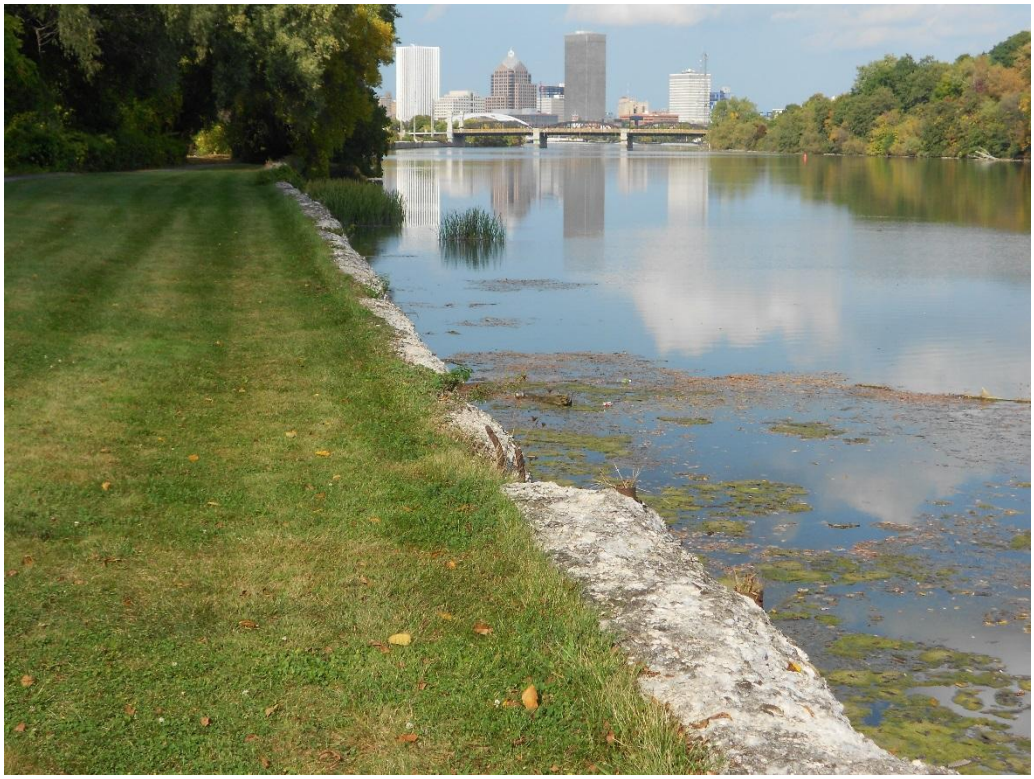
Vacuum Oil-South Genesee River Brownfield Opportunity Area Implementation Strategy/Environmental Impact Statement

NYSDOS Contract C1000362 / City Project. No. 127366



Wall Evaluation Report

October 2015

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1 INTRODUCTION

1.1 PURPOSE AND OVERVIEW OF THE REPORT

The City of Rochester received a grant from the New York State Department of State Brownfield Opportunity Area Program to conduct a limited engineering evaluation for the Vacuum Oil wall, located on the west side of the Genesee River between the Ford Street Bridge and Genesee River Trail Bridge (former RR bridge).

Currently, the scope of services for this work is to provide the following;

- Obtain and review historical site information related to the wall;
- Visit the site and observe the condition of the river wall;
- Perform Hydrologic and Hydraulic (H&H) analysis of the river in the vicinity of the wall;
- Compare the findings of the H&H analysis with the wall in terms of flood protection and water management according to FEMA criteria;
- Prepare a Letter of Map Revision (LOMR) application to the Federal Emergency Management Agency (FEMA) to revise the effective floodplain maps in the project area to reflect the effects of Mount Morris Dam (current mapping does not). The LOMR application is being prepared under separate cover; and
- Outline areas where additional information may be required to conduct further evaluation of the wall.

As part of a separate project, the City has conducted a more detailed evaluation and preliminary design for the West River Wall in 2014. This project is located directly downstream of the Vacuum Oil site and is believed to have similar flood protection requirements. Further, the wall is comprised of similar construction and exhibits a similar level of concrete degradation. In addition to the items bulleted above, the West River Wall Project also included the following:

- Topographic survey of the wall and adjacent features;
- Bathymetric survey of the river bottom in the wall vicinity;
- Concrete coring and testing of wall concrete;
- Hands-on inspection of the landside and riverside of the wall, including a dive inspection;
- Stability assessment of the existing wall according to FEMA standards;
- Development of various wall reconstruction alternatives designed to be integrated with the master plan created along the wall length, including key advantages and disadvantages;
- Development of 50% design drawings that outline a combination of wall reconstruction and construction of an earthen berm to provide flood protection; and
- Opinion of probable construction costs.

Although the current scope for evaluation of the Vacuum Oil wall does not include the same level of site investigation, analysis, or design as conducted for the West River Wall, it may be that some of

the findings, recommendations, and design alternatives are similar between the two sites. This report presents the findings of this limited evaluation, outlines some wall improvement alternatives that may be applicable, and provides recommendations for further evaluation. Additional evaluation will be required to verify the applicability of such alternatives, provide development of construction cost estimates, and outline information necessary to progress with the wall renovation design.

1.2 BACKGROUND

Protection from Genesee River flooding in the Vacuum Oil area has historically been provided by the floodwall, constructed around 1918. The wall is currently under the jurisdiction of the New York State Canal Corporation (NYSCC). It is not known if the wall was originally constructed for purposes of flood protection. However, the original FEMA flood insurance maps, issued in November 1978, showed this wall as protecting the Vacuum Oil area. In 2008, deficiencies related to the condition of the floodwall resulted in revised flood mapping, showing portions of the Vacuum Oil area in the one percent annual chance floodplain. Another reason for the revised mapping, according to correspondence issued by FEMA, is that new regulations for flood walls were adopted (44 CFR 65.10) and the wall was deemed unlikely to satisfy such requirements without a complete rehabilitation. Although not conducted as part of this study, a wall stability analysis would be needed to evaluate the wall further and could show the wall does not currently satisfy FEMA criteria for levees and floodwalls in terms of stability performance, as was the case downstream in the Corn Hill Landing Section.

One primary purpose of this report is to identify preliminary alternatives that would provide necessary flood protection and remove flood insurance requirements for properties within the one percent annual chance floodplain. Section 2 of this report describes flood protection alternatives that meet FEMA criteria for levees and floodwalls.

Construction of the river wall (undated photo)

2 TECHNICAL ANALYSIS

2.1 FLOOD PROTECTION AND WATER MANAGEMENT

This section describes key considerations for flood protection and management in and around the river wall, including an updated hydrologic and hydraulic analysis of the Genesee River.

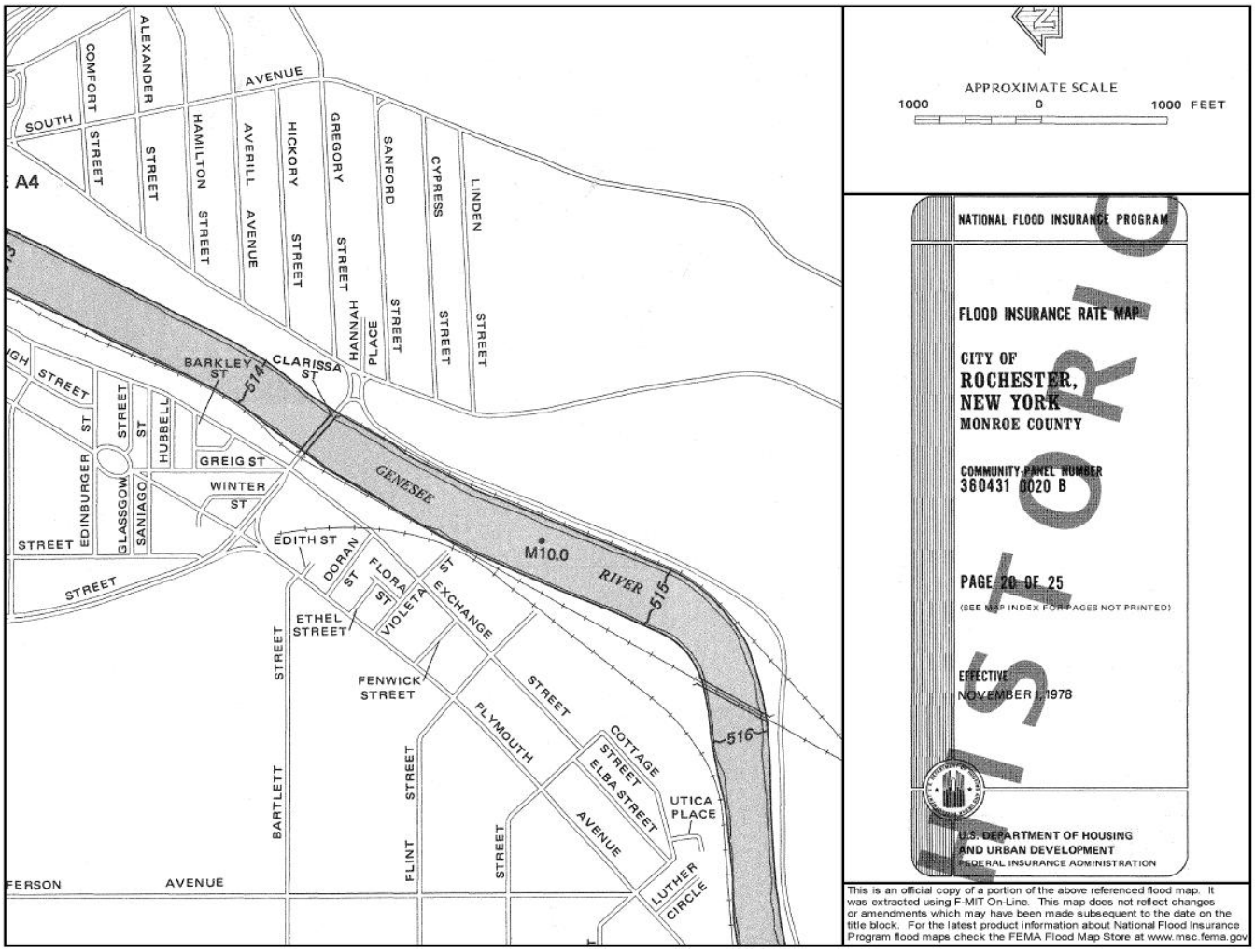
2.1.1 Background

Protection from Genesee River flooding in the Vacuum Oil area has historically been provided by the floodwall, constructed around 1918 by the New York State Canal Corporation (NYSCC). The construction of the Mount Morris Dam, completed in 1952 by the U.S. Army Corps of Engineers, Buffalo District, provides considerable flood control by storing the volume of the floodwaters behind the dam. In 1972, Hurricane Agnes caused considerable flooding throughout western New York State. However, Mount Morris was filled to capacity during this event and minimal flooding occurred downstream. It is estimated that this dam averted over $200 million in damages (in 1972 dollars, estimated to be about $1 billion in 2015 dollars) in Rochester. This project has made the floodwall less important as a flood control measure.

In addition to these structural flood control measures, the City of Rochester practices floodplain management through its participation in the National Flood Insurance Program (NFIP). This program, run by FEMA, provides for otherwise unavailable flood insurance, in return for the City adopting and enforcing a Flood Damage Prevention Ordinance. This ordinance requires all new and substantially improved structures in the mapped floodplain to be elevated to at or above the 100-year flood elevation (frequently referred to as the Base Flood Elevation, or BFE). In New York State, through the state's requirement of adoption of higher standards, new and substantially improved construction in the mapped floodplain must be 2.0 feet above BFE. An additional provision of the NFIP is a requirement to purchase flood insurance for properties purchased with federally-insured mortgages.

In the City of Rochester, there are 88 flood insurance policies in force with an average yearly premium of $1,360 (as of 4/30/2014). FEMA's privacy policies do not allow the locations of individual policy holders to be released, but it is reasonable to assume that many of these policy holders are in the Corn Hill and Vacuum Oil areas. The historic FEMA floodplain maps, issued in 1977 (see Figure 2-1), showed the floodwall providing flood protection and the Vacuum Oil area as being located outside of the floodplain.

Figure 2-1 Historic FEMA Floodplain Map



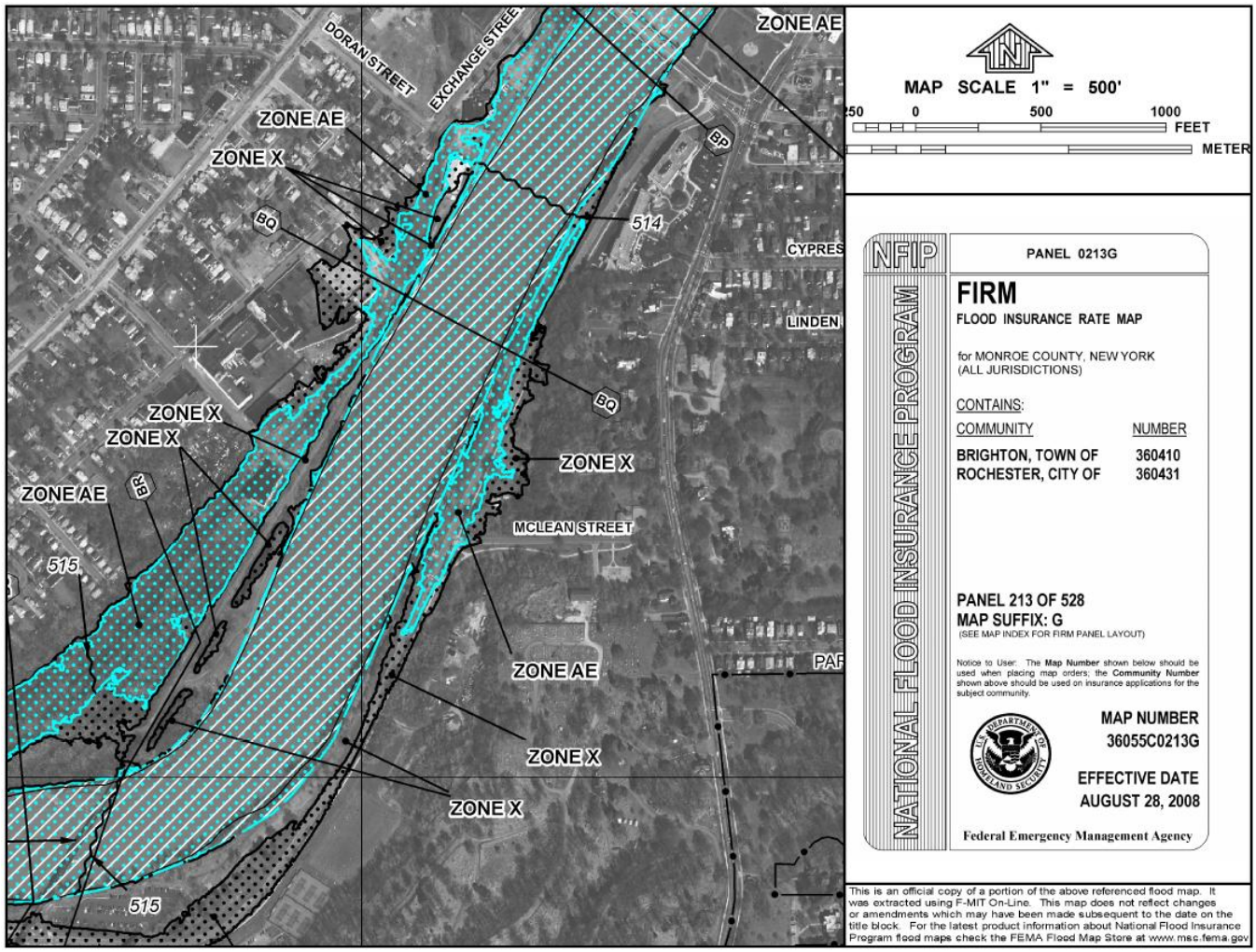
Source: FEMA (Elevations are according to National Geodetic Vertical Datum of 1929)

When FEMA produced a seamless county-wide map for Monroe County in 2008, the agency used hydraulic analyses from the historic maps and mapped the new floodplain with:

- Updated topographic information (from Monroe County LiDAR);
- A datum conversion for the floodwall (1929 Mean Sea Level to 1988 North American Vertical Datum); and
- Floodwall no longer shown as providing flood protection.

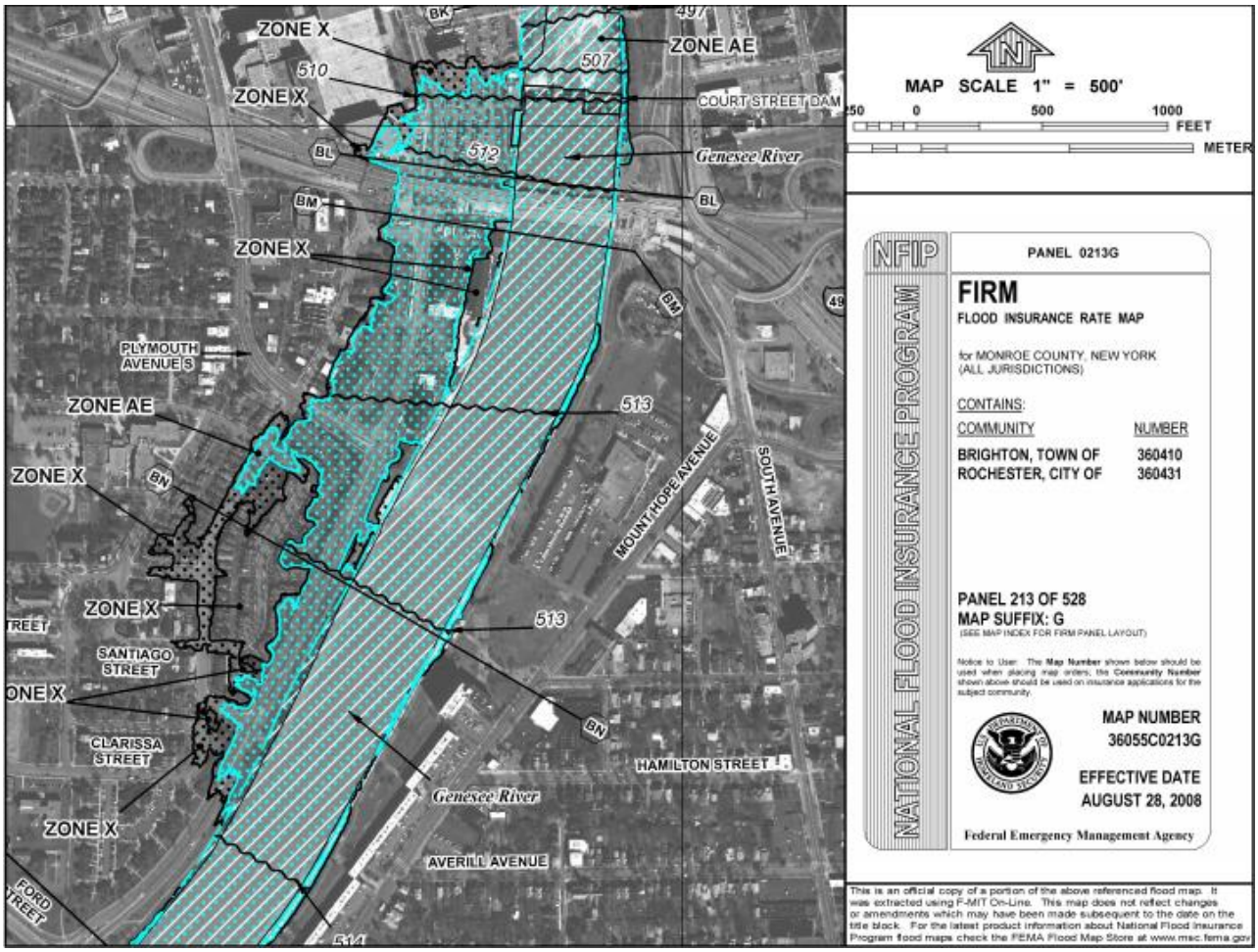
As shown in Figure 2-2 and 2-3 there are areas in the Vacuum Oil project area that are in the newly mapped floodplain.

Figure 2-2 Flood Insurance Rate Map (Upstream Portion of Site)



Source: FEMA (Elevations are according to the NAVD88 Datum. The conversion from NAVD88 to City of Rochester is +1.56' for the project site.)

Figure 2-3 Flood Insurance Rate Map (Downstream Portion of Site)



Source: FEMA (Elevations are according to the NAVD88 Datum. The conversion from NAVD88 to is City of Rochester +1.56' for the project site.)

It is believed that some of the flood insurance policy holders in the City of Rochester are property owners in the Vacuum Oil area. Reconstruction of the floodwall to meet FEMA criteria for levees and floodwalls would relieve this financial burden.

2.1.2 Analysis

The approach to the floodwall improvements is based to a large extent on an updated hydrologic and hydraulic analysis of the Genesee River to establish an appropriate flood elevation for design purposes. One of FEMA's criteria for indicating on its maps that a floodwall provides protection is that it has 3 feet of freeboard. Therefore, the project team developed an updated representation of the 100-year flood conditions of the Genesee River for presenting to FEMA for a map update.

The historic hydrologic analyses used a regression equation to estimate the 100-year discharge. The approach was to use the US Geologic Survey gaging station records near Ford Street--using only data from the time after Mount Morris began operation. Our Log Pearson statistical analyses of the years 1956 to 2013 resulted in a 100-year flow of 25,851 cubic feet per second (cfs). When compared with the historic hydrologic 100-year flow of 32,000 cfs, our analyses resulted in a significant flow

reduction. The USGS gage recorded 22,500 cfs in 1972 (during Hurricane Agnes) which compares favorably with our results.

