Notice	Stantec	2 weeks	Final Design	Stantec assumes the Project can be authorized under the Clean Water Act Section 404 Nationwide Permitting process. Stantec will prepare an USACE Section 404 Pre-Construction Notice for authorization under NWP 27 Aquatic Habitat Restoration, Enhancement and Establishment Activities. Prior to submitting the permit PCN package to the regulatory body, Stantec will send a copy to MWCD for their review and mutual agreeance on any comments or modifications to the PCN submittal package.
Submit USACE Section 404 NWP 27 PCN	Stantec	1 week	Final Design	Stantec will submit the finalized PCN package to the USACE and District Engineer for authorization of the Project. Additionally, the OEPA has specific conditions to be authorized under this NWP. However, those conditions are anticipated to be

Permitting Matrix for HCFRRP Additional Hydraulic Improvements				
Task Name	**Proposed Task Lead**	**Estimated Duration**	**Estimated Project Phase**	**Comments**
				met and notification to the OEPA is not required under this NWP.
USACE reviews the Section 404 NWP 27 PCN and authorizes the Project	USACE	60-90 days	Final Design	Assume up to 60-90 days for receipt of authorization for PCN. This schedule is assuming that there are no issues with concurrence from SHPO based on findings from the Phase II survey being conducted.
Storm Water Pollution (SWPPP) Prevention Plan and Notice of Intent (NOI) for General Construction Storm Water Permit	Contractor	N/a	Pre-Construction	The SWPPP and NOI for General Construction Storm Water Permit will be prepared by the construction contractor based on the final design approval of the Additional Benching.
Submit NOI electronically to OEPA	Stantec	1 day	Pre-Construction	Stantec will submit the updated NOI electronically to the OEPA upon approval from Maumee Watershed Conservancy District
Prepare No Rise Calculations Report and City of Findlay Floodplain Development Permit Application; Receive Floodplain Permit	Stantec	TBD	Pre-Construction	The project is within the mapped 1% ACE (100-year) floodplain of the Blanchard River. The existing City of Findlay Floodplain Development Permit issued on 02/06/2018 for tree clearing was amended on 9/14/2018 for construction activities within the 100-year floodplain of the Blanchard River and associated with the benching portion of Phase I of the HCFRRP Hydraulic Improvements Project was valid for 1-year from the date issued. Therefore, a new Floodplain Development Permit will need to be acquired prior to the commencement of any additional construction activities within the 100-year floodplain of the Blanchard River. Stantec will prepare and submit the appropriate floodplain permit application and No-Rise Calculations Report to the City of Findlay.
Letter of Map Revision (LOMR) to FEMA	Stantec	TBD	Post-Construction	Stantec assumes a Letter of Map Revision (LOMR) will be required for the project. Coordination will be needed to determine if one LOMR can be submitted for the Phase I Hydraulic Improvements, NS bridge expansion, and additional hydraulic improvements work proposed.

8.4 REGULATORY CONSTRUCTION CONSTRAINTS

The following table details the dates for which certain construction activities are not allowed due to the presence of threatened or endangered species identified within Section 2.2.

Table 13. Regulatory Construction Constraints

Task	Restricted Dates
In Stream Restrictions:	
Mussel Survey and Relocation	October 1 – May 1
In Stream Activity (Fish Spawning)	April 15 – June 30
Benching Restrictions:	
Tree Clearing	April 1 – September 30

9.0 CONCLUSIONS AND RECOMMENDATIONS

The Additional Hydraulic Improvements of the HCFRRP will consist of three activities intended to improve hydraulic efficiency along the Blanchard River within Findlay. These activities include the excavation of a floodplain bench on the northern riverbank, the construction of two (2) riffle structures in the Blanchard River, and the construction of a bike path to connect the City's existing bike paths to the east and west of the project area. These Additional Hydraulic Improvements will be a continuation of the Phase I Hydraulic Improvements currently under construction and the proposed widening of the Norfolk Southern railroad bridge.

Two (2) in stream riffle structures will be constructed to promote stream stability and improve the habitat for local wildlife. The riffles will be constructed adjacent to the floodplain bench, Riffle 1 upstream of the pedestrian bridge and Riffle 2 downstream of the pedestrian bridge.

Floodplain bench widening will occur on the right overbank of the Blanchard River (north side) between the CSX railroad right of way to the east and Cory Street to the west. The proposed floodplain bench will be constructed in two levels, a lower and upper tier intended to allow for community access to the upper tier during flooding events of the 1 to 2-year return interval. The proposed floodplain bench is expected to require approximately 90,000 cubic yards of excavation.

9.1 RESTORATION AND FLOOD RISK REDUCTION OPPORTUNITIES

The bench widening project, by expanding the floodplain, is expected to provide a small benefit to aquatic ecosystems by reducing the magnitude of physical forces working on the riverbed. Riparian vegetation will provide bank stabilization, some stormwater runoff filtering, shading with temperature control, and leaf litter producing organic matter for the aquatic food web. The structural habitat will also be improved from the trees, sticks and cover.