The hydraulic analyses were intended to reflect actual operations during flood conditions, specifically, (1) Mount Morris Dam gate closure and (2) lowering of sector gates at Court Street Dam. These results are shown in the "Proposed FEMA 100-yr" column of Figure 2-4, between 1.5 and 2.0 feet lower than the current FEMA 100-year elevations in the Vacuum Oil area.

Figure 2-4 Hydraulic Analyses Results

Description	Distance u/s of Ford St (ft)	Current FEMA 100-yr (ft) (NAVD88)	Proposed FEMA 100-yr (ft) (NAVD88)	Decrease in FEMA 100-yr (ft) (NAVD88)	Required Top of Wall (ft) (NAVD88 // City Datum)	Original Top of Wall (ft) (NAVD88 // City Datum) (1)	Potential Wall Lowering (ft) (3)
Genesee Trail Bridge	3,916.5	515.2	513.3	1.9	516.3 // 517.9	517.4 // 519.0	1.1
2,000 ft upstream of Ford St. Bridge	2,000	514.8	512.9	1.9	515.9 // 517.5	517.4 // 519.0 (2)	1.5
						520.4 // 522.0 (2)	4.5
1,000 ft upstream of Ford St. Bridge	1,000	514.5	512.5	2.0	515.5 // 517.1	519.9 // 521.5	4.4
Ford St. Bridge	0	513.8	512.3	1.5	515.3 // 516.9	519.4 // 521.0	4.1
Court St. Dam	-4,067.5	511.1	509.8	N/A	512.8 // 514.4	516.5 // 518.1	N/A

Notes:

1.) The original top of wall is based on record drawings information. The top of wall would need to be surveyed to confirm actual elevations. The top of the existing wall concrete is eroded and degraded is expected to vary from the original elevation.

2.) A 3 foot step in the wall elevation occurs approximately 2,000 feet upstream from the Ford Street Bridge.

3.) Potential wall lowering values do not account for future sedimentation in the Genesee River, which is discussed in later in this report.

Figure 2-4 also shows the required top-of-wall assuming 3.0 feet of freeboard above the proposed 100-year elevation, as well as the current top of wall (per design recorder drawing information).

The findings of the hydraulic analysis indicate a required top of wall ranging from El. 516.9 (near Ford Street) to El. 517.9 (near the Genesee River Trail Bridge), according to City Datum. The original top of wall surface slopes from El. 521.0 (near Ford Street) to El. 522.0 (approximately 2000 ft upstream), before the wall elevation drops to El. 519.0 (for the remaining 1700 ft upstream), per City Datum. Hence, this suggests that the top of the wall could be lowered on the order of 4 to 4 ½ feet from Ford Street to a location about 2,000 feet upstream of Ford Street.

For an analysis of sedimentation impacts, the current sediment conditions in the vicinity of the West River Wall were field surveyed from a boat. These sediment elevations were incorporated into the channel cross-section in the hydraulic model and analyzed as a component of the Wet River Wall project. The results of that study was an estimated sedimentation rate of about 0.073 (0.87 inches) feet per year. If this sedimentation rate would continue for another 20 years, it was estimated that the resulting water surface elevations in the West River Wall area would increase by about 0.5 feet. If the same approach were taken in the Vacuum Oil area, the wall lowering estimates would be reduced by 0.5 feet.

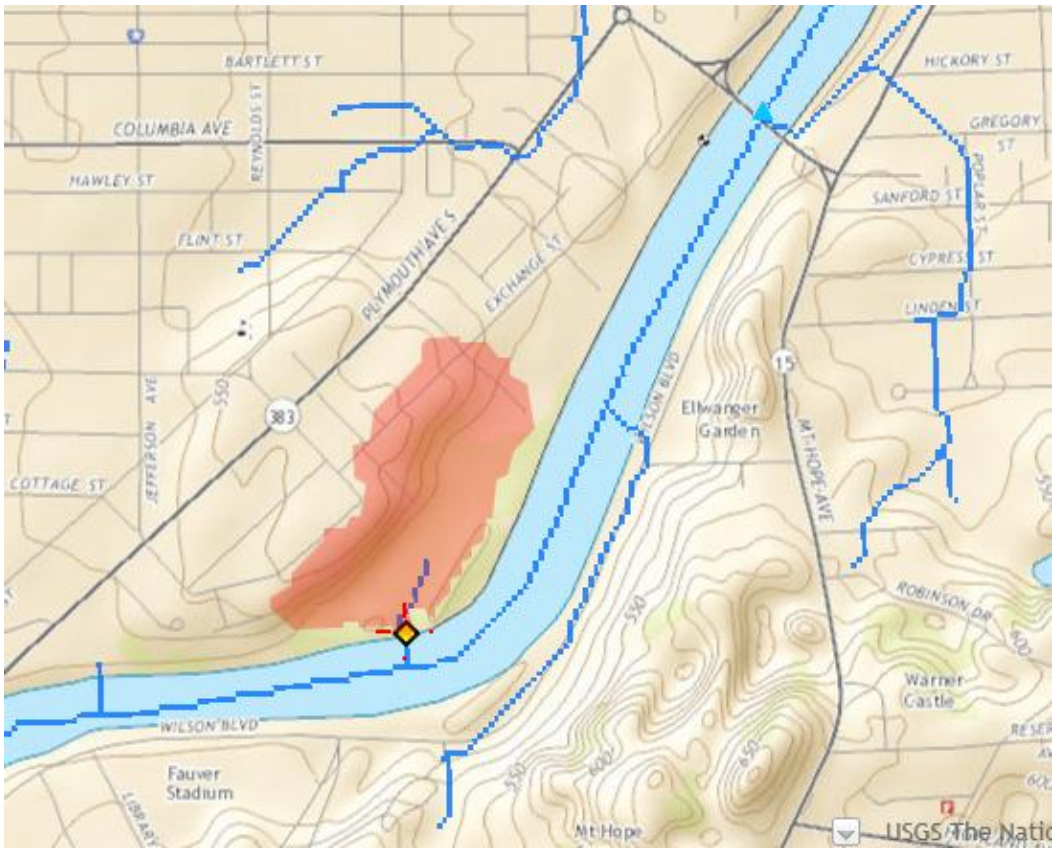
The number of properties removed from the floodplain as result of the new analyses is dependent on a number of factors. For finished construction, FEMA considers the following two criteria when determining whether a structure is in or out of the floodplain:

- Low Adjacent Grade (LAG), or the lowest spot elevation where the structure makes contact with the ground surface; and
- Base Flood Elevation (BFE).

If the LAG is equal to or above the BFE, the structure is considered by FEMA to be out of the floodplain. If the LAG is lower than the BFE, the structure is considered to be in the floodplain. Also, if the reconstructed floodwall meets FEMA criteria for accreditation, all structures behind it will be considered not in the regulatory floodplain. To our knowledge, there are no surveyed LAGs for structures in the Vacuum Oil project area.

One of the criteria for FEMA to accredit a floodwall is consideration of interior drainage behind the wall. Using the USGS application *StreamStats*, no drainage areas behind the wall were identified. StreamStats identified a drainage area just upstream of the project area (Figure 2-5), which measures about 33 acres:

Figure 2-5 USGS StreamStats Drainage Area



Interior drainage can be managed in one of the following ways:

- Backflow valves to prevent Genesee River flood elevations from flooding into the area. This is appropriate if the duration and timing of peaks from the interior drainage will be short compared with high waters on the Genesee River; or

- Pumping station behind the wall, if the interior hydrograph compared with high Genesee River elevations, indicate that interior flooding would occur without a pump station.

It is possible that backflow valves would be sufficient; however, this would need to be confirmed by through design.

2.2 WALL STRUCTURAL EVALUATION

This section describes the conditions of the existing concrete river wall, presents its work history, and provides potential alternatives to modify or rehabilitate the existing wall as part of the subject project.

Figure 2-6 indicates the location and limits of this site. This figure also denotes nearby features impacting the site, such as the Court Street Dam, and shows the vicinity of other completed projects involving river wall work adjacent to the project site.

2.2.1 Introduction

The river wall consists of a concrete gravity wall with a battered stem and concrete footing. Record drawings suggest the wall was originally constructed in about 1918 and is founded on bedrock, according to the New York State Canal Corporation (NYSCC) record drawings (Contract No. 59.). However, a few wall segments are shown to be founded on soil with a sheet pile cut-off wall where rock is deeper (see Contract No. 59, Type “Q’ wall). The wall structure lines the Genesee River and is owned by the NYSCC. The limits of wall being considered as part of this project extend from the Ford Street Bridge (northerly limit) to a railroad bridge that was converted into part of the Genesee River Trail (southerly limit). This translates to approximately 3,700 linear feet of wall.

The wall is made up of a series of concrete monoliths with joints spaced from approximately 25 to 40 feet apart. The original top of wall surface slopes from El. 521.0 (near Ford Street) to El. 522.0 (approximately 2000 ft upstream), before the wall elevation drops to El. 519.0 (for the remaining 1700 ft upstream), per City Datum. The remainder of the wall is elevated to El. 519.0 (City Datum). Depth to bedrock also varies at this site ranging from approximately El. 490.9 to El. 500.2.

There are five different wall sections at the site, which are similar in makeup. Where rock is deeper, the wall generally transitions in width and height, but reflects a similar geometry. The Type ‘Q’ wall is the only section of wall not founded on rock. This wall also includes a steel sheet pile cut-off wall. Figure 2-7 shows the elevation of the wall and sections according the original construction drawings (Contract No. 59). With the exception of the Type ‘Q’ wall segments, the wall remaining segments are typically shown to be founded on bedrock, but the foundation is not shown to be keyed into the bedrock. The concrete structure is largely unreinforced, but some sections (Type ‘C’ and ‘D’) do indicate some reinforcement running along the backside of the stem (into the heel), extending through a mid-height construction joint, and at the toe of the footing.

The wall is furnished with periodic mooring cleats along the top of the wall (see Photo 5) and includes recessed ladders on the riverside, spaced approximately 500 feet apart. The original construction drawings indicate that a 36 inch and 16-inch diameter water main pass underneath the wall (into rock) near Flint Street (see Photo 11). It is suspected that the 6-inch vitrified pipe was installed to provide drainage and limit hydrostatic pressures along the back side of the wall. It is not known if the drainage system is open (cleared) and works effectively to drain soils behind the wall. No other utilities are known to be located within the immediate vicinity of the wall.

The soil elevation on the backside of the river wall varies along the length of the wall and is nearly even with the top of the wall at some locations (see Photo 12), but the backside of the wall can be exposed by about 8 feet at the northerly project limits near Ford Street (see Photo 1). The exposed wall height transitions randomly along the length of the wall. River sediments on the river side of the wall also appear to vary along the length of wall. The sediment levels appear to be higher near the Genesee River Trail Bridge.

Figure 2-6 Project Limits and Adjacent Sites

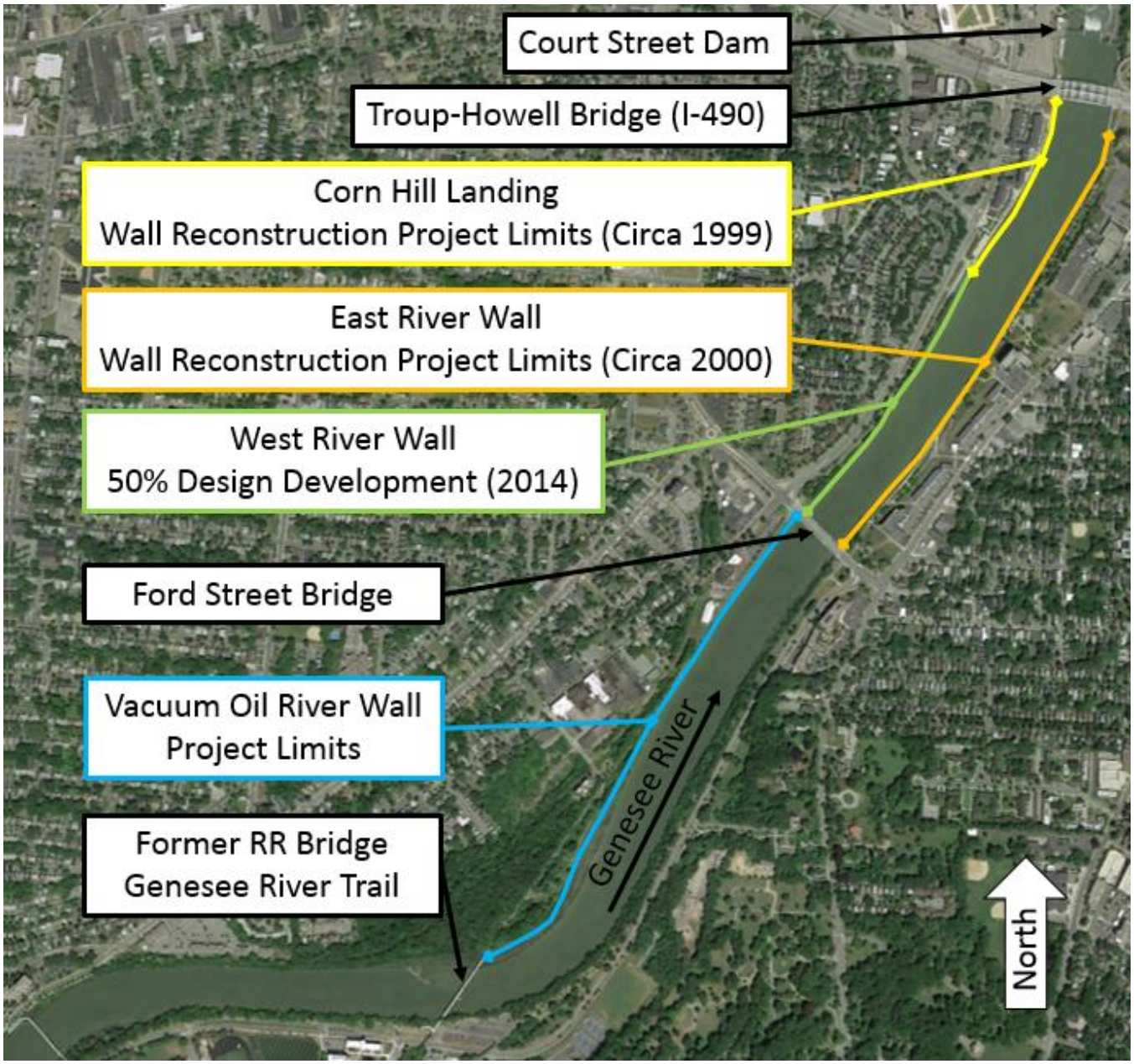
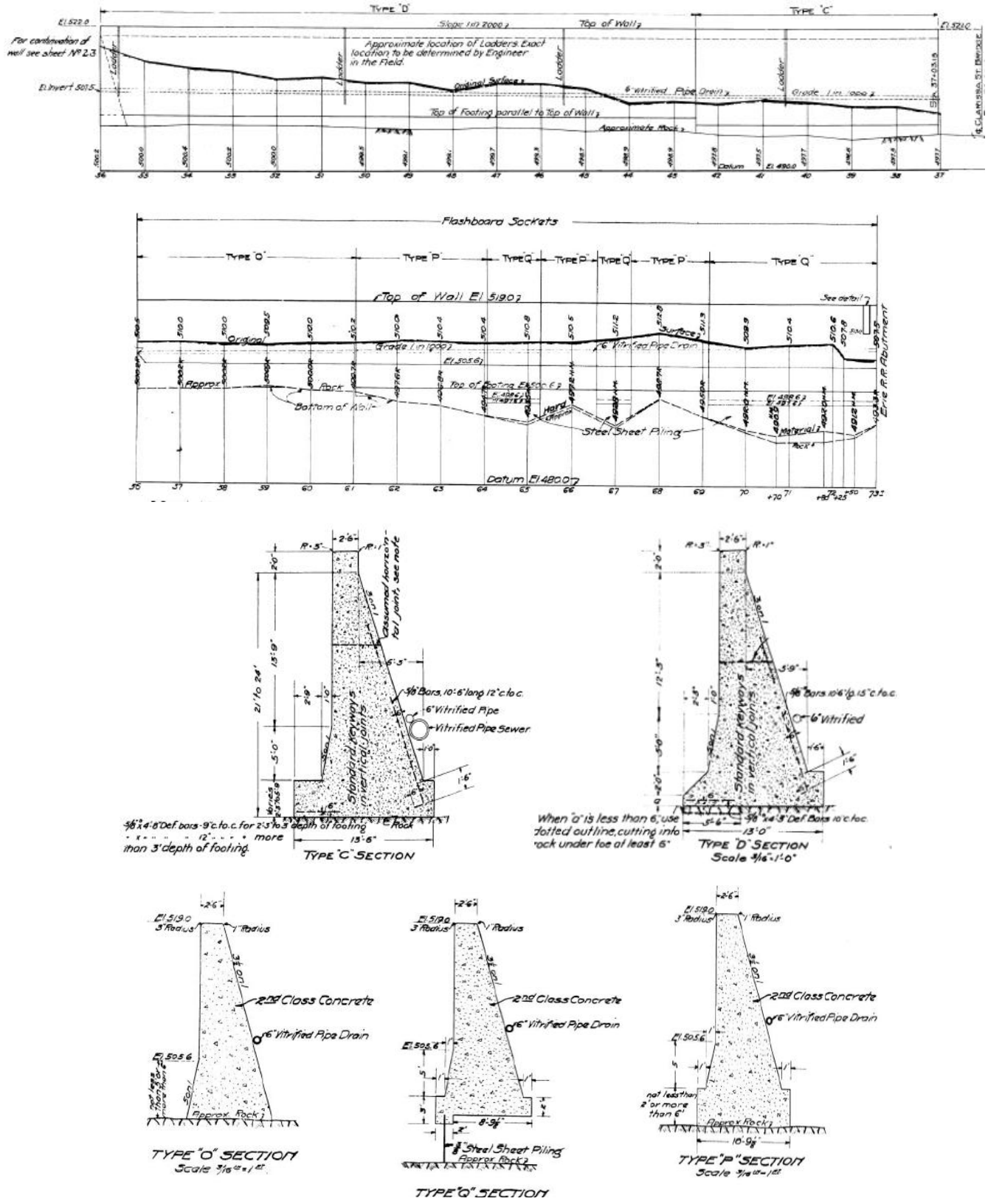


Figure 2-7 Elevation and Sections of Wall (from NYSCC Contract 59 Drawings – Appendix A)



2.2.2 Background

There have been very few documented wall repair or renovation efforts since the wall's original construction. Previous inspection reports have suggested that concrete repairs were made to the wall from 1941 to 1943 by "State Maintenance Forces", indicating that seventeen of the 40 feet long panels on the river wall were repaired. However, it is not known if this work was conducted on the wall within the limits of the Vacuum Oil area.

Although not within the projects limits for this wall, similar nearby wall renovation efforts have previously been conducted as part of the East River Wall Project (2000) and Corn Hill Landing (1999). Previous wall failures have been reported on the east river wall, which was configured similarly to the Vacuum Oil wall, prior to the 2000 repair. However, there are no known wall failures that have occurred on the Vacuum Oil wall near the project limits.

Several documents are available that are related to nearby segments of river wall. The following documents were used as a reference for the development of this report:

- Geotechnical Investigation for Promenade at Erie Harbor, by ROC Geotechnical for the City of Rochester (dated 2013).
- Contract Drawings for Erie Harbor – East River Wall Rehabilitation Project, prepared by LaBella Associates and Reimann-Buechner (dated 2000).
- Wave Reflection Study for the Erie Harbor Basin), prepared by LaBella Associates and Han-Padron Associates for the City of Rochester (dated 2000).
- Contract Drawings for Canal Wall Rehabilitation and Site Improvements at Rochester Harbor at Corn Hill Landing, prepared by the Sear-Brown Group (date 1999).
- 1999 Diving Inspection, prepared for NYSCC and NYSTA (dated 1999).
- Preliminary Planning and Engineering Report for Erie Harbor – East Riverwall Rehabilitation Project, prepared by LaBella Associates and Reimann-Buechner (dated 1998).
- Erie-Harbor East River Wall Concrete Core Testing Results, prepared by LaBella Associates and CME Associates (dated 1998).
- Structural Calculations for River Wall, prepared by LaRue Associates and MRP Associates for NYSDOT (dated 1989).
- Concrete Retaining Wall Inspection, Genesee River, prepared by NYSDOT (dated 1985).
- Concrete Retaining Wall Inspection and Core Testing, Genesee River, prepared by NYSDOT (dated 1979).
- West River Wall – Wall Alternatives Report & 50% Plans, prepared by Bergmann Associates (dated 2014).

2.2.3 Wall Condition Assessment

Assessment of the existing river wall was limited to a landside walk-through observation of wall conditions. Detailed inspection (land or river-side) and wall stability assessment were not conducted. A general description of the wall is provided herein to summarize its overall condition.

The wall is generally in poor condition and displays significant degradation from freeze-thaw deterioration and likely ice and debris impact damage (see Photo 3 and 4). Many of the monolith sections are deeply eroded at the waterline. Numerous efflorescent covered cracks existed all over the non-scaled surfaces and sounded areas of the wall were generally hollow.

The top of the wall is scaled, rounded off, and could be picked apart by hand. The top of wall elevation is also notably less than the original wall profile due to the extent of deterioration in many areas (See Photo 5 and 8). Deterioration at some monolith joints was severe enough to form a groove in the wall (see Photo 4).

Heavy vegetation, including ivy and trees, is present along the back side of the wall (see Photo 7 and 10). The presence of vegetation limited observation of the wall in some areas. The vegetation may be causing added damage to the wall concrete and should be removed.

Despite the poor concrete condition, no major signs of a progressive stability failure were identified, such as displacement between monolith joints or a tilting/rotated wall section. However, the deep and progressing deterioration near the waterline greatly increases the risk of a potential wall failure mid-height of the wall. Therefore, repair of these areas is recommended to mitigate such risks.

Although no concrete cores were taken as part of this project, the following information is provided based on cores previously taken in the vicinity of this project on similar wall sections.

- East River Wall Cores (1998) – 2 cores taken:
    - Overall condition on concrete denoted as fair to poor.
    - Cement paste was relatively soft and porous.
    - Concrete has poor durability and was not purposefully air entrained.
    - Petrographic results denoted the following:
        - Course aggregate up to 3” was fair to poorly graded.
        - Fly ash pozzolanic admixture was not observed.
        - Paste was judged to be medium to soft and slump estimated to be medium to high (4” to 8”). Paste/aggregate bond was considered fair to good.
        - Depth of carbonation was not applicable.
        - Water/cement ratio estimated between 0.48 to 0.57 with approximately 6-10% unhydrated cement particles.
    - Compressive strength tests ranged from 4160 to 9320 psi for the two samples.
- West River Wall Cores (1979) – 4 cores taken:
    - Cores were inspected visually, no compressive or petrographic testing conducted.
    - One 20.5” deep core indicated depth of deterioration over its full length (20.5 inches).
    - A 19.5 inch deep core indicated 11 inches depth of deterioration.
    - An 11.5 inch deep core indicated 8 inches depth of deterioration.
    - An 11.5 inch deep core, taken within a previously repair area (1940’s) indicated no depth of deterioration at the time the coring was conducted.

The result of the previous coring work suggests that the wall concrete is not air entrained and is therefore subject to a higher risk of deterioration, particularly at the waterline. This condition is highly

evident in the field observations. The depth of deterioration indicates that more extensive concrete repair measures would be needed to remove existing deteriorated wall concrete and re-build the wall section to its original profile. This is similar to the concrete repair details utilized on nearby wall concrete repair projects at the East River Wall and Corn Hill Landing. Additional cores were taken from the West River Wall area in 2014, which showed similar results.

2.2.4 Wall Stability Assessment

Previous Stability Assessment

A previous wall stability assessment was performed (Structural Calculations for River Wall, prepared by LaRue Associates and MRP Associates for NYSDOT (dated 1989)). However, it is unknown if this analysis was conducted according to a wall section in the Vacuum Oil area or West River Wall region. This analysis indicated the following results:

- Overturning Factor of Safety (F.O.S.) of 2.97.
- Toe Pressure of 4,200 psf and heel pressure of 1,550 psf.
- If the wall is bearing on soil, then the soil coefficient of sliding friction must be at least 0.4 to provide a F.O. S. of 1.5.

However, the simplified analysis is dependent upon several assumptions. Based on more recent information, the two assumptions below are believed to be inappropriate for analysis and could vastly impact results.

- The river wall is assumed to be bearing on rock and is either on dowels or keyed into bedrock. However, record drawings do not suggest use of dowels and do not show the footing being keyed into rock.
- Backfill is of unit weight not exceeding 120 pcf and has a minimum angle of repose of 30 degrees. Based on borings from the East River Wall project (1999), the backfill use in this area is expected to be of a greater unit weight and lesser angle of repose.

For the reasons stated above, the result of this previous stability analysis are largely discounted.

Stability Criteria

Although a wall stability analysis was not performed for the Vacuum Oil area as part of this scope, a summary of the analysis methods and criteria that would typically be used to assess the wall stability is provided within this section.

The existing wall primarily acts as a retaining structure; however, it also serves as a floodwall. Because the wall is responsible to provide flood protection, use of FEMA and U.S. Army Corps of Engineers (USACE) design criteria is considered appropriate. The structure was analyzed using the gravity method and elastic techniques according to the following U.S. Army Corps of Engineers (USACE) guidelines:

- EM 1110-2-2100 - Stability Analysis of Concrete Structures (2005)
- EM 1110-2-2502 - Retaining and Flood Walls (1989)

The applied loads should include hydrostatic water pressures, uplift pressures, silt pressures, and the self-weight of the structure. Pseudo-static seismic forces, including active soil and hydrodynamic loads, would be applied and calculated in accordance with Chakrabarti, et al.'s Seismic Design of Retaining Walls and Cellular Cofferdams (ASCE, 1978). The horizontal coefficient for seismic

acceleration could be based on the peak ground acceleration reported by Roc Geotechnical for the nearby site of the proposed promenade at Erie Harbor. Vertical seismic acceleration could be neglected in the stability analysis in accordance with the direction of the USACE EMs listed above for sites with horizontal acceleration coefficients less than 0.2.

In all cases a "Friction Factor of Safety" method is recommended to calculate the sliding safety factor. Given the character of assumed foundation material, no cohesion resistance would be expected to be included in the calculation of total sliding resistance capacity.

Uplift should be assumed to vary linearly between the full pool or groundwater pressures from the high water side to the low water side. Depending on the case being evaluated, either side of the wall could be the high or low water side. Evaluation of the foundation bearing stresses conservatively would include hydrostatic uplift pressures on the foundations to maximize applied bearing pressures consistent with USACE EM 1110-2-2200 (Section 3-3.k(3)). Where loads would result in a cracked base condition (less than 100% bearing at base), the uplift should be iterated with uniform high water pressure acting along the full length of the crack (length not in bearing), the remaining un-cracked length varies uniformly to low water pressure.

Section 2.1 of this report provides detailed information on hydraulics for this project site. Below is an abbreviated summary of key water levels that would be used for assessment of the wall. All elevations listed below are according to City Datum.

Operating Pool:

- El. 512.6 to El. 513.1 (usual condition) indicates operating pool levels during the Erie Canal navigation season (generally early May to mid-November) controlled by the Court Street Dam, just downstream from the project site.
- El. 511.0 minimum (usual condition) indicates operating pool levels during the Erie Canal non-navigation season (generally mid-November to early May) controlled by the Court Street Dam, just downstream from the project site.

Low Water:

- El. 507.0 (taken as unusual condition) indicates the approximate minimum pool elevation according to the assessment and rehabilitation documents developed for the East River Wall project (1998). Although not previously documented as such, it is suspected that this elevation is related to an unusual event where the movable sector gates at the Court Street Dam suddenly drop in elevation and allow a rapid and unanticipated drop in pool upstream. However, it is understood that dam operating procedures limit the duration of this sort of event to minimize potential of upstream river wall failures.

For preliminary stability analyses, the pool differential across the wall could be typically taken as a 2' drop from the high water side to the low water side. This allowance for partial cutoff by the wall and foundations is roughly consistent with the river pool and groundwater elevations reported in the Subsurface Cross Sections included in the Figures of the East River Wall Rehabilitation Preliminary Report (1998).

Stability Results

A wall stability analysis was not performed for the Vacuum Oil area as part of this scope, but is recommended to determine the wall's stability performance and compare that with required criteria to see if wall stability improvements may be warranted as part of any future wall renovation effort.

In order to assess the stability of the wall, stability evaluations of the wall should be performed along the length of the wall to capture results for varying wall geometries (Type ‘C’, ‘D’, ‘O’, ‘Q’, and ‘P’), varying bedrock depth, varying sedimentation elevation, and varying landside soil elevations. Geotechnical parameters should be based on site-specific investigation. There is no known geotechnical information specific to this site.

Wall stability checks should be performed for sliding, overturning, and bearing for usual, unusual, and extreme loading conditions, as defined by USACE design criteria.

Listed below are major factors and assumptions that would normally contribute to stability results:

- The structure would be assumed to be founded on bedrock, as generally indicated in the original construction drawings. Some sections of the wall are founded on soil with a sheet pile wall, which should be analyzed separately.
- Uplift would be assumed to vary linearly between full pressures from the high water side to the low water side.
- At-rest earth pressure (vs. active/passive) would be assumed, primarily due to the fact the concrete wall is considered rigid and primarily founded on rock.
- Geotechnical conditions would be assumed based on information from geotechnical investigation performed at the site.
- The wall would be analyzed according to the original section profile. No account would generally be made for loss of deteriorated concrete for purposes of the stability calculations. Weight reductions, as a result of significant concrete deterioration, would be expected to have an adverse effect on stability results.
- Two conditions for river sediment could be considered; one where the river sediment acts to provide river-side support to the wall where present, and one neglecting the presence of the river sediments (down to the bottom of footing elevation). The absence of the river sediments could be anticipated as a reasonable case due to potential future dredging or potential erosion.

2.2.5 Wall Retrofit Considerations

Given the poor condition of concrete at the existing river wall, concrete repair should be included for long-term rehabilitation of the wall. This could include removal of existing deteriorated concrete, doweling of new reinforcement into existing competent concrete, installing reinforcement, and casting the wall back to its original profile. Where lowering of the wall is determined to be feasible, as dictated by the hydraulic evaluation, the wall may be reconstructed to a lower elevation as part of the wall reconstruction work. Regardless of selected wall height, the reconstruction on the riverward face may need to extend below the waterline, which may require water-tight forms or cofferdams. Use of precast concrete panels along the riverside of the wall may be another option as part of long-term concrete reconstruction work in lieu of complete cast-in-place concrete construction.

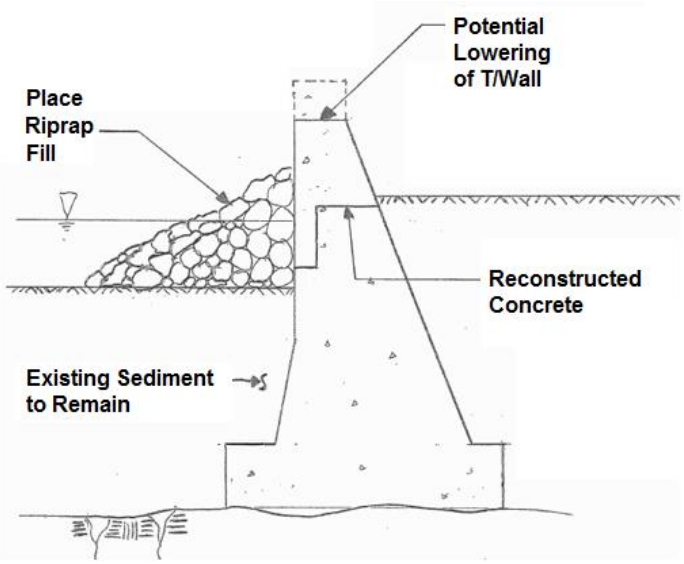
Aside from concrete repair work, stability improvements may also be warranted, depending on the result of a stability evaluation. Based on the results from adjacent wall reconstruction projects, portions of the wall are likely to require some improvements to satisfy stability requirements. Such stability improvement concepts could include the options outlined below. Each of the options outlined herein, or a combination thereof, should be considered to improve the stability performance and concrete condition of the wall. Some of the options outlined, such as the vertical rock anchor

alternative, may require the implementation of a site-specific geotechnical investigation to verify rock parameters and soil properties.

The retrofit should also include removal of all vegetation along the length of the wall. Future plantings and growth within the vicinity of the wall should be maintained to avoid damage to the wall and allow for future inspection of the wall. Both FEMA and USACE have guidelines that should be considered when providing plantings in the vicinity of a retaining or flood wall.

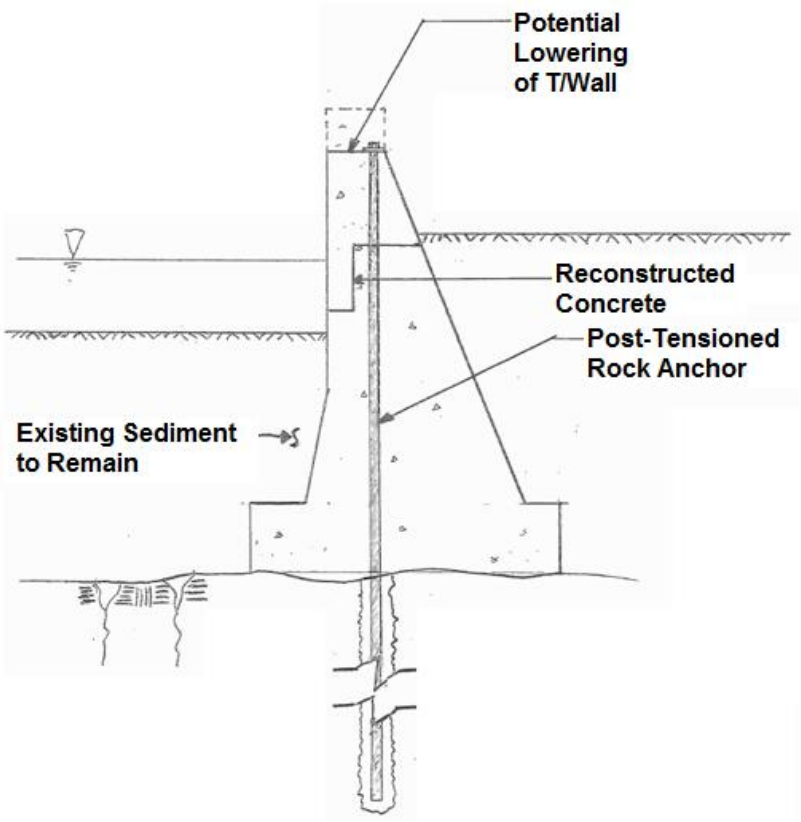
Option 1 - Placement of stone fill riverside of the wall:

- Provides increased resisting side pressured to stabilize the wall structure.
- Would likely restrict navigation directly in front of the wall.
- May improve wave attenuation (improves conditions in channel for recreational rowing).



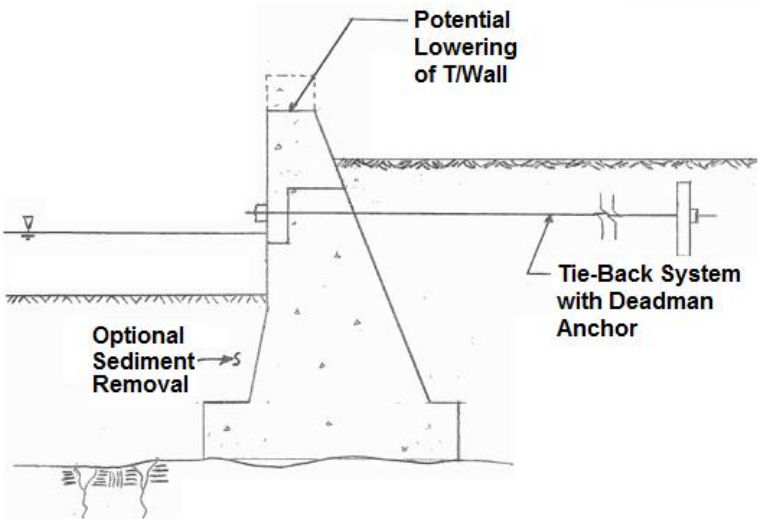
Option 2 - Install vertical post-tensioned rock anchors through wall:

- Provides sliding and overturning resistance to stabilize the wall.
- Would allow for future dredging/erosion in front of the wall and permit navigation in front of the wall.



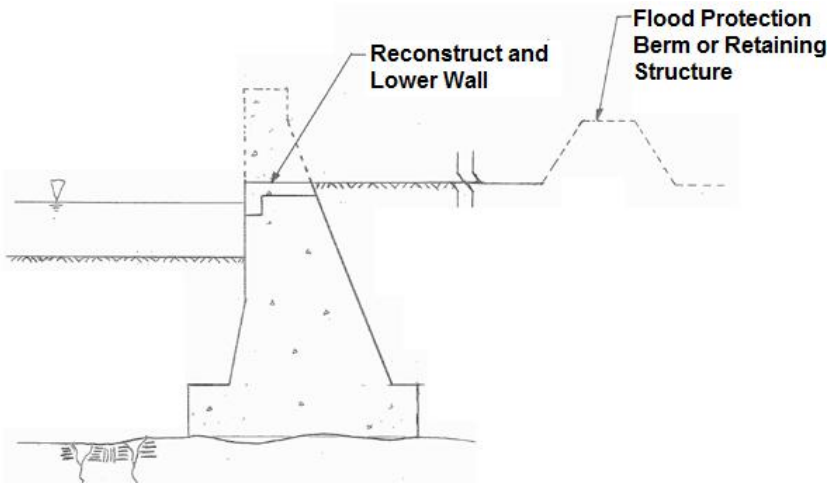
Option 3 - Install tie-backs and deadman system:

- Provides sliding and overturning resistance to stabilize the wall.
- Tiebacks and deadman result in poor access to utilities and may hinder future use of land (interfere with tie-backs).
- Requires a high level of earthwork disturbance for tie-back installation.



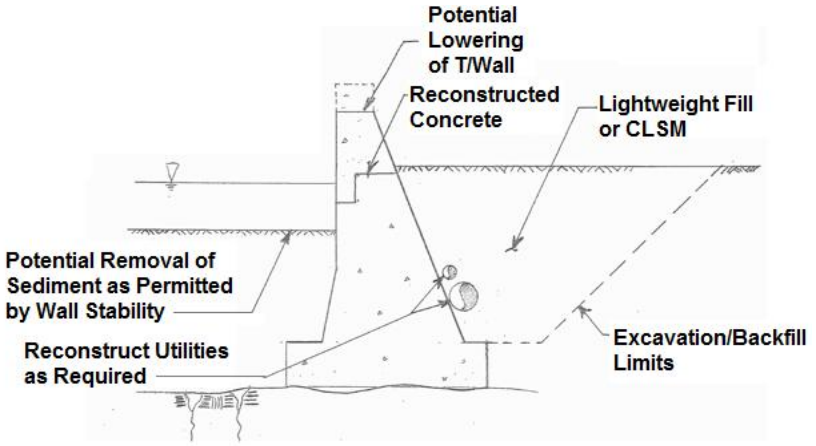
Option 4 - Lowering of the wall and providing landside flood protection berm:

- Lowering of the wall is limited by flood protection requirements. Hence, as secondary wall/berm or terrace may be needed to provide offset flood protection.
- Lowering of landside soils would improve stability results.



Option 5 - Excavation behind a backfill with lightweight or self-supporting materials (CLSM).

- Provides reduced driving side soil pressures in selected areas and may improve wall stability to satisfy criteria.



2.3 FINDINGS FROM WEST RIVER WALL ASSESSMENT

As previously mentioned, the City has conducted a more detailed evaluation and preliminary design for the West River Wall Project just north of the Vacuum Oil site in 2014. The wall is comprised of similar construction and exhibits a similar level of concrete degradation. Although further assessment and design would be required to confirm, it is expected that the work required to modify and reconstruct the river wall in the Vacuum Oil area would be similar to that being considered for the West River Wall Project. Listed below is a summary of key conclusions and considerations that were taken for the assessment, evaluation, and preliminary design conducted for the Corn Hill Section Project:

- The top of the river wall could be lowered and still satisfy FEMA flood protection requirements.
- The top portion of the wall requires full-depth concrete reconstruction due to the findings from concrete coring work, as the depth of deterioration was substantial. The river side face of the wall could be reconstructed using precast panels with concrete infill, which has been done at nearby riverwall sections in the past (Corn Hill and East River Wall).
- The amount of sediment in front of the wall and height of backfill behind the wall were key factors in stability analysis results. Portions of the wall are expected to require stabilization, by way of vertical rock anchors, which has been done at nearby riverwall sections in the past (East River Wall in 1999). This is similar to Option 2, as described within the previous section.
- Where it was desired to lower the wall below the required flood elevation, a landside flood protection berm would be designed, as illustrated by Option 4 in the previous section. Flood protection at the West River Wall was to be provided by a “hybrid” alternative that included reconstructed wall that would transition to a lowered wall with a flood protection berm along its length.

3 SUMMARY AND RECOMMENDATIONS

As part of this scope of services, a limited hydraulic and structural evaluation was conducted for the river wall within the Vacuum Oil BOA study limits. This work, as summarized herein, generally included the assessment and analysis of the hydraulics impacting the future design and wall reconstruction considerations of this critical segment of flood protection within the area. The following tasks were also performed:

- Review of historical documents related to the wall and its flood protection measures.
- Hydraulic and hydrologic modeling according to FEMA criteria.
- Issuing and processing of a Letter of Map Revision (LOMR) based on the hydraulic and hydrologic assessment provided as part of the ongoing BOA project. This is to be prepared under separate cover.

Understanding that the tasks above are not entirely sufficient to advance design, the following additional tasks are recommended to provide a more complete river wall assessment and develop more detailed recommendations.

- Topographic survey of the land behind the wall to determine existing grades and identify site features.
- Bathymetric survey across the Genesee River in the vicinity of the wall to identify sediment depths and cross sections.
- Hands-on inspection of the concrete wall structure, including underwater (diving) inspection, to assess the condition of the wall.
- Concrete coring of the concrete wall to determine the depth of deterioration as it may relate to repair needs.
- Structural stability analysis of the wall to gauge stability performance of the wall according to stability criteria.
- Participation in the Project Advisory Committee (PAC) meetings and Technical Advisory Committee (TAC) meetings to update the committees on work to date, upcoming work, findings, and also seek input on approach to work and direction for landside amenities from those involved in the meetings.
- Geotechnical support to provide design parameters for assessment of the wall, based on site exploration. This would involve review of boring information and development of recommendations for stability design of the existing wall.
- Development of preliminary design drawings (50% level) and construction cost opinion.

The existing river wall within the Vacuum Oil BOA is generally in poor condition. It is anticipated that renovation of the wall would involve concrete repair and stability improvements. Development for the landside of the river wall, other than those required to provide flood protection, should also be investigated and integrated with the wall renovation design. Five conceptual alternatives, as outlined in Section 2, were developed for consideration at this site. Once a more detailed evaluation of the wall and site is conducted, it is recommended that each of these alternatives be considered further for their appropriateness in satisfying flood protection criteria, stability issues, concrete deterioration, and integration with future landside development. It is possible that a combination of alternatives (hybrid option) will be found to be most desirable in satisfying these consideration. Further, it is

understood that the City is pursuing reconstruction / renovation of the West River Wall site to the north of this study area. Hence, it is possible that these projects could be combined. This could yield cost savings through the design and construction phases, may result in less overall site disturbance, and could provide favorable project scheduling.