Coordinating with local stakeholders on the greenspace planning efforts will ensure the Project Area is utilized for community enhancement. The proposed bike path will connect existing bike trails to the east and west creating a 2-mile continuous bike path along the Blanchard River from Center Street to Broad Avenue.

9.2 IMPLEMENTATION AND CONSTRUCTION CONSIDERATIONS

The potential presence of local species of bats and mussels within the Project Area must be considered for the Additional Hydraulic Improvements construction schedule. Once further developed, the construction schedule will reflect the windows of opportunity for construction to accommodate the native species hibernation periods.

The proposed work sites may be accessed from Clinton Court. Temporary stone access ramps may be placed on the north bank of the river to allow track hoes to reach the proposed riffle structures adjacent to the floodplain bench. The construction of each riffle structure may be completed with the use of

trackhoes and similar equipment to excavate and shape the existing channel and place the riffle material per design. Materials removed from each location may be loaded onto dump trucks and hauled to approved disposal sites. The floodplain bench areas may be accessed from existing points of entry along Clinton Court. Equipment to be utilized at the site may generally consist of excavators, trackhoes, bulldozers, skid-steers, tractors, and dump trucks for moving, loading, hauling, and fine-grading. Live staking may be utilized to stabilize areas of the riverbank that are disturbed and a 50-foot vegetated buffer strip along the floodplain bench may include new trees and riparian vegetation. The remaining bench areas may be seeded to Findlay's preference to allow for community access and recreational use. Both direct and visual impacts from the floodplain benching, the proposed bike path alignment, and live staking of riparian vegetation may be limited to the affected parcels (including those where temporary access easements may be acquired).

Some of the soils within the excavation areas may contain characteristically hazardous waste based on previous environmental sampling; impacted soils may be isolated and additionally sampled for disposal off-site at a licensed facility. Existing storm sewers acting as discharge points to the Blanchard River may be removed and replaced as the proposed excavation may undercut their current depth. Pipe materials may be selected that can support maintenance vehicle traffic with shallow soil cover.

9.3 SCHEDULE AND SCHEDULING RISKS

With the submittal of this report, the following tasks remain to be completed: floodplain bench widening final design, riffle structure final design, and project permitting.

Table 14. Task Projection

Task	Duration
Site Assessment and Survey	Complete
Preliminary Design Report	Complete
Riffle Structure Final Design	9 months from NTP
Floodplain Bench Widening Final Design	9 months from NTP
Permitting	4 to 5 months

Final design of the riffle structures and floodplain bench widening design are anticipated to be complete 9 months from the notice to proceed. Project permitting is anticipated to take 4 to 5 months in total with several agencies reviewing in parallel as noted within Table 12. The estimated duration for project permitting is dependent on findings of ongoing fieldwork being consistent with the project assumptions. Most notably, the assumption that the Phase II Cultural Resources Survey will not result in significant findings and prompt a Phase III Survey. If exceptional findings are discovered, changes to the schedule may be required.

Preliminary environmental sampling has been performed, prompting additional exploration upon receiving results which indicated elevated concentrations of hexavalent chromium in the soils south of a former chromium plating facility within the project site. The findings may impact the construction schedule with the addition of field testing.

As part of the HCFRRP, the construction schedules of the Norfolk Southern Railroad Improvements and Additional Hydraulic Improvements projects are preferred to be sequenced from west to east. The existing Phase I Hydraulic Improvements bench will be extended to the east by the Norfolk Southern Railroad Improvements, then continued to the east by the Additional Hydraulic Improvements.

The proposed in-stream construction activity is constrained within regulatory windows and dependent on low-flow conditions in the Blanchard River. The Phase I Hydraulic Improvements project experienced frequent delays due to high water and bench inundation throughout the duration of the Project. The same risks are possible for the Additional Hydraulic Improvements.

10.0 REFERENCES

1. Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO.

2. Rosgen, D.L. 2006. Watershed Assessment of River Stability and Sediment Supply (WARSSS). Wildland Hydrology, Pagosa Springs, CO.

Appendix A 30% HCFRRP ADDITIONAL HYDRAULIC IMPROVEMENTS DRAWING SET

Appendix B WETLAND AND WATERBODY DELINEATION REPORT

Appendix C THREATENED AND ENDANGERED SPECIES HABITAT ASSESSMENT REPORT

Appendix D BLANCHARD RIVER PROFILE

Appendix E BLANCHARD RIVER XS

Appendix F BLANCHARD RIVER XS DISCHARGE CALCULATIONS

Appendix G BLANCHARD RIVER PEBBLE COUNT

Appendix H REPORT OF PRELIMINARY GEOTECHNICAL EXPLORATION

Appendix I POTENTIAL RIFFLE LOCATIONS

Appendix J PROPERTY OWNERSHIP FIGURE