Hydraulic Findings and Recommendations:

Key hydraulic findings include:

- Revised flows from including effects of Mount Morris Dam result in lowering of FEMA 100-year elevations in the project area between 1.5 and 2.0 feet.
- Based on design drawings, the revised wall would could be rebuilt to between 4 and 4 ½ feet lower than the original height throughout most of the project area;
- If impacts of sedimentation are to be considered, allow for 0.5 feet of increase in 100-year elevations in about 20 years; therefore rebuilt wall height could be reduced by 3 ½ to 4 feet.
- Interior drainage requirements to comply with FEMA levee criteria appear to be minimal.

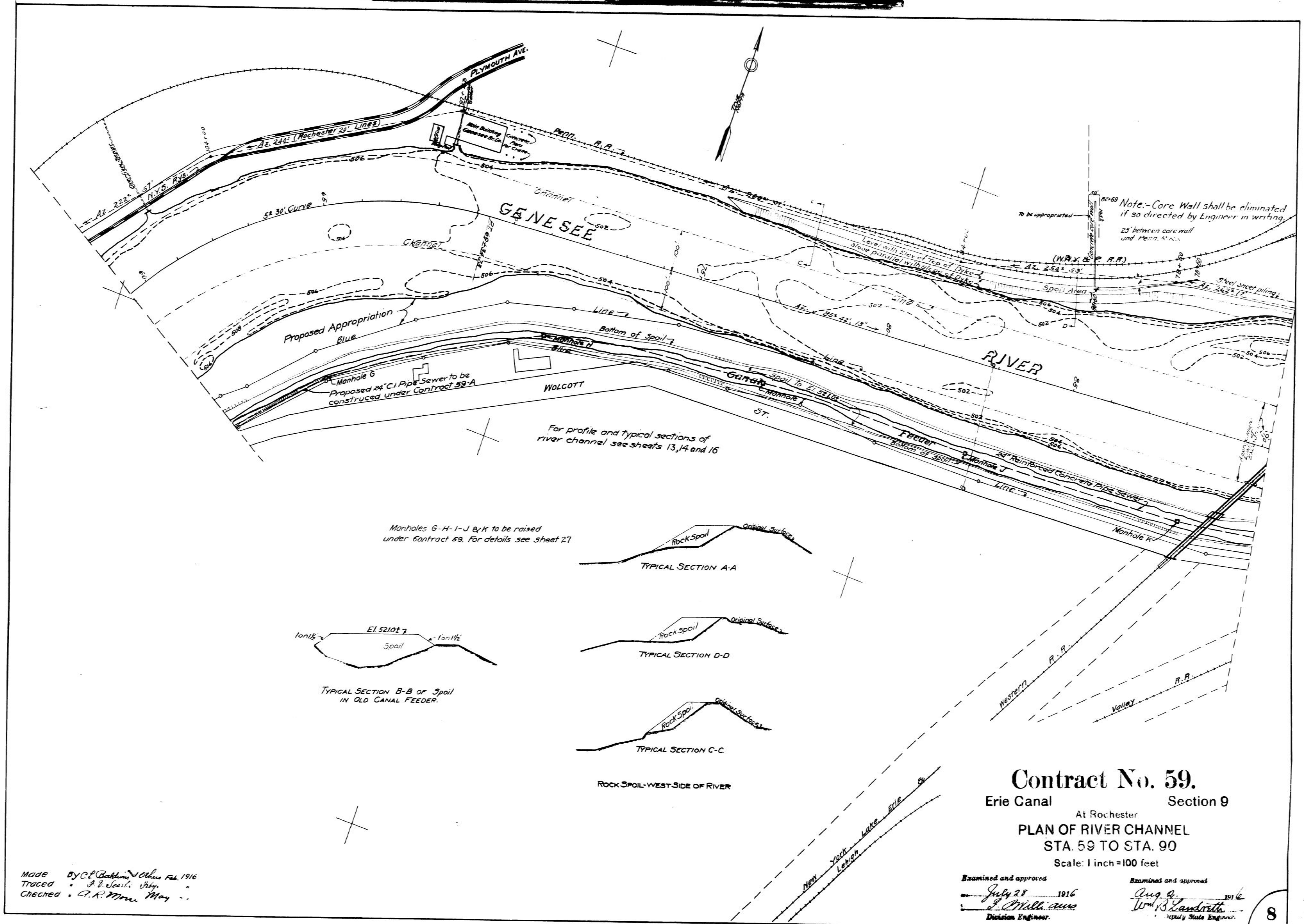
Areas that would require further data for the next phase would include:

- Obtain Lowest Adjacent Grade (LAG), First Floor Elevations (FFE), and other key structures specific elevation data for structures in or near the current 100-year floodplain.

Recommendations from the hydraulic analysis include:

- File for a Letter of Map Revision (LOMR) to FEMA to revise the current 100-year elevation;
- Use the FEMA levee criteria as a guide in the design of the reconstructed flood wall;
- Pursue accreditation and Conditional Letter of Map Revision (CLOMR)/LOMR as wall design proceeds into the next phase.

APPENDIX A - RECORD DRAWINGS



Contract No. 59.

Erie Canal — Section 9

At Rochester

PLAN OF RIVER CHANNEL
STA. 59 TO STA. 90

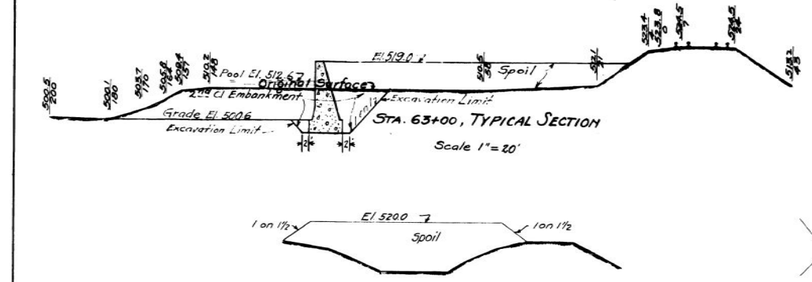
Scale: 1 inch = 100 feet

Made By C.E. Baldwin & Others Feb. 1916
Traced " F.V. Seail. Feby. "
Checked " A.R. Moore May "

Examined and approved July 28 1916 — T. Williams, Division Engineer.

Examined and approved Aug. 9, 1916 — Wm. B. Landreth, Deputy State Engineer.

8



TYPICAL SECTION A-A OF IN OLD CANAL FEEDER.

NOTE:
The Genesee River Feeder shall be filled with spoil to the approximate elevation of the banks except as otherwise shown on the plans.
In case, however, it becomes necessary for the Lehigh Valley Railroad Co. on account of the shifting of tracks made necessary by the construction of this contract to fill portions of this feeder prior to the time when spoil is available for this purpose, such portions are not to be used as spoil areas. In this case the alternate spoil area as shown on the plans shall be used to the extent necessary and as ordered by the Engineer.

For note regarding Poles, telegraph and telephone Systems, East and West banks of river, See Sheet No. 11.

Mode By C. P. Goldsmith Feb. 1916
Traced " J. J. Searle Jany. "
Checked " A. R. Morse May. "

Contract No. 59.

Erie Canal Section 9

At Rochester

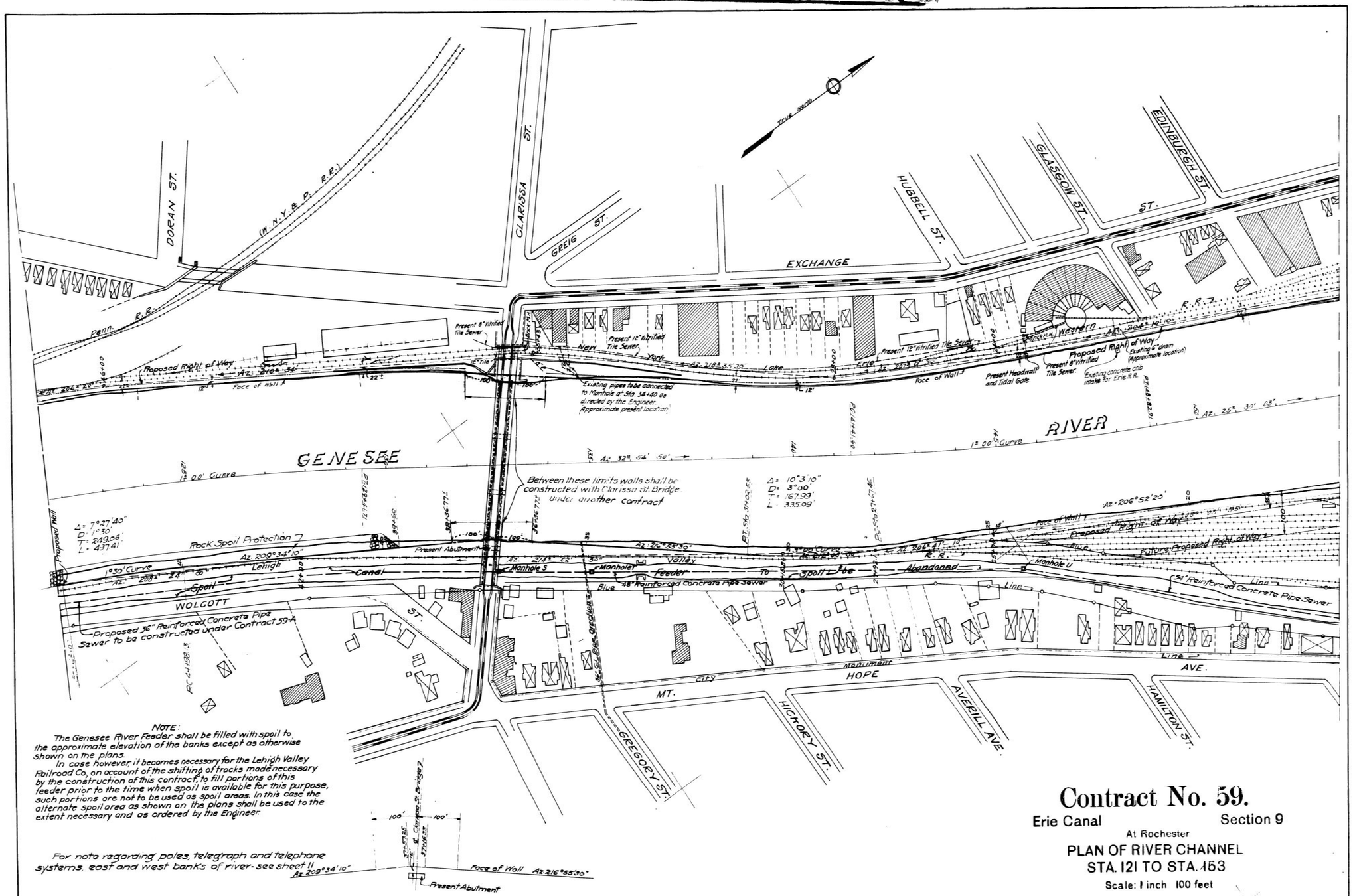
PLAN OF RIVER CHANNEL
STA. 90 TO STA. 121

Scale: 1 inch 100 feet

Examined and approved
July 28 1916
F. Mills Adams
Division Engineer

Examined and approved
Aug 2 1916
Wm B Landreth
Deputy State Engr.

9



NOTE:
The Genesee River Feeder shall be filled with spoil to the approximate elevation of the banks except as otherwise shown on the plans.
In case however, it becomes necessary for the Lehigh Valley Railroad Co. on account of the shifting of tracks made necessary by the construction of this contract, to fill portions of this feeder prior to the time when spoil is available for this purpose, such portions are not to be used as spoil areas. In this case the alternate spoil area as shown on the plans shall be used to the extent necessary and as ordered by the Engineer.

For note regarding poles, telegraph and telephone systems, east and west banks of river - see sheet 11

ALIGNMENT OF WALL AT CLARISSA ST.

Made BY C.F. Vahlkin Feb. 1916
Traced " J.B. Steele "
Checked " A.R. Morse May 1916.

Contract No. 59.

Erie Canal Section 9

At Rochester

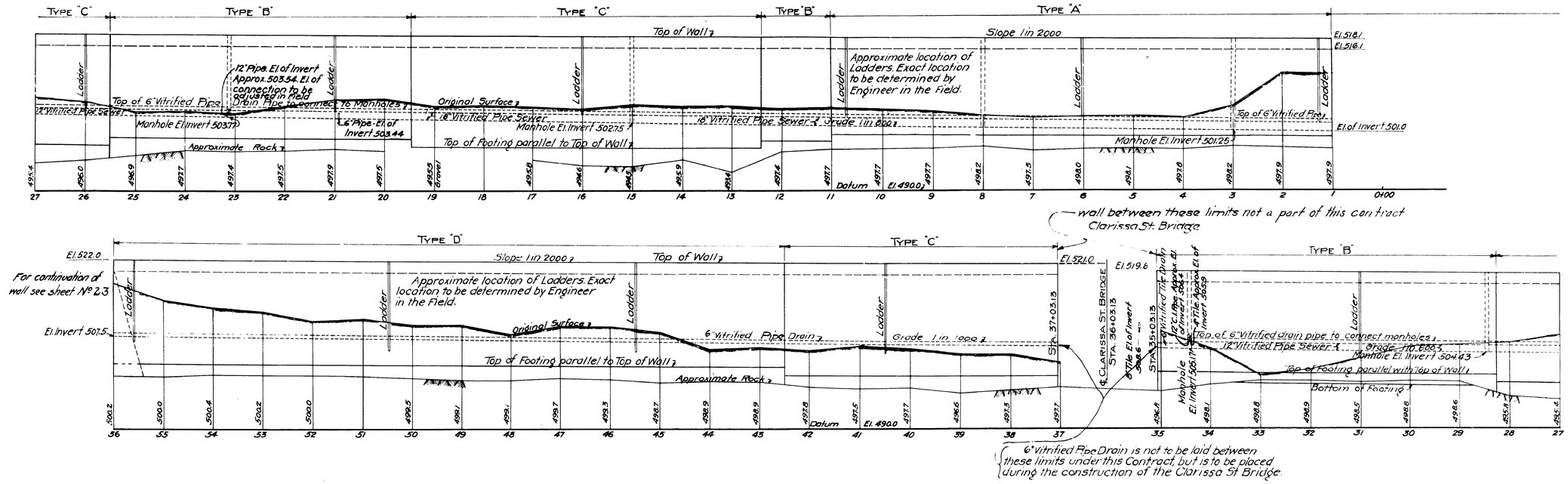
PLAN OF RIVER CHANNEL
STA. 121 TO STA. 153

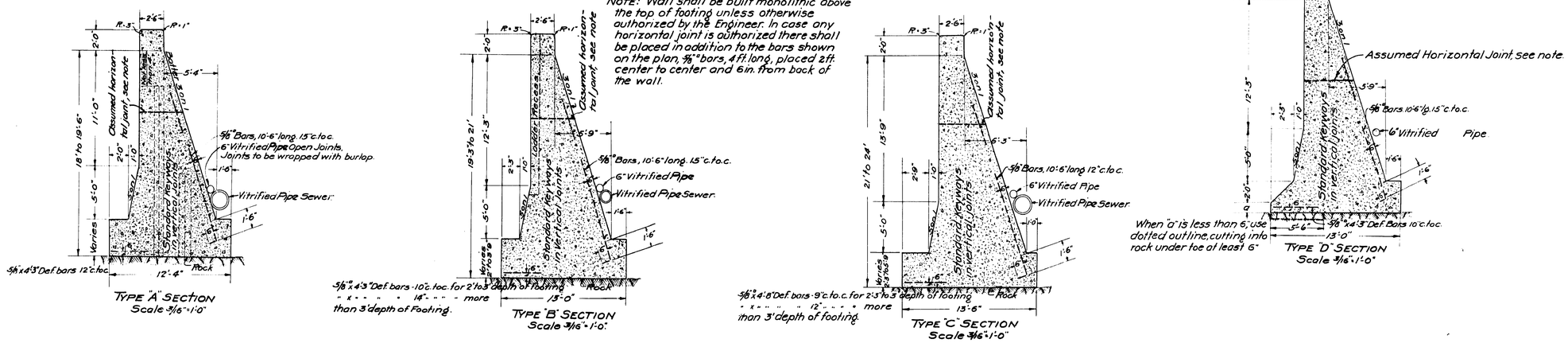
Scale: 1 inch 100 feet

Examined and approved
July 28 1916
E. A. Williams
Division Engineer.

Examined and approved
Aug 5 1916
Wm. B. Landreth
Deputy State Engineer.

10





—NOTES.—

The base of wall as shown on this plan is to be considered as approximate only and may be ordered by the Engineer, in writing, to be at any elevation and of any dimensions necessary to give a proper foundation.
For details of Vertical Joints, see sheet 21
For details of Ladders, see sheet 21
For details of Manholes, see sheet 22
All Masonry shown on this sheet to be Second Class Concrete.
All Metal Reinforcement to be deformed bars.
Length of sections shall not exceed 40 feet.
For stepping of rock surface when it slopes transversely more than 1 on 20 see sheet 24.
For connection between different Types of Wall see sheet 211

Location of 4"-12" and 18" drains in the vicinity of Sta. 34+40 are approximate only and are shown from the best available information. The contractor will be required to make connections between these drains and the sewer, also between any other drains found during construction and the sewer as directed by the Engineer.
The cost of all connections is to be included in the contract price of 12" and 18" Vitrified Pipe.

For location of blind laterals see specifications

Made by J. Feinstein May 1916
Traced by H.G. Bourne May 1916
Checked by W.C. Zabel May 1916.

Contract No. 59.

Erie Canal — Section 9

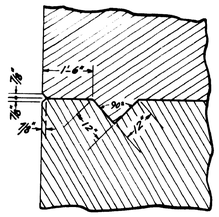
At Rochester

PROFILE & TYPICAL CROSS SECTIONS OF WALL ALONG WEST BANK OF RIVER

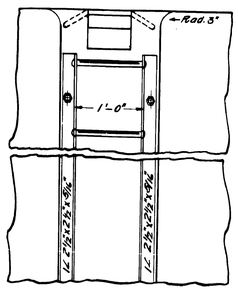
Scales as indicated

Examined and approved
July 28 1916
F. Mitchell
Division Engineer.

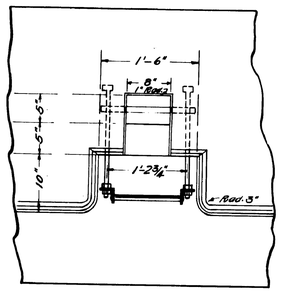
Examined and approved
Aug 2. 1916
Wm. P. Landreth
Deputy State Engineer.



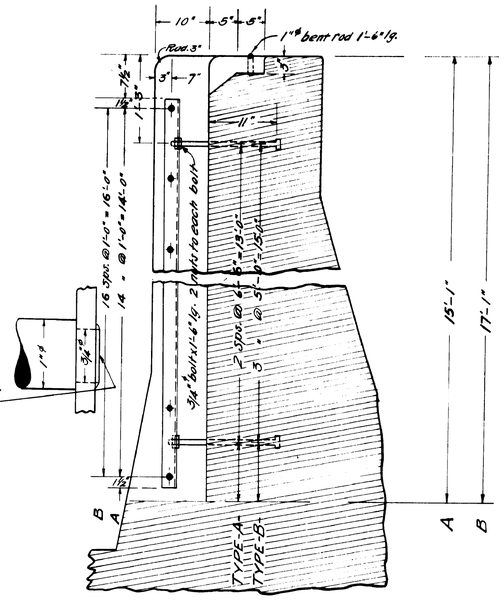
DETAIL OF VERTICAL JOINT.
Scale: 1/2"=1'.



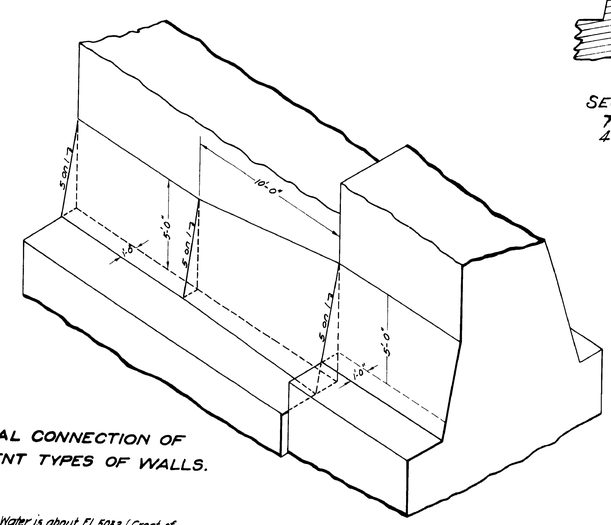
FRONT ELEVATION OF LADDER RECESS.
Scale: 1"=1'.



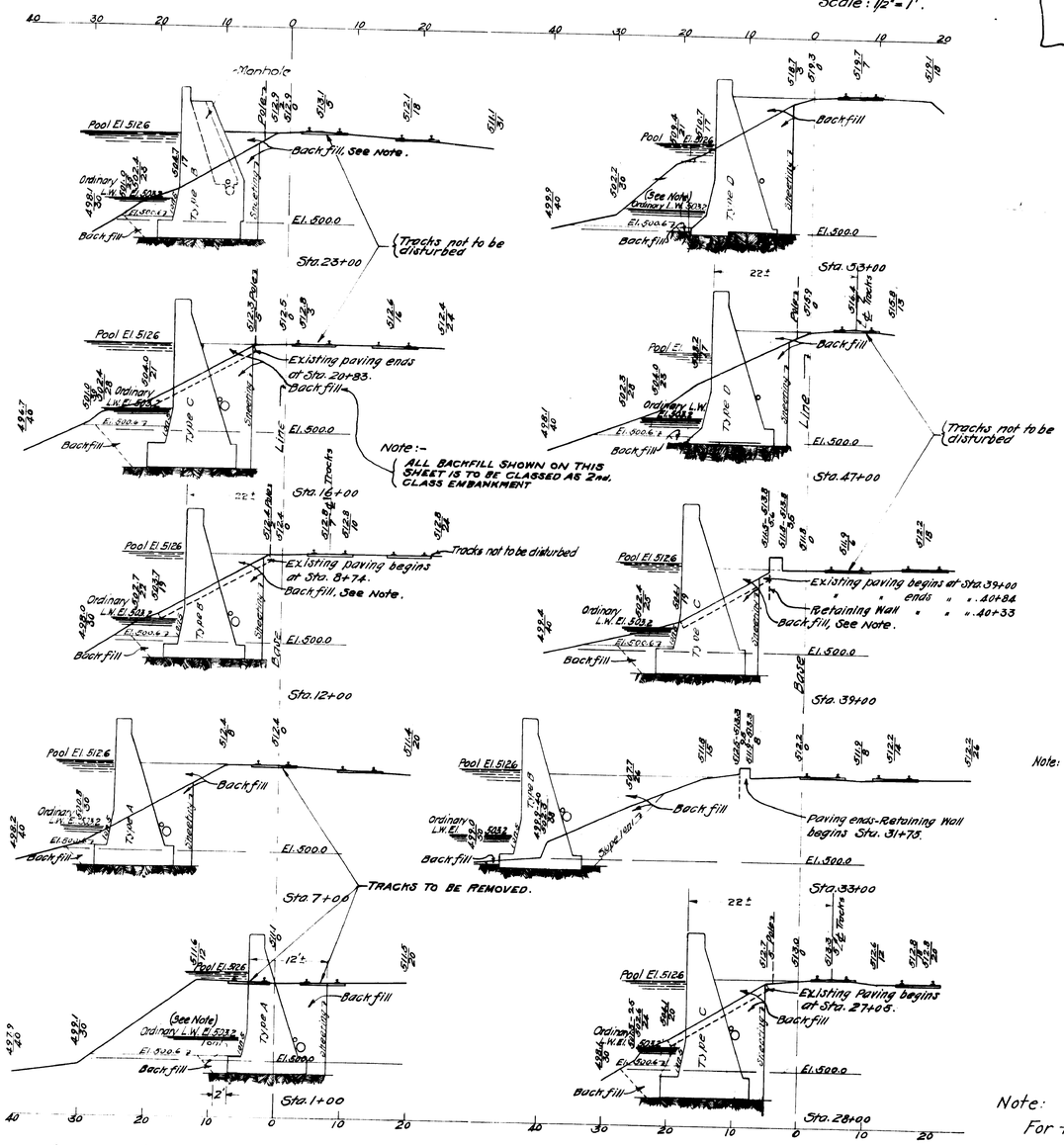
PLAN OF WALL THROUGH LADDER RECESS.
1" ϕ rods, ends cut ¾" and to project slightly beyond angle and be hamered over
Scale: 1"=1'.



SECTION THROUGH LADDER RECESS.
7 - Ladders Type-A- For West Wall No. Clarissa St.
4 - " " -B- " " " So. " ".
Scale: 1"=1'.



TYPICAL CONNECTION OF DIFFERENT TYPES OF WALLS.



Note:- ALL BACKFILL SHOWN ON THIS SHEET IS TO BE CLASSED AS 2nd. CLASS EMBANKMENT

Note: Ordinary Low Water is about El. 503.2 (Crest of Johnson & Seymour Dam)

Note:
For typical sections - Sta. 56-73, See Sheet 9

Made By J. Feinstein May 1916
Traced " F.F.Sears apr. "
Checked " C.L.Baldwin " "

TYPICAL SECTIONS - WEST RIVER WALL.
Scale: 1"=10'.

Contract No. 59.

Erie Canal — Section 9

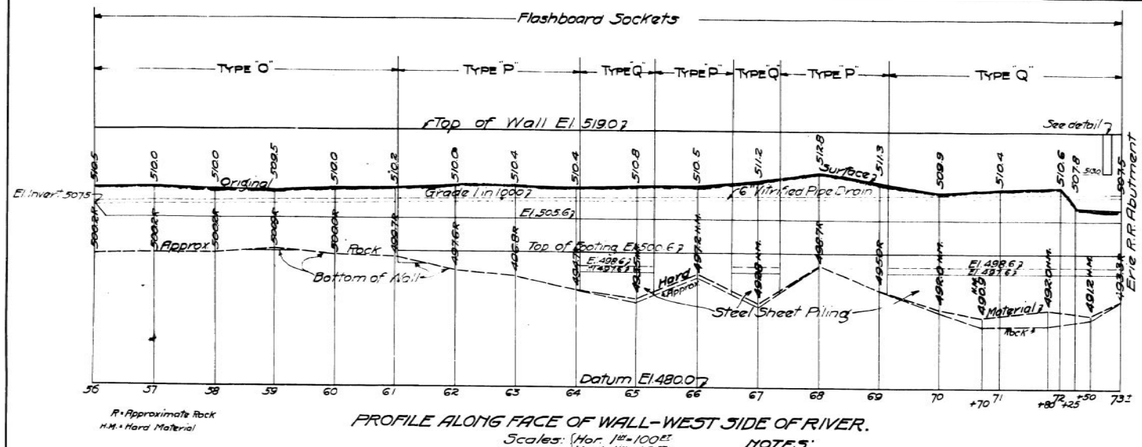
At Rochester

CROSS SECTIONS & DETAILS OF WALL ALONG WEST BANK OF RIVER

Scales as indicated

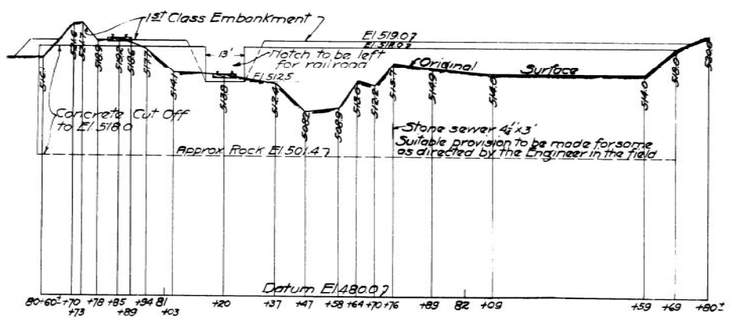
Examined and approved
July 28 1916
F. Williamson
Division Engineer.

Examined and approved
Aug 2, 1916
Wm. J. Landreth
Deputy State Engineer.



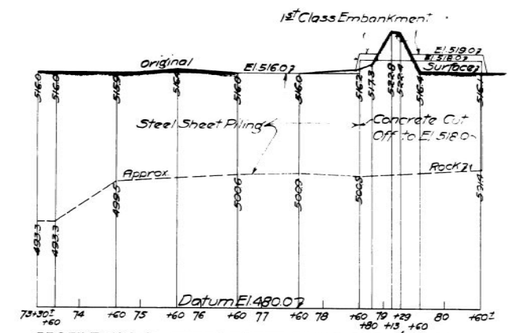
PROFILE ALONG FACE OF WALL - WEST SIDE OF RIVER.

Scales: Hor. 1" = 100'
Vert. 1" = 10'.



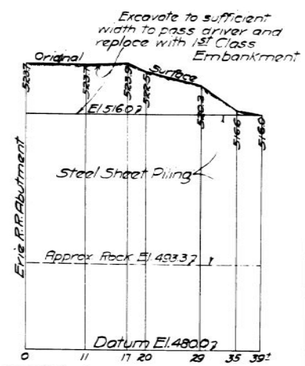
PROFILE ON ℄ OF RETURN WALL

Scales: Hor. 1" = 80'
Vert. 1" = 10'.



PROFILE ALONG STEEL SHEET PILING AND ℄ OF CUT OFF WEST SIDE OF RIVER

Scales: Hor. 1" = 100'
Vert. 1" = 10'.

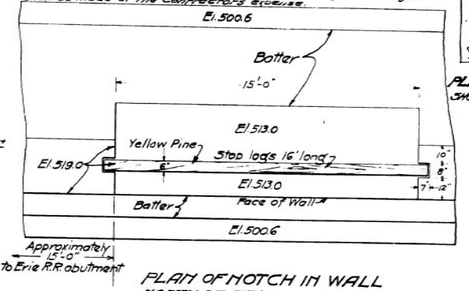


PROFILE ALONG STEEL SHEET PILING BY ERIE R.R. ABUTMENT

Scales: Hor. 1" = 10'
Vert. 1" = 10'.

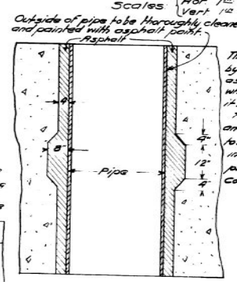
NOTES:

For General Notes see sheet 20.
For details of Flashboard Sockets see sheet 24.
In all cases where steel sheet piling is shown the same shall be carried to rock. In all other cases the concrete foundation shall be carried to rock.
Where steel sheet piling is used to cut off a portion of the side of the end, shall be embedded in the adjacent concrete sufficient to form a seal satisfactory to the Engineer.
Where the steel sheet piling butts up to the Erie R.R. abutment it shall be embedded in a block of concrete to rock sufficient to form a seal satisfactory to the Engineer.
Wherever steel sheet piling is shown on the plans the elevations of the rock are approximate only and the Contractor shall determine the lengths of the steel sheet piling to be driven. However, the piling must be driven to rock and within 6" of the top elevation as shown on the plans and all cutting necessary to bring to such grade shall be made at the Contractors expense.



PLAN OF NOTCH IN WALL NORTH OF ERIE R.R. BRIDGE

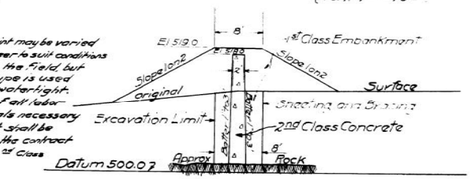
Scale 1" = 3'.



PLAN SECTION THRU WALL SHOWING METHOD OF PASSING PIPE THRU WALL.

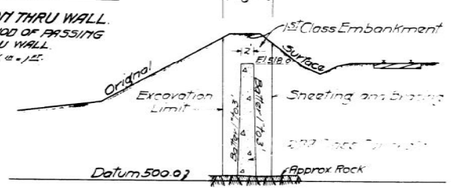
Scale 1/2" = 1'.

The type of joint may be varied by the Engineer to suit conditions as found in the field, but whatever type is used it must be water tight.
The cost of all labor and materials necessary to make joint shall be included in the contract price for 2nd Class Concrete.



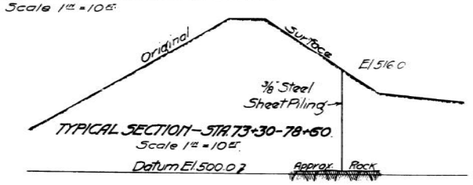
TYPICAL SECTION - STA. 78+60 - 82+69. WHERE ORIGINAL SURFACE IS BELOW El. 519.0

Scale 1" = 10'.



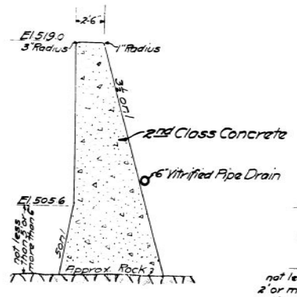
TYPICAL SECTION - STA 78+60 - 82+69. WHERE ORIGINAL SURFACE IS BELOW ELEV. 519.0

Scale 1" = 10'.



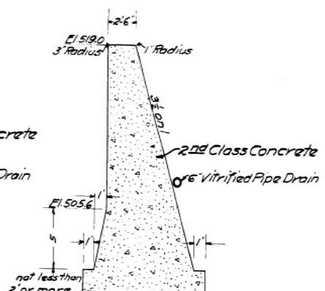
TYPICAL SECTION - STA 73+30 - 78+60.

Scale 1" = 10'.



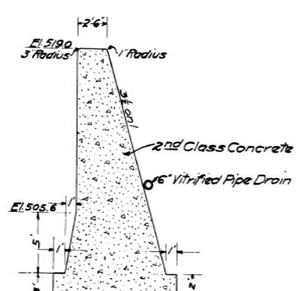
TYPE "O" SECTION

Scale 3/16" = 1'.



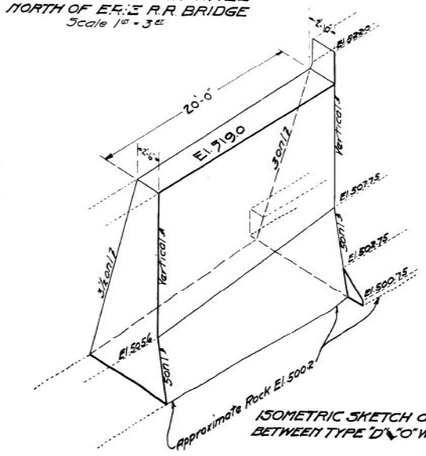
TYPE "P" SECTION

Scale 3/16" = 1'.



TYPE "Q" SECTION

Scale 3/16" = 1'.



ISOMETRIC SKETCH OF CONNECTION BETWEEN TYPE "O" WALLS - STA. 56+00.

Contract No. 59.

Erie Canal — Section 9

At Rochester

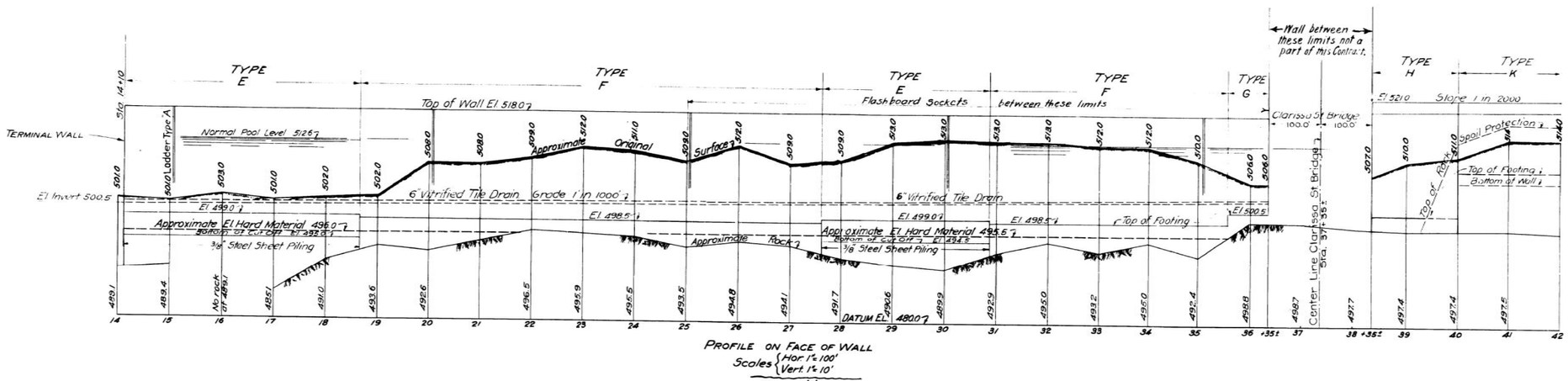
PLAN & DETAILS OF WALL ON WEST SIDE OF RIVER, SOUTH OF STA. 56

Scales as indicated

Examined and approved
July 28 1916
E. Mills
Division Engineer.

Examined and approved
Aug 2. 1916
Wm. B. Landreth
Deputy State Engineer.

Made by W.W. Braun July 1916
Traced by W.W. Braun " "
Checked by C.T. Baldwin " "



PROFILE ON FACE OF WALL
Scales { Hor 1"=100'
Vert 1"=10'

Notes:-

All masonry shown on this Plan to be 2nd Class Concrete.

The bases of the Walls shown on this Plan shall be considered approximate only, and may be ordered in writing to be at any elevation and of any dimensions necessary to secure a proper foundation.

Lengths of Sections shall not exceed 40 ft.

All metal reinforcement to be deformed bars.

For details of ladders See Sheet No. 21

For details of Vertical Joints see Sheet No. 21

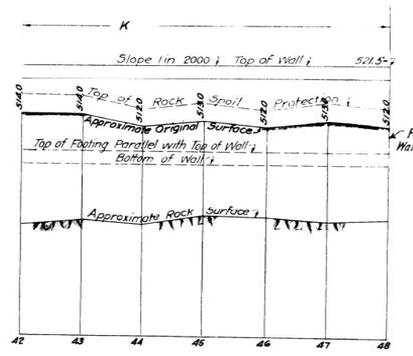
Keyways to be provided at all Joints.

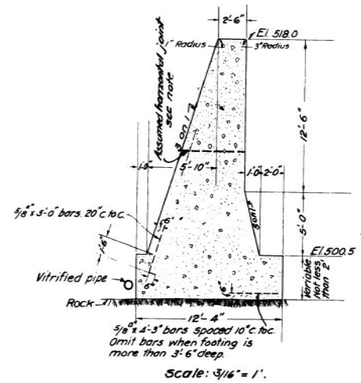
Walls shall be built monolithic above the top of the footing unless otherwise authorized by the Engineer. In case any horizontal Joint is authorized, there shall be placed in addition to the bars shown on the Plans, 5/8" ø bars 4'-0" long 2'-0" C. to C., 6" from back of wall.

Whenever the elevation of hard material, that is, material which is suitable for the foundation of the Walls, is three feet or more above the elevation of rock, 3/8" Steel Sheet piling shall be driven as shown on the section of Type "E".

After excavating to hard material the Contractor shall sound along the site of any section of the wall prior to its construction to determine the elevation of rock and lengths of steel sheet piling.

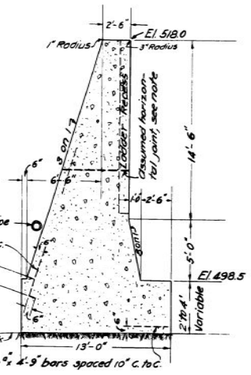
For connection between different types of Wall see sheet 21. Where steel sheet piling is used for a cut off, a portion of the pile at the end shall be embedded in the adjacent concrete sufficient to form a seal satisfactory to the Engineer.





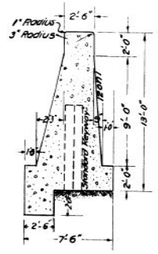
Scale: 3/16" = 1'.

TYPE 'G' SECTION



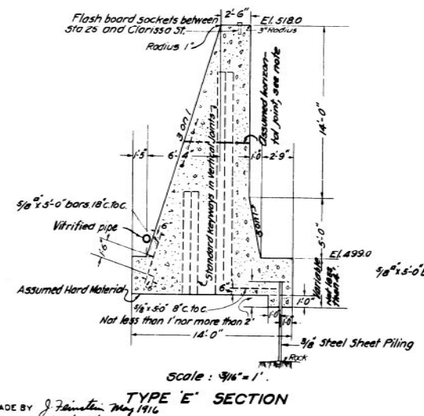
Scale: 3/16" = 1'.

TYPE 'F' SECTION



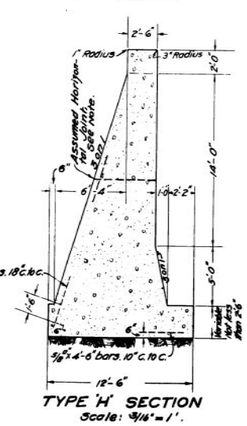
Scale: 3/16" = 1'.

TYPE 'K' SECTION

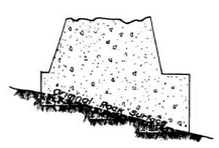


Scale: 3/16" = 1'.

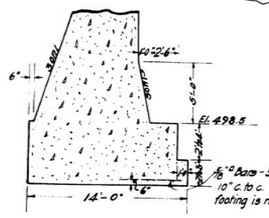
TYPE 'E' SECTION



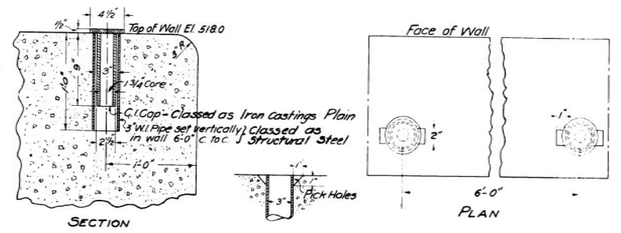
TYPE 'H' SECTION
Scale: 3/16" = 1'.



DETAIL OF FOUNDATION WHEN ROCK IS SLOPING TRANSVERSELY MORE THAN 1 ON 20.



TYPE "F" - WHEN ROCK IS MORE THAN 4' BELOW TOP OF FOOTING
Scale: 3/16" = 1'.



DETAILS OF FLASHBOARD SOCKETS.
Scale 1 1/2" = 1'-0"

MADE BY J. Feinstein May 1916
TRACED BY J.G. Smith May 1916
CHECKED BY M.J. Zabel "

Contract No. 59.

Erie Canal — Section 9

At Rochester

PROFILE & TYPICAL SECTIONS OF WALL ALONG EAST BANK OF RIVER

Scales as indicated

Examined and approved
July 28 1916
E. Williams
Division Engineer.

Examined and approved
Aug 2 1916
Wm B. Landreth
Deputy State Engineer.

NOTES.

For profile located 4 feet west of Wall see Sheet No. 20, Original Contract.

There are poles for the support of the Electrified Erie R.R. Trolley Wires on the top of the west river bank the total length of the Wall.

Telegraph and telephone system in line of the Construction of the East Wall are to be removed by their owners.

This sheet is for the purpose of showing change in location of Wall along west bank of the Genesee River. For all details not shown see plans of original contract.

Voids in wall to receive electric poles for telephone, telegraph and trolley system are to be placed at such points and to be of such dimensions as directed by the Engineer.

Mooring cleats, as per details, are to be placed on the top of the West River Wall, at approximately 200 feet apart, for its entire length.

MANHOLES.

The tops of all manholes shown in the original contract for West Wall are to be at the elevation of the road bed of the Erie R.R. Tracks. Elevation to be given by the Engineer in Field.

The Erie R.R. Co. will remove and care for all poles in the line of work whose center of base is within a line 2' back of the base of the West Wall.

Contract No. 59.

ALTERATION NO. 1

Erie Canal — Section 9

At Rochester

PLAN SHOWING CHANGE IN LOCATION OF WALL ALONG WEST BANK OF RIVER

Scale: 1 inch=100 feet

Examined and approved

Feb 24 1917.

F. P. Williams

Division Engineer.

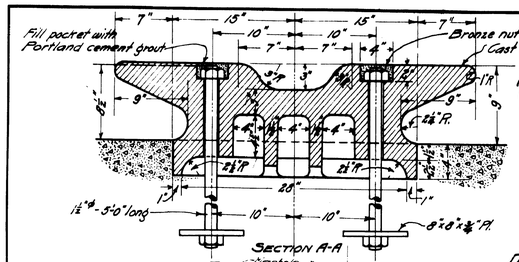
Recommended and approved

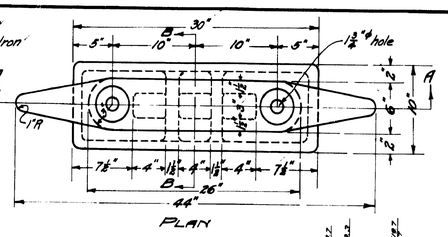
Apr 1 1917

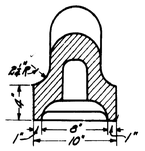
Superintendent Public Works

Made by C.L. Baldwin, Feb. 1916.
Traced by L. Hoferwarz, Feb. 1917.
Checked by A.S. Wilbeck, Feb. 1917.

58

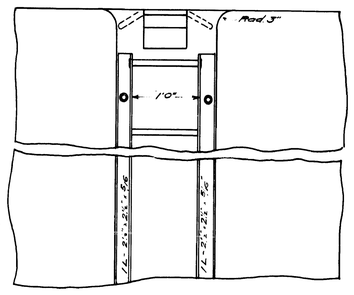




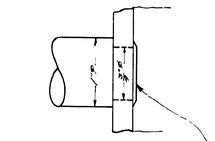


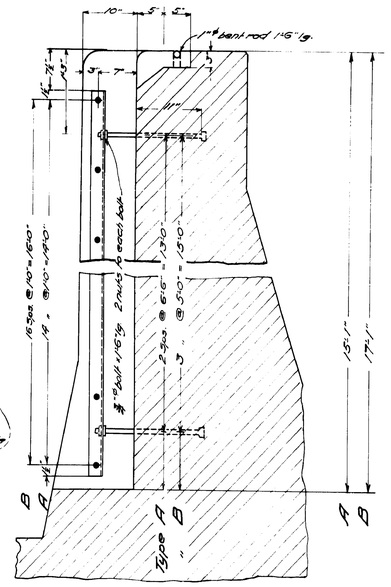
DETAIL OF MOORING CLEATS
1½" = 1'-0"

Note-
Mooring cleats shall be classified as Iron Castings, Plain.
Bolts, nuts and plates shall be classified as Structural Steel.

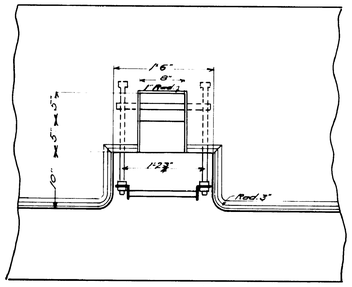


FRONT ELEVATION OF LADDER RECESS
Scale: 1" = 1'.

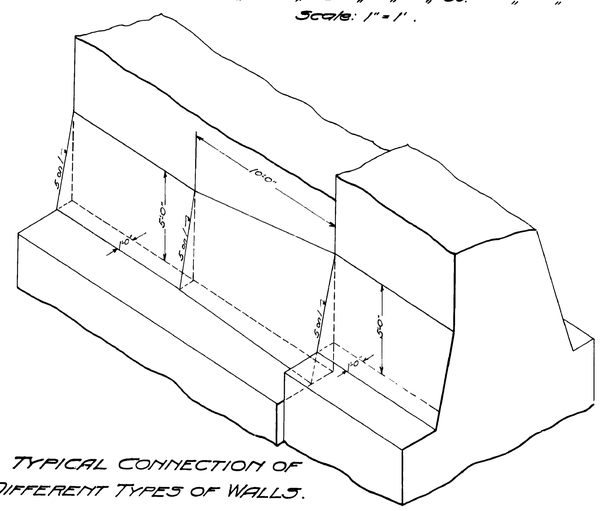




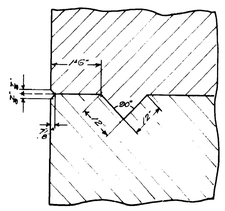
SECTION THROUGH LADDER RECESS
7-Ladders-Type A-For West Wall No. Clarissa St.
4- " " B " " " 30. " "
Scale: 1" = 1'.



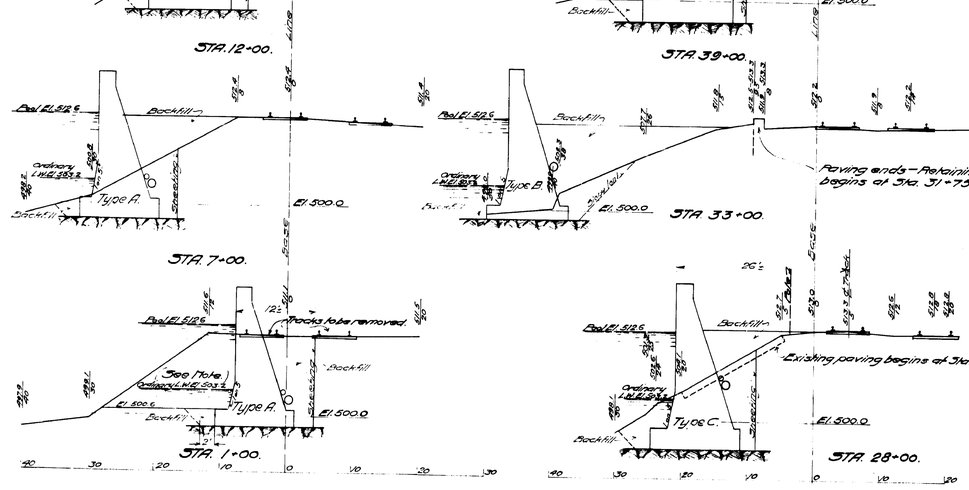
PLAN OF WALL THROUGH LADDER RECESS.
Scale: 1" = 1'.



TYPICAL CONNECTION OF DIFFERENT TYPES OF WALLS.



DETAIL OF VERTICAL JOINT.
Scale: 1" = 1'.



TYPICAL SECTIONS
WEST RIVER WALL.
Scale: 1" = 10'.

NOTES:
Ordinary Low Water is about El. 503.2 (Crest of Johnson & Seymour Dam.)
For typical sections - Sta. 56 - 73, see Sheet No. 9, Original Contract.

Made by J. Feinstein, May, 1916.
Traced by L. Haberwas Feb. 1917.
Checked by R.S. Whitbeck, Feb. 1917.

Contract No. 59.

ALTERATION NO 1

Erie Canal — Section 9

At Rochester

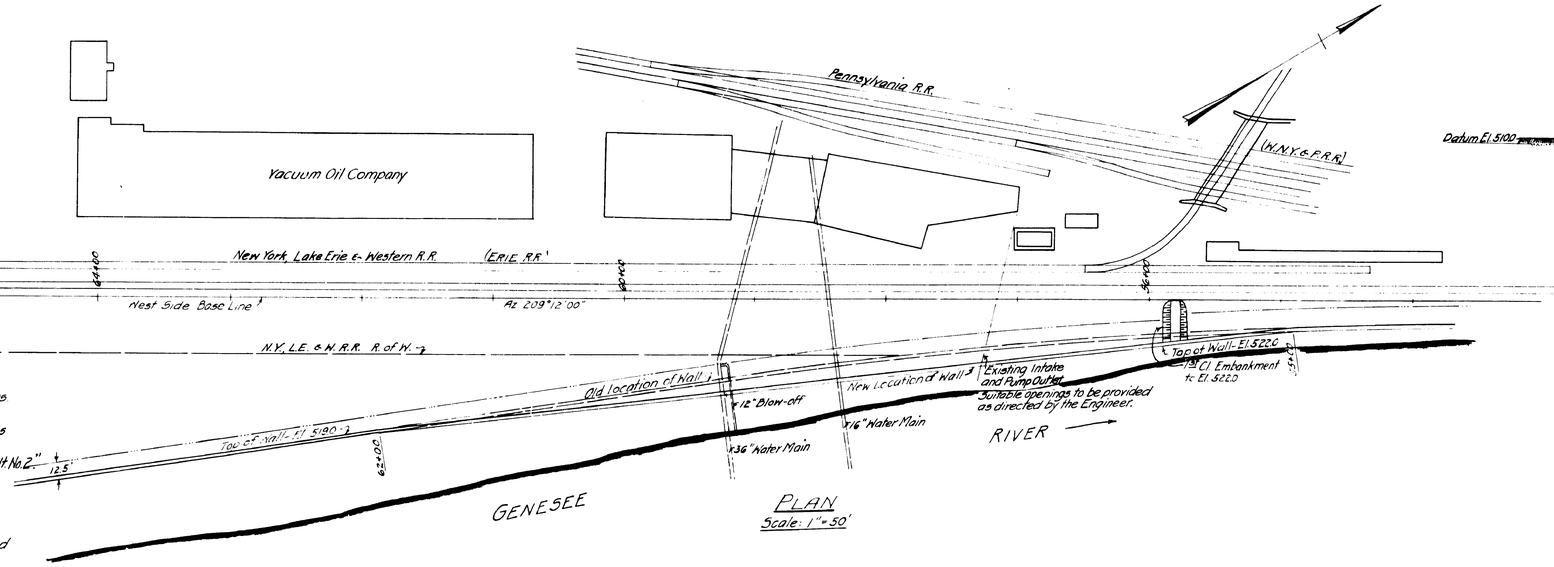
CROSS SECTIONS & DETAILS OF WALL ALONG WEST BANK OF RIVER

Scales as indicated

Examined and approved
Feb. 24th 1917.
F. Williams
Division Engineer.

Examined and approved
Apr 4 1917
Assistant Deputy State Engineer.

59



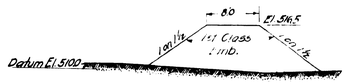
PLAN
Scale: 1"=50'

Notes: For all details not shown see sheets under Alteration No. 1 and Original Contract Plans.

The cost of constructing, furnishing material for, and sealing, of three arch openings in wall shall be included in item: "Additional Coffer-dams, Pumping, Bailing and Draining, Alt No. 2"

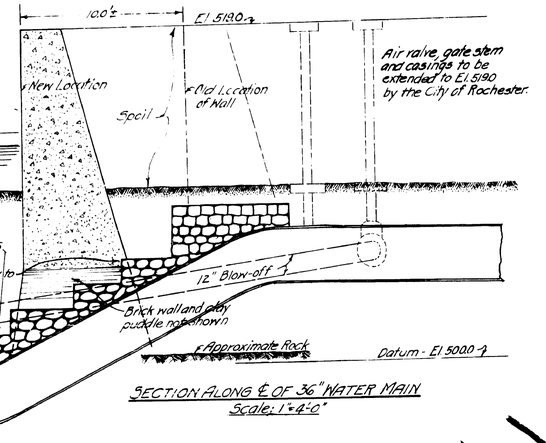
Especial care shall be taken not to disturb existing water mains.

Material for making fill in Feeder Bank and near headgate shall be taken from land adjacent in River Bank or Feeder Bed as directed by Engineer.

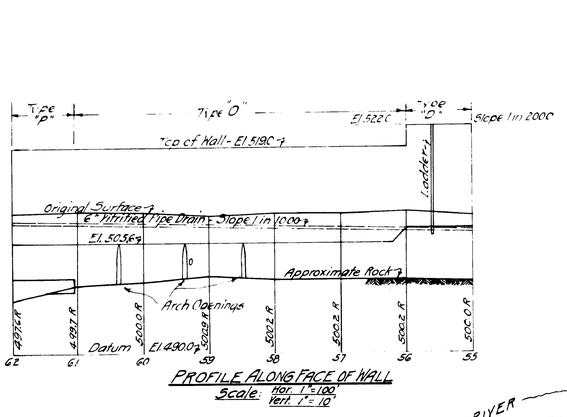


TYPICAL SECTION
STA 86+84
Scale: 1"=10'

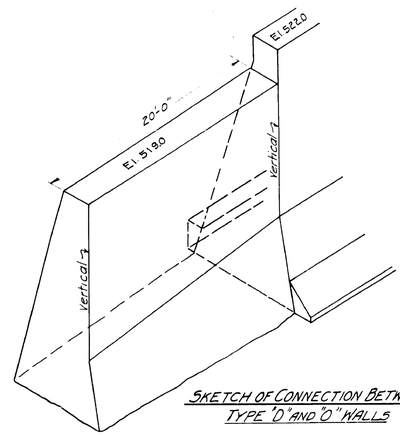
TYPICAL SECTION
STA 72+45
Scale: 1"=10'



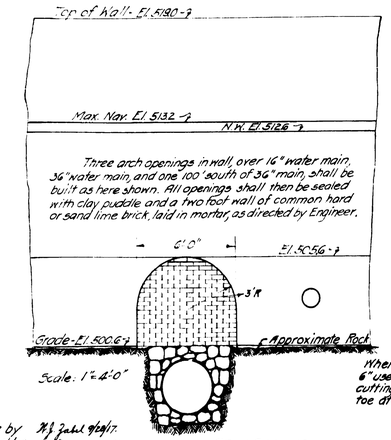
SECTION ALONG ℄ OF 36" WATER MAIN
Scale: 1"=4'-0"



PROFILE ALONG FACE OF WALL
Scale: Hor. 1"=100'
Vert. 1"=10'

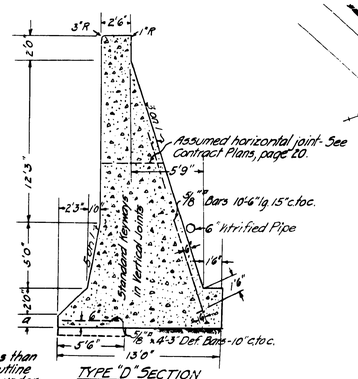


SKETCH OF CONNECTION BETWEEN TYPE "O" AND "O" WALLS



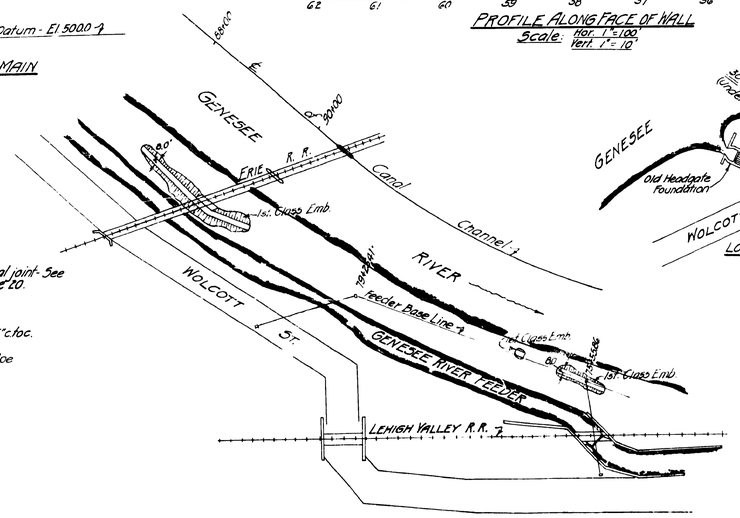
Scale: 1"=4'-0"

ELEVATION OF ARCH OPENING

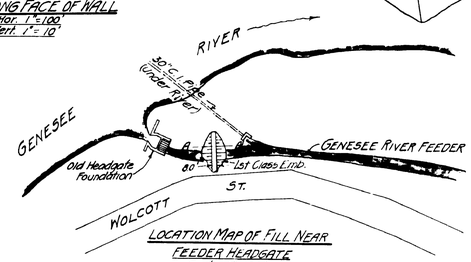


TYPE "D" SECTION
Scale: 3/16"=1'-0"

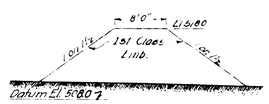
When "a" is less than 6" use dotted outline cutting into rock under toe at least 6"



LOCATION MAP OF FILL IN FEEDER BANK
Scale: 1"=100'



LOCATION MAP OF FILL NEAR FEEDER HEADGATE
Scale: 1"=100'



SECTION AA
Scale: 1"=10'

Made by M. J. Isbell 9/29/17.
Traced by
Checked by C.M. Colony.

Contract No. 59

ALTERATION NO. 2

Erie Canal — Section 9

PLAN SHOWING RELOCATION OF WEST RIVER WALL & OTHER DETAILS

Scales as indicated

Examined and approved:

Nov 2 7 1917.

F. W. Williams
Division Engineer.

Examined and approved

1917

Special Deputy State Engineer

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APPENDIX B - SITE PHOTOS IN WALL VICINITY

RIVERWALL PHOTOS APPENDIX

PHOTO NO: 1 LOCATION: Ford Street Bridge DESCRIPTION: West River Wall (to left) Start of Vacuum Oil Wall (to right)	
PHOTO NO: 2 LOCATION: Ford Street Bridge DESCRIPTION: Ponding of water along trail and bridge abutment.	

PHOTO NO: 3 LOCATION: Wall Concrete (near Ford Street) DESCRIPTION: Typical spalling and degradation of concrete.	
PHOTO NO: 4 LOCATION: Wall Concrete (near Ford Street) DESCRIPTION: Typical concrete deterioration at monolith joint. Section to the left appears to have been previously repaired.	

PHOTO NO: 5 LOCATION: Wall Concrete (near Ford Street). DESCRIPTION: Typical concrete deterioration at mooring cleat.	
PHOTO NO: 6 LOCATION: Near Ford Street. DESCRIPTION: USGS gauge station next to wall.	

PHOTO NO: 7 LOCATION: Near Ford Street. DESCRIPTION: Moderate vegetation and wall condition along trail.	
PHOTO NO: 8 LOCATION: Mid-length of wall. DESCRIPTION: Periodic notch in wall. Notches are of varying depth.	

PHOTO NO: 9

LOCATION:

Wall and trail at Violetta Street.

DESCRIPTION:

Wall elevation lowered at trail near Violetta Street.

PHOTO NO: 10

LOCATION:

Mid-length of wall.

DESCRIPTION:

Transition between Type D and Type O wall (3 foot drop).

PHOTO NO: 11 LOCATION: Wall at Flint Street. DESCRIPTION: Location where one of two water lines transitions under the wall.	
PHOTO NO: 12 LOCATION: Mid-length of wall. DESCRIPTION: Shallow water depth on river side of wall and vegetation. Wall in this area was furnished with sockets, presumably for flashboard installations.	

PHOTO NO: 13 LOCATION: Near Genesee Trail Bridge. DESCRIPTION: Apparent notch in river wall, presumably for stop logs.	
PHOTO NO: 14 LOCATION: Genesee Trail Bridge (southerly project limit). DESCRIPTION: Shallow water depth. Transition from RR abutment to river wall.	

APPENDIX C - FLOOD MODELING SUPPORTING INFORMATION

Appendix C: Flood Elevation Modeling Results (Revised 100-Year)

The U.S. Army Corps of Engineers computer program HEC-RAS version 4.1.0 was used to compute the 100-year existing conditions analysis. Attached are the following results from the 100-year existing conditions analysis:

- Summary Output Table
- Detailed Output Table
- Riverine Profile
- Hydraulic Cross-Sections

Note: All elevations in these HEC-RAS files were computed using the NAVD 1988 datum.

HEC-RAS Plan: Revised River: Genesee River Reach: WestWall_reach Profile: 100-yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
WestWall_reach	8735.671	100-yr	25851.00	496.29	513.32	506.35	514.09	0.000723	7.05	3693.98	324.11	0.35
WestWall_reach	6150.903	100-yr	25851.00	496.19	512.58	503.70	512.91	0.000268	4.59	5641.74	450.13	0.22
WestWall_reach	4882.973	100-yr	25851.00	492.99	512.31	502.31	512.64	0.000175	4.61	5607.23	562.34	0.21
WestWall_reach	4774.966	100-yr	25851.00	493.19	512.31	502.28	512.62	0.000058	4.49	5759.26	435.14	0.20
WestWall_reach	4745.265 Ford St.		Bridge									
WestWall_reach	4705	100-yr	25851.00	493.19	512.28	502.29	512.59	0.000105	4.48	5864.00	440.82	0.20
WestWall_reach	4704.674	100-yr	25851.00	492.72	512.17	502.79	512.56	0.000314	5.02	5155.63	371.31	0.24
WestWall_reach	2851.82	100-yr	25851.00	495.72	511.47	503.10	511.89	0.000437	5.24	4938.94	415.74	0.27
WestWall_reach	1231.058	100-yr	25851.00	496.22	510.86	502.84	511.25	0.000350	5.03	5144.26	406.45	0.25
WestWall_reach	1190.862	100-yr	25851.00	493.72	510.71	503.79	511.20	0.000500	5.65	4575.59	393.70	0.29
WestWall_reach	1058.752		Bridge									
WestWall_reach	926.721	100-yr	25851.00	493.72	510.56	503.78	511.07	0.000517	5.70	4534.18	394.23	0.30
WestWall_reach	851.7031	100-yr	25851.00	493.42	510.68	498.63	510.91	0.000150	3.86	6813.15	458.38	0.16
WestWall_reach	611.7598	100-yr	25851.00	499.12	509.59	506.47	510.73	0.002017	8.56	3024.09	394.34	0.54

Plan: Revised Genesee River WestWall_reach RS: 8735.671 Profile: 100-yr

E.G. Elev (ft)	514.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.	0.120	0.030	0.120
W.S. Elev (ft)	513.32	Reach Len. (ft)	2660.00	2549.00	1870.00
Crit W.S. (ft)	506.35	Flow Area (sq ft)	11.38	3666.49	16.11
E.G. Slope (ft/ft)	0.000723	Area (sq ft)	11.38	3666.49	16.11
Q Total (cfs)	25851.00	Flow (cfs)	3.91	25841.45	5.65
Top Width (ft)	324.11	Top Width (ft)	10.67	298.69	14.75
Vel Total (ft/s)	7.00	Avg. Vel. (ft/s)	0.34	7.05	0.35
Max Chl Dpth (ft)	17.03	Hydr. Depth (ft)	1.07	12.28	1.09
Conv. Total (cfs)	961475.3	Conv. (cfs)	145.3	961120.0	210.0
Length Wtd. (ft)	2548.94	Wetted Per. (ft)	10.88	301.14	14.92
Min Ch El (ft)	496.29	Shear (lb/sq ft)	0.05	0.55	0.05
Alpha	1.01	Stream Power (lb/ft s)	1305.00	0.00	0.00
Frctn Loss (ft)	1.06	Cum Volume (acre-ft)	2.65	923.12	3.35
C & E Loss (ft)	0.13	Cum SA (acres)	3.07	70.78	2.62

Plan: Revised Genesee River WestWall_reach RS: 6150.903 Profile: 100-yr

E.G. Elev (ft)	512.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.120	0.030	0.120
W.S. Elev (ft)	512.58	Reach Len. (ft)	1180.00	1240.00	1300.00
Crit W.S. (ft)	503.70	Flow Area (sq ft)	5.81	5635.81	0.11
E.G. Slope (ft/ft)	0.000268	Area (sq ft)	16.45	5635.81	9.83
Q Total (cfs)	25851.00	Flow (cfs)	1.17	25849.82	0.00
Top Width (ft)	450.13	Top Width (ft)	34.99	412.00	3.14
Vel Total (ft/s)	4.58	Avg. Vel. (ft/s)	0.20	4.59	0.03
Max Chl Dpth (ft)	16.39	Hydr. Depth (ft)	1.09	13.68	1.19
Conv. Total (cfs)	1578802.0	Conv. (cfs)	71.7	1578730.0	0.2
Length Wtd. (ft)	1240.00	Wetted Per. (ft)	5.85	419.02	2.39
Min Ch El (ft)	496.19	Shear (lb/sq ft)	0.02	0.23	0.00
Alpha	1.00	Stream Power (lb/ft s)	1135.00	0.00	0.00
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	1.80	650.95	2.80
C & E Loss (ft)	0.00	Cum SA (acres)	1.68	49.99	2.24

Plan: Revised Genesee River WestWall_reach RS: 4882.973 Profile: 100-yr

E.G. Elev (ft)	512.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.120	0.025	0.120
W.S. Elev (ft)	512.31	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)	502.31	Flow Area (sq ft)	0.02	5607.19	0.02
E.G. Slope (ft/ft)	0.000175	Area (sq ft)	100.46	5607.19	106.55
Q Total (cfs)	25851.00	Flow (cfs)	0.00	25851.00	0.00
Top Width (ft)	562.34	Top Width (ft)	73.80	389.92	98.62
Vel Total (ft/s)	4.61	Avg. Vel. (ft/s)	0.01	4.61	0.01
Max Chl Dpth (ft)	19.32	Hydr. Depth (ft)	1.08	14.38	1.05
Conv. Total (cfs)	1951557.0	Conv. (cfs)	0.0	1951557.0	0.0
Length Wtd. (ft)	100.00	Wetted Per. (ft)	2.16	395.71	2.13
Min Ch El (ft)	492.99	Shear (lb/sq ft)	0.00	0.16	0.00
Alpha	1.00	Stream Power (lb/ft s)	2350.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.22	490.93	1.06
C & E Loss (ft)	0.01	Cum SA (acres)	0.21	38.57	0.72

Plan: Revised Genesee River WestWall_reach RS: 4774.966 Profile: 100-yr

E.G. Elev (ft)	512.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.000	0.015	0.000
W.S. Elev (ft)	512.31	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	502.28	Flow Area (sq ft)	0.00	5759.26	0.00
E.G. Slope (ft/ft)	0.000058	Area (sq ft)	0.00	5759.26	117.28
Q Total (cfs)	25851.00	Flow (cfs)	0.00	25851.00	0.00
Top Width (ft)	435.14	Top Width (ft)		380.08	55.06
Vel Total (ft/s)	4.49	Avg. Vel. (ft/s)	0.00	4.49	0.00
Max Chl Dpth (ft)	19.12	Hydr. Depth (ft)	1.16	15.15	1.13
Conv. Total (cfs)	3387475.0	Conv. (cfs)	0.0	3387475.0	0.0
Length Wtd. (ft)	1.00	Wetted Per. (ft)	2.31	398.07	2.29
Min Ch El (ft)	493.19	Shear (lb/sq ft)		0.05	
Alpha	1.00	Stream Power (lb/ft s)	2244.90	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	0.10	477.88	0.80
C & E Loss (ft)		Cum SA (acres)	0.12	37.69	0.54

Plan: Revised Genesee River WestWall_reach RS: 4745.265BR U Profile: 100-yr

E.G. Elev (ft)	512.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.	0.000	0.022	
W.S. Elev (ft)	512.28	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	502.42	Flow Area (sq ft)	0.38	5467.74	
E.G. Slope (ft/ft)	0.000156	Area (sq ft)	0.38	5467.74	
Q Total (cfs)	25851.00	Flow (cfs)	1.56	25849.44	
Top Width (ft)	360.10	Top Width (ft)	0.05	360.05	
Vel Total (ft/s)	4.73	Avg. Vel. (ft/s)	4.14	4.73	
Max Chl Dpth (ft)	19.09	Hydr. Depth (ft)	7.57	15.19	
Conv. Total (cfs)	2072354.0	Conv. (cfs)	125.4	2072228.0	
Length Wtd. (ft)	50.00	Wetted Per. (ft)	0.06	417.86	
Min Ch El (ft)	493.19	Shear (lb/sq ft)	0.06	0.13	
Alpha	1.00	Stream Power (lb/ft s)	2244.90	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	0.10	477.75	0.80
C & E Loss (ft)		Cum SA (acres)	0.12	37.68	0.54

Plan: Revised Genesee River WestWall_reach RS: 4745.265BR D Profile: 100-yr

E.G. Elev (ft)	512.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.	0.000	0.022	
W.S. Elev (ft)	512.28	Reach Len. (ft)	7.00	7.00	7.00
Crit W.S. (ft)	502.42	Flow Area (sq ft)	0.38	5467.74	
E.G. Slope (ft/ft)	0.000156	Area (sq ft)	0.38	5467.74	
Q Total (cfs)	25851.00	Flow (cfs)	1.32	25849.69	
Top Width (ft)	360.10	Top Width (ft)	0.05	360.05	
Vel Total (ft/s)	4.73	Avg. Vel. (ft/s)	3.48	4.73	
Max Chl Dpth (ft)	19.09	Hydr. Depth (ft)	7.56	15.19	
Conv. Total (cfs)	2072335.0	Conv. (cfs)	105.4	2072230.0	
Length Wtd. (ft)	7.00	Wetted Per. (ft)	0.08	417.86	
Min Ch El (ft)	493.19	Shear (lb/sq ft)	0.05	0.13	
Alpha	1.00	Stream Power (lb/ft s)	2244.90	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)	0.10	471.48	0.80
C & E Loss (ft)		Cum SA (acres)	0.12	37.27	0.54

Plan: Revised Genesee River WestWall_reach RS: 4705 Profile: 100-yr

E.G. Elev (ft)	512.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.015	0.021	0.120
W.S. Elev (ft)	512.28	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	502.29	Flow Area (sq ft)	0.13	5766.84	97.03
E.G. Slope (ft/ft)	0.000105	Area (sq ft)	0.13	5766.84	140.99
Q Total (cfs)	25851.00	Flow (cfs)	0.01	25828.12	22.87
Top Width (ft)	440.82	Top Width (ft)	0.03	382.05	58.74
Vel Total (ft/s)	4.41	Avg. Vel. (ft/s)	0.07	4.48	0.24
Max Chl Dpth (ft)	19.09	Hydr. Depth (ft)	3.79	15.09	2.66
Conv. Total (cfs)	2517048.0	Conv. (cfs)	0.8	2514820.0	2226.7
Length Wtd. (ft)	50.00	Wetted Per. (ft)	7.59	388.09	38.46
Min Ch El (ft)	493.19	Shear (lb/sq ft)	0.00	0.10	0.02
Alpha	1.03	Stream Power (lb/ft s)	2244.90	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.10	470.57	0.79
C & E Loss (ft)	0.02	Cum SA (acres)	0.12	37.21	0.54

Plan: Revised Genesee River WestWall_reach RS: 4704.674 Profile: 100-yr

E.G. Elev (ft)	512.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.060	0.030	0.060
W.S. Elev (ft)	512.17	Reach Len. (ft)	1705.00	1800.00	1898.00
Crit W.S. (ft)	502.79	Flow Area (sq ft)	1.14	5152.81	1.69
E.G. Slope (ft/ft)	0.000314	Area (sq ft)	1.14	5152.81	1.69
Q Total (cfs)	25851.00	Flow (cfs)	0.32	25850.13	0.56
Top Width (ft)	371.31	Top Width (ft)	1.20	368.42	1.70
Vel Total (ft/s)	5.01	Avg. Vel. (ft/s)	0.28	5.02	0.33
Max Chl Dpth (ft)	19.45	Hydr. Depth (ft)	0.95	13.99	1.00
Conv. Total (cfs)	1459519.0	Conv. (cfs)	17.8	1459470.0	31.3
Length Wtd. (ft)	1800.00	Wetted Per. (ft)	2.24	376.81	2.62
Min Ch El (ft)	492.72	Shear (lb/sq ft)	0.01	0.27	0.01
Alpha	1.00	Stream Power (lb/ft s)	3284.72	1229.90	1608.90
Frctn Loss (ft)	0.66	Cum Volume (acre-ft)	0.10	464.31	0.71
C & E Loss (ft)	0.00	Cum SA (acres)	0.12	36.78	0.50

Plan: Revised Genesee River WestWall_reach RS: 2851.82 Profile: 100-yr

E.G. Elev (ft)	511.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.	0.060	0.030	0.060
W.S. Elev (ft)	511.47	Reach Len. (ft)	1537.17	1620.76	1704.35
Crit W.S. (ft)	503.10	Flow Area (sq ft)	1.35	4935.08	2.51
E.G. Slope (ft/ft)	0.000437	Area (sq ft)	1.35	4935.08	2.51
Q Total (cfs)	25851.00	Flow (cfs)	0.47	25849.42	1.11
Top Width (ft)	415.74	Top Width (ft)	1.31	412.00	2.43
Vel Total (ft/s)	5.23	Avg. Vel. (ft/s)	0.35	5.24	0.44
Max Chl Dpth (ft)	15.75	Hydr. Depth (ft)	1.03	11.98	1.03
Conv. Total (cfs)	1237307.0	Conv. (cfs)	22.6	1237231.0	53.0
Length Wtd. (ft)	1620.76	Wetted Per. (ft)	2.45	433.38	3.19
Min Ch El (ft)	495.72	Shear (lb/sq ft)	0.02	0.31	0.02
Alpha	1.00	Stream Power (lb/ft s)	3177.46	1100.16	1524.84
Frctn Loss (ft)	0.63	Cum Volume (acre-ft)	0.05	255.88	0.62
C & E Loss (ft)	0.01	Cum SA (acres)	0.07	20.65	0.41

Plan: Revised Genesee River WestWall_reach RS: 1231.058 Profile: 100-yr

E.G. Elev (ft)	511.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.060	0.030	0.060
W.S. Elev (ft)	510.86	Reach Len. (ft)	43.58	40.20	48.19
Crit W.S. (ft)	502.84	Flow Area (sq ft)	0.20	5141.20	2.87
E.G. Slope (ft/ft)	0.000350	Area (sq ft)	0.20	5141.20	2.87
Q Total (cfs)	25851.00	Flow (cfs)	0.02	25850.30	0.68
Top Width (ft)	406.45	Top Width (ft)	0.20	399.33	6.91
Vel Total (ft/s)	5.03	Avg. Vel. (ft/s)	0.10	5.03	0.24
Max Chl Dpth (ft)	14.64	Hydr. Depth (ft)	0.98	12.87	0.42
Conv. Total (cfs)	1381758.0	Conv. (cfs)	1.1	1381720.0	36.6
Length Wtd. (ft)	40.20	Wetted Per. (ft)	1.98	406.76	7.77
Min Ch El (ft)	496.22	Shear (lb/sq ft)	0.00	0.28	0.01
Alpha	1.00	Stream Power (lb/ft s)	2408.35	963.45	1439.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	0.03	68.42	0.51
C & E Loss (ft)	0.03	Cum SA (acres)	0.04	5.56	0.23

Plan: Revised Genesee River WestWall_reach RS: 1190.862 Profile: 100-yr

E.G. Elev (ft)	511.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.	0.060	0.030	0.060
W.S. Elev (ft)	510.71	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	503.79	Flow Area (sq ft)	0.73	4573.67	1.19
E.G. Slope (ft/ft)	0.000500	Area (sq ft)	0.73	4573.67	1.19
Q Total (cfs)	25851.00	Flow (cfs)	0.21	25850.36	0.43
Top Width (ft)	393.70	Top Width (ft)	0.79	391.64	1.28
Vel Total (ft/s)	5.65	Avg. Vel. (ft/s)	0.28	5.65	0.36
Max Chl Dpth (ft)	16.99	Hydr. Depth (ft)	0.93	11.68	0.93
Conv. Total (cfs)	1155731.0	Conv. (cfs)	9.3	1155703.0	19.3
Length Wtd. (ft)	50.00	Wetted Per. (ft)	2.03	396.92	2.26
Min Ch El (ft)	493.72	Shear (lb/sq ft)	0.01	0.36	0.02
Alpha	1.00	Stream Power (lb/ft s)	2388.36	979.19	1380.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	0.03	63.94	0.51
C & E Loss (ft)	0.00	Cum SA (acres)	0.04	5.20	0.23

Plan: Revised Genesee River WestWall_reach RS: 1058.752BR U Profile: 100-yr

E.G. Elev (ft)	511.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.	0.060	0.030	
W.S. Elev (ft)	510.68	Reach Len. (ft)	114.00	114.00	114.00
Crit W.S. (ft)	503.78	Flow Area (sq ft)	0.55	4557.32	
E.G. Slope (ft/ft)	0.000508	Area (sq ft)	0.55	4557.32	
Q Total (cfs)	25851.00	Flow (cfs)	0.18	25850.82	
Top Width (ft)	392.00	Top Width (ft)	0.44	391.56	
Vel Total (ft/s)	5.67	Avg. Vel. (ft/s)	0.33	5.67	
Max Chl Dpth (ft)	16.96	Hydr. Depth (ft)	1.26	11.64	
Conv. Total (cfs)	1146636.0	Conv. (cfs)	8.0	1146628.0	
Length Wtd. (ft)	114.00	Wetted Per. (ft)	1.24	398.06	
Min Ch El (ft)	493.72	Shear (lb/sq ft)	0.01	0.36	
Alpha	1.00	Stream Power (lb/ft s)	2388.36	979.19	1380.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	0.03	58.70	0.51
C & E Loss (ft)	0.00	Cum SA (acres)	0.04	4.75	0.22

Plan: Revised Genesee River WestWall_reach RS: 1058.752BR D Profile: 100-yr

E.G. Elev (ft)	511.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.	0.060	0.030	
W.S. Elev (ft)	510.62	Reach Len. (ft)	100.14	100.14	100.14
Crit W.S. (ft)	503.77	Flow Area (sq ft)	0.02	4551.16	
E.G. Slope (ft/ft)	0.000513	Area (sq ft)	0.02	4551.16	
Q Total (cfs)	25851.00	Flow (cfs)	0.00	25851.00	
Top Width (ft)	392.00	Top Width (ft)	0.01	391.99	
Vel Total (ft/s)	5.68	Avg. Vel. (ft/s)	0.06	5.68	
Max Chl Dpth (ft)	16.90	Hydr. Depth (ft)	1.75	11.61	
Conv. Total (cfs)	1141784.0	Conv. (cfs)	0.0	1141784.0	
Length Wtd. (ft)	100.14	Wetted Per. (ft)	0.45	399.24	
Min Ch El (ft)	493.72	Shear (lb/sq ft)	0.00	0.36	
Alpha	1.00	Stream Power (lb/ft s)	2312.29	979.19	1381.39
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.02	46.78	0.51
C & E Loss (ft)	0.00	Cum SA (acres)	0.04	3.72	0.22

Plan: Revised Genesee River WestWall_reach RS: 926.721 Profile: 100-yr

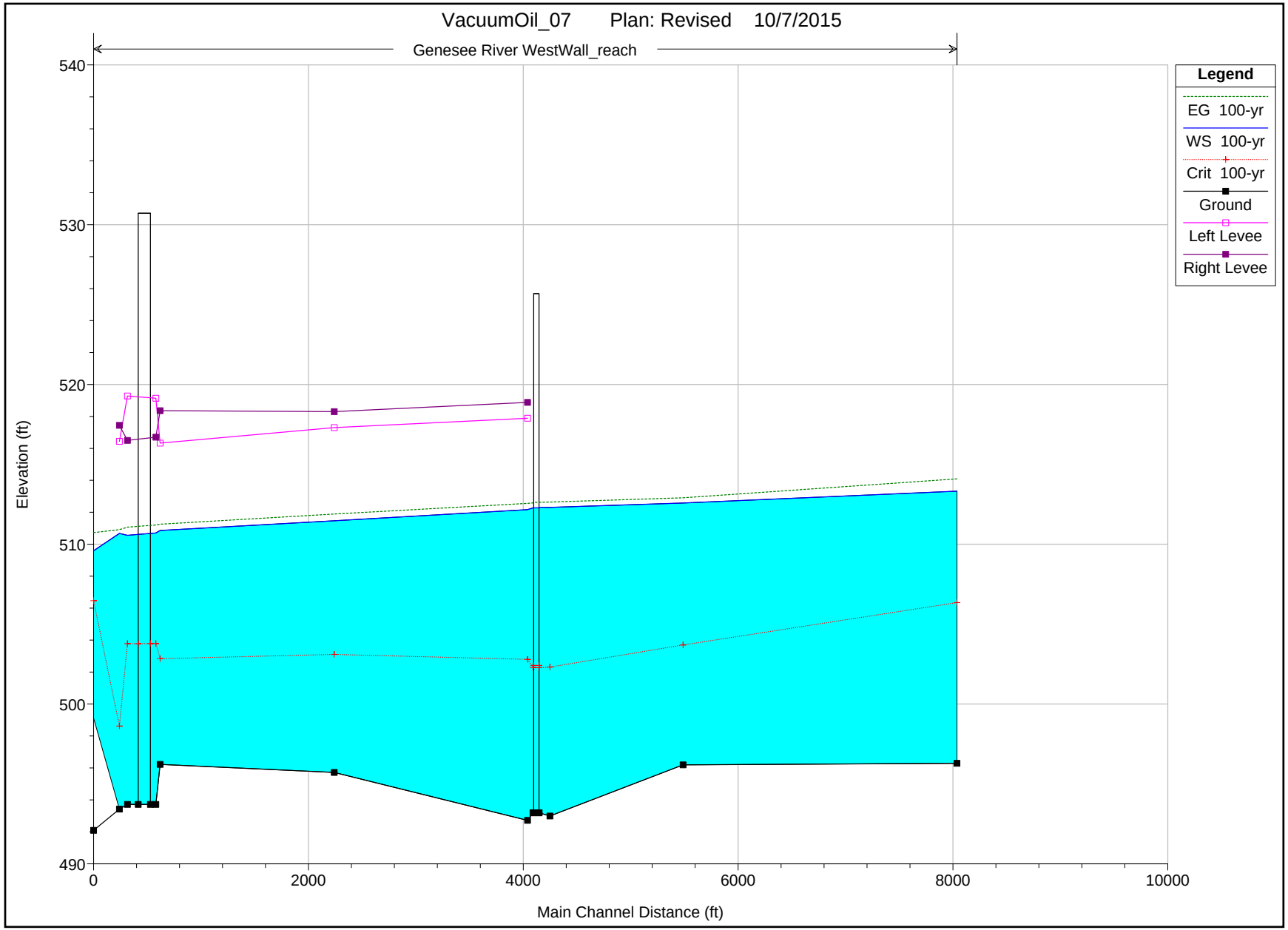
E.G. Elev (ft)	511.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.	0.060	0.030	0.060
W.S. Elev (ft)	510.56	Reach Len. (ft)	75.40	75.02	75.00
Crit W.S. (ft)	503.78	Flow Area (sq ft)	0.59	4532.12	1.47
E.G. Slope (ft/ft)	0.000517	Area (sq ft)	0.59	4532.12	1.47
Q Total (cfs)	25851.00	Flow (cfs)	0.15	25850.26	0.59
Top Width (ft)	394.23	Top Width (ft)	0.61	392.07	1.55
Vel Total (ft/s)	5.70	Avg. Vel. (ft/s)	0.25	5.70	0.40
Max Chl Dpth (ft)	16.84	Hydr. Depth (ft)	0.96	11.56	0.95
Conv. Total (cfs)	1136528.0	Conv. (cfs)	6.4	1136496.0	26.0
Length Wtd. (ft)	75.02	Wetted Per. (ft)	2.02	397.84	2.45
Min Ch El (ft)	493.72	Shear (lb/sq ft)	0.01	0.37	0.02
Alpha	1.00	Stream Power (lb/ft s)	2312.29	979.19	1381.39
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	0.02	36.34	0.51
C & E Loss (ft)	0.14	Cum SA (acres)	0.04	2.82	0.22

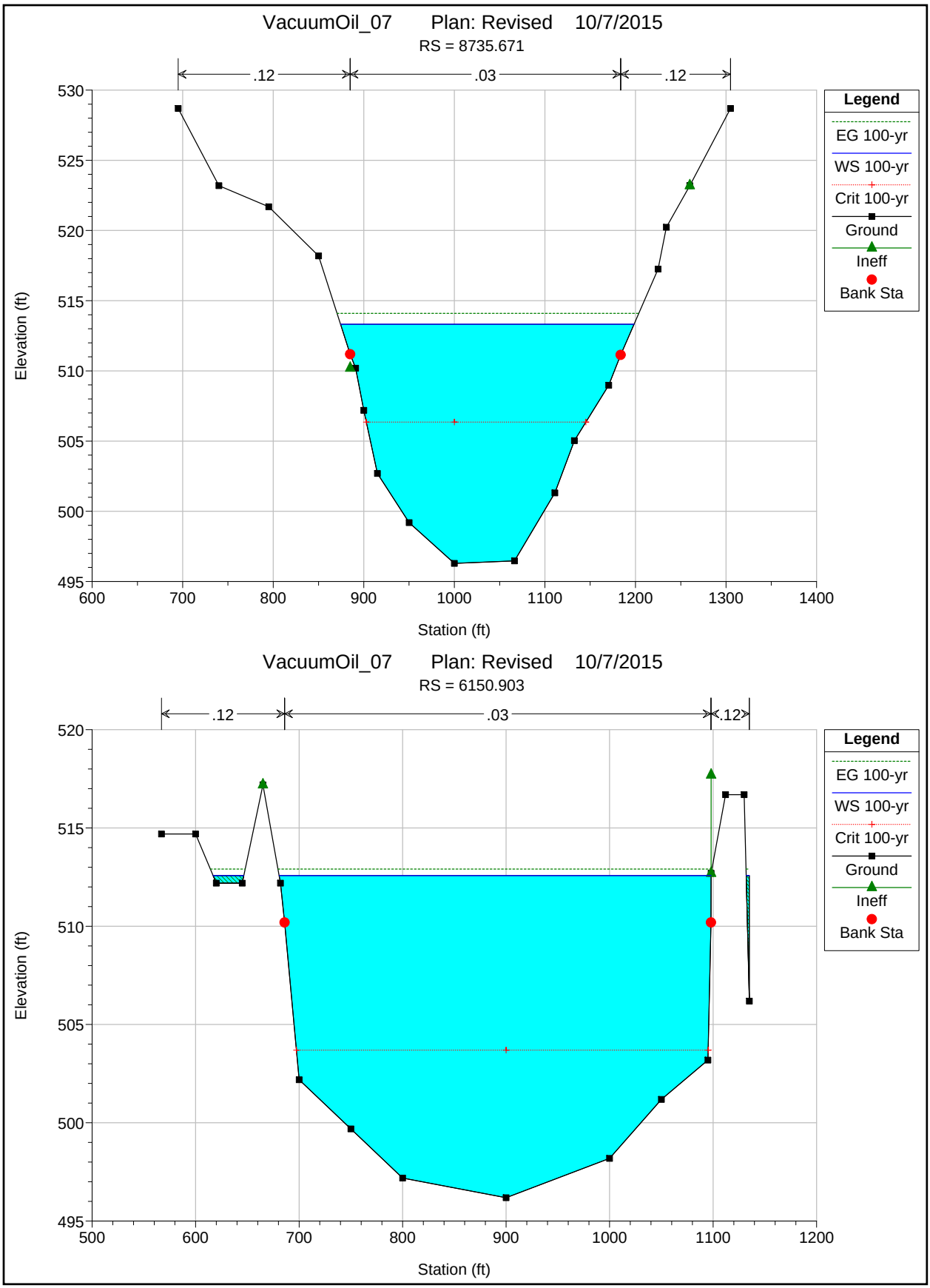
Plan: Revised Genesee River WestWall_reach RS: 851.7031 Profile: 100-yr

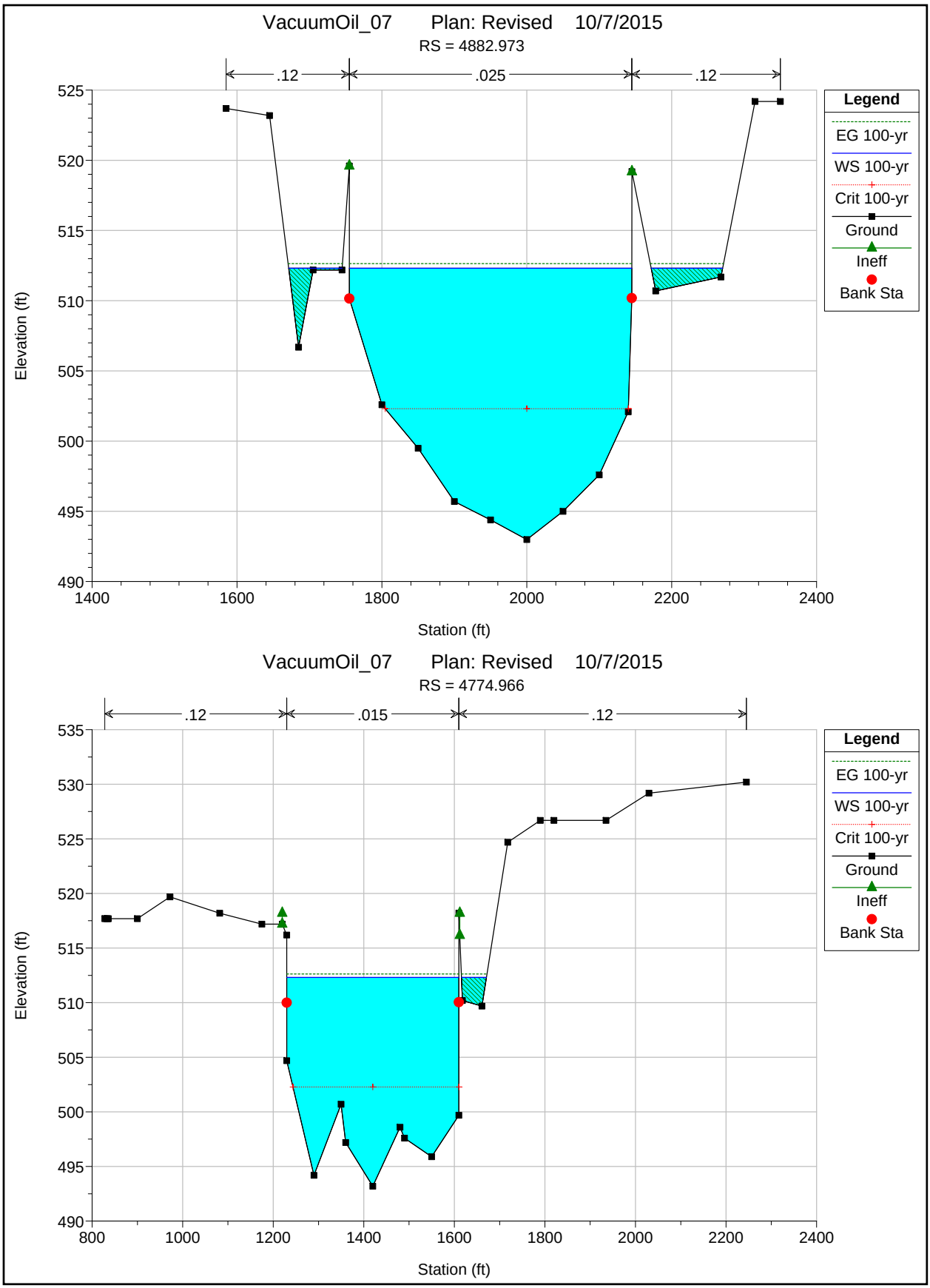
E.G. Elev (ft)	510.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.060	0.030	0.060
W.S. Elev (ft)	510.68	Reach Len. (ft)	221.78	239.94	245.31
Crit W.S. (ft)	498.63	Flow Area (sq ft)	6.92	6672.03	134.19
E.G. Slope (ft/ft)	0.000150	Area (sq ft)	6.92	6672.03	134.19
Q Total (cfs)	25851.00	Flow (cfs)	1.40	25777.64	71.96
Top Width (ft)	458.38	Top Width (ft)	12.16	389.43	56.79
Vel Total (ft/s)	3.79	Avg. Vel. (ft/s)	0.20	3.86	0.54
Max Chl Dpth (ft)	17.26	Hydr. Depth (ft)	0.57	17.13	2.36
Conv. Total (cfs)	2107798.0	Conv. (cfs)	114.1	2101817.0	5867.4
Length Wtd. (ft)	239.95	Wetted Per. (ft)	12.75	415.97	57.21
Min Ch El (ft)	493.42	Shear (lb/sq ft)	0.01	0.15	0.02
Alpha	1.03	Stream Power (lb/ft s)	2290.68	323.70	1565.55
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.02	26.69	0.39
C & E Loss (ft)	0.09	Cum SA (acres)	0.03	2.15	0.17

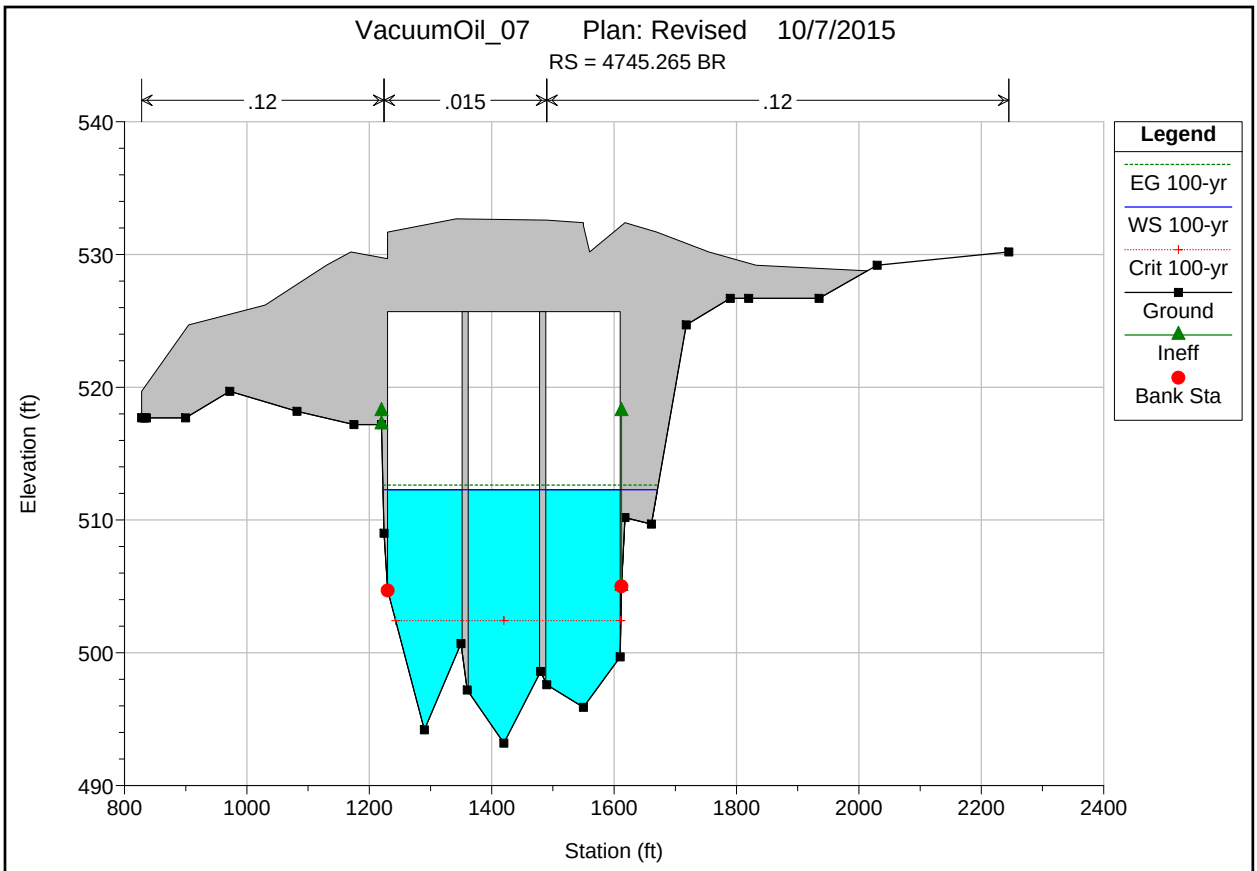
Plan: Revised Genesee River WestWall_reach RS: 611.7598 Profile: 100-yr

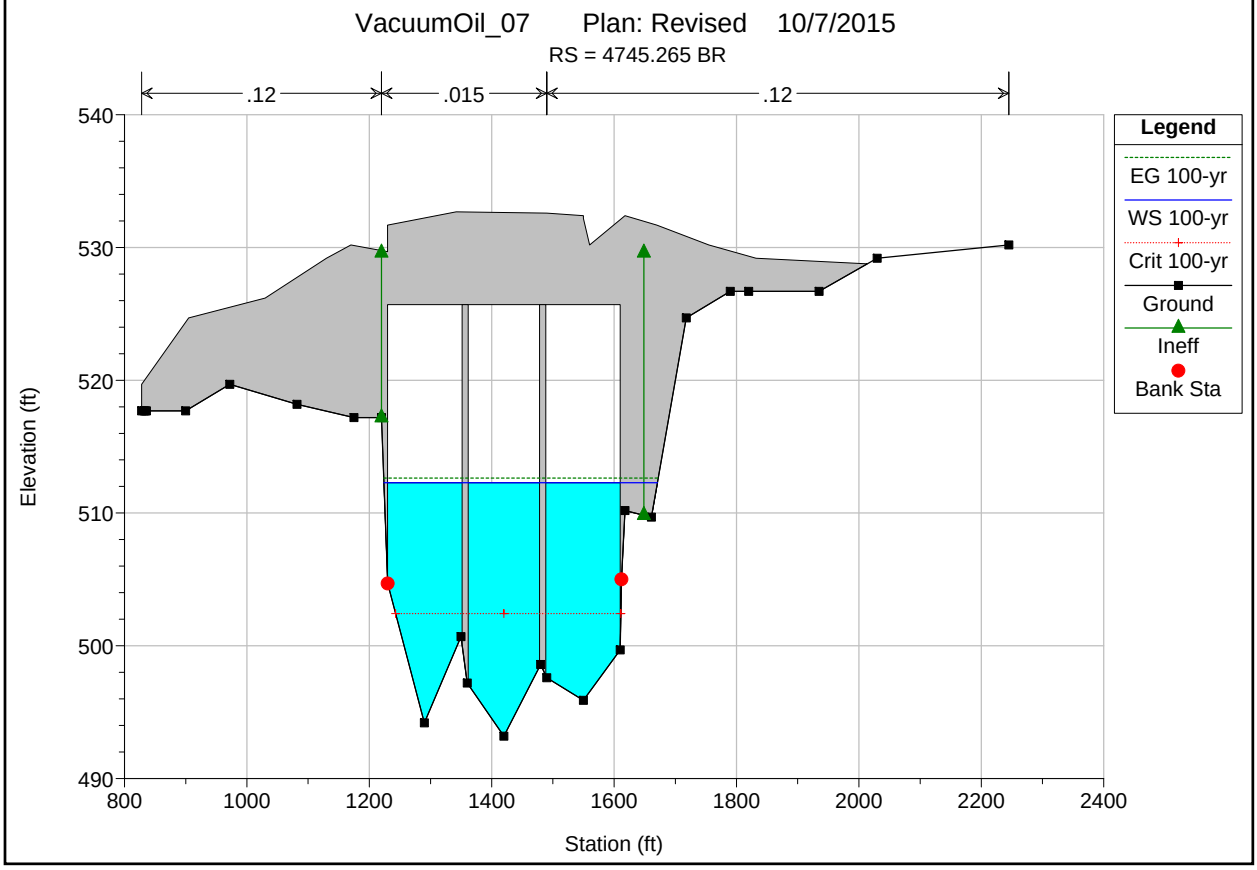
E.G. Elev (ft)	510.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.14	Wt. n-Val.		0.030	0.060
W.S. Elev (ft)	509.59	Reach Len. (ft)			
Crit W.S. (ft)	506.47	Flow Area (sq ft)		3019.88	4.21
E.G. Slope (ft/ft)	0.002017	Area (sq ft)		3019.88	4.21
Q Total (cfs)	25851.00	Flow (cfs)		25846.78	4.22
Top Width (ft)	394.34	Top Width (ft)		389.81	4.53
Vel Total (ft/s)	8.55	Avg. Vel. (ft/s)		8.56	1.00
Max Chl Dpth (ft)	10.47	Hydr. Depth (ft)		7.75	0.93
Conv. Total (cfs)	575555.3	Conv. (cfs)		575461.2	94.0
Length Wtd. (ft)		Wetted Per. (ft)		400.19	4.90
Min Ch El (ft)	499.12	Shear (lb/sq ft)		0.95	0.11
Alpha	1.00	Stream Power (lb/ft s)	2275.55	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

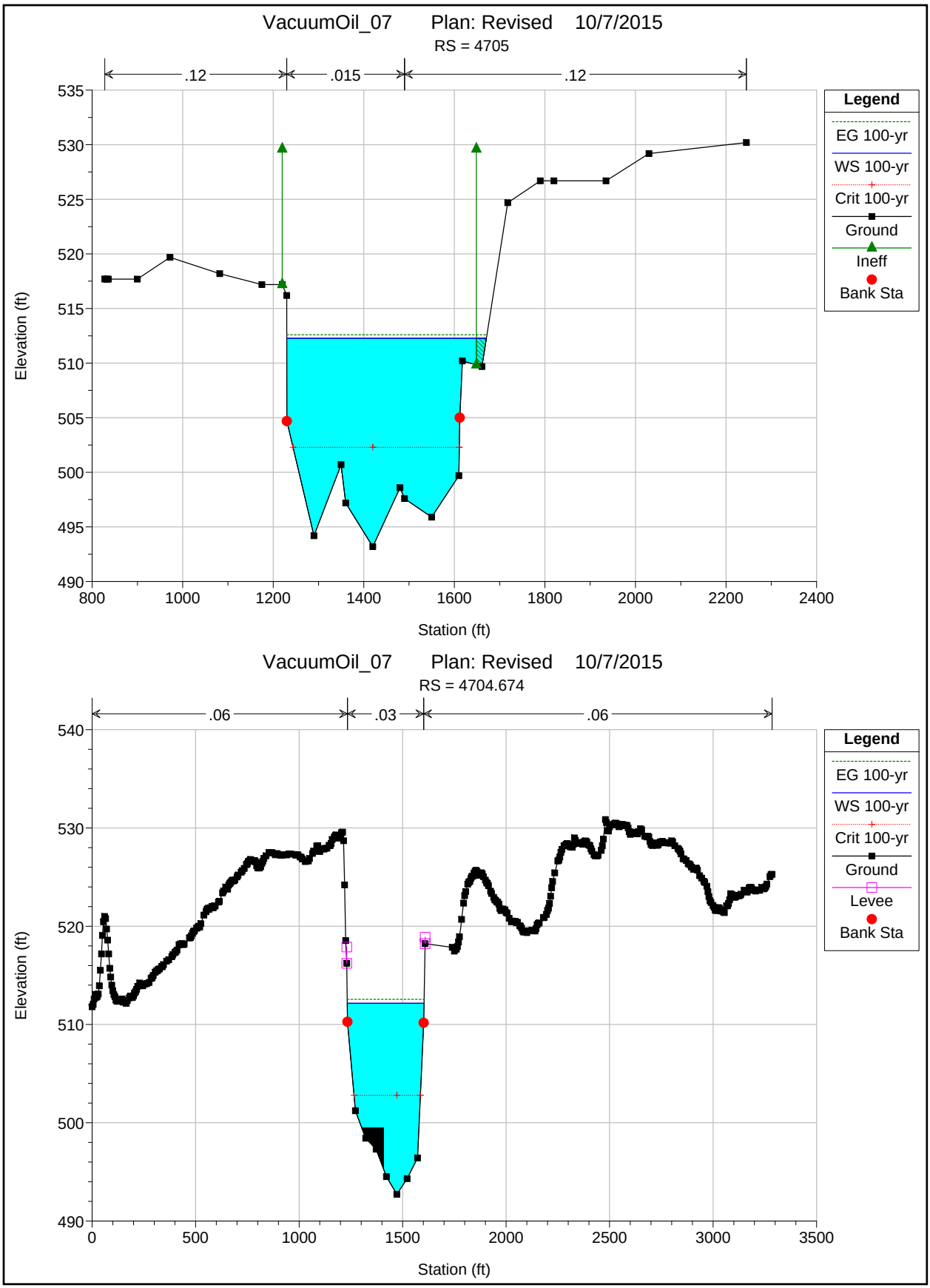

VacuumOil_07 Plan: Revised 10/7/2015
Genesee River WestWall_reach
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Left Levee
Right Levee
Elevation (ft)
Main Channel Distance (ft)
540
530
520
510
500
490
0
2000
4000
6000
8000
10000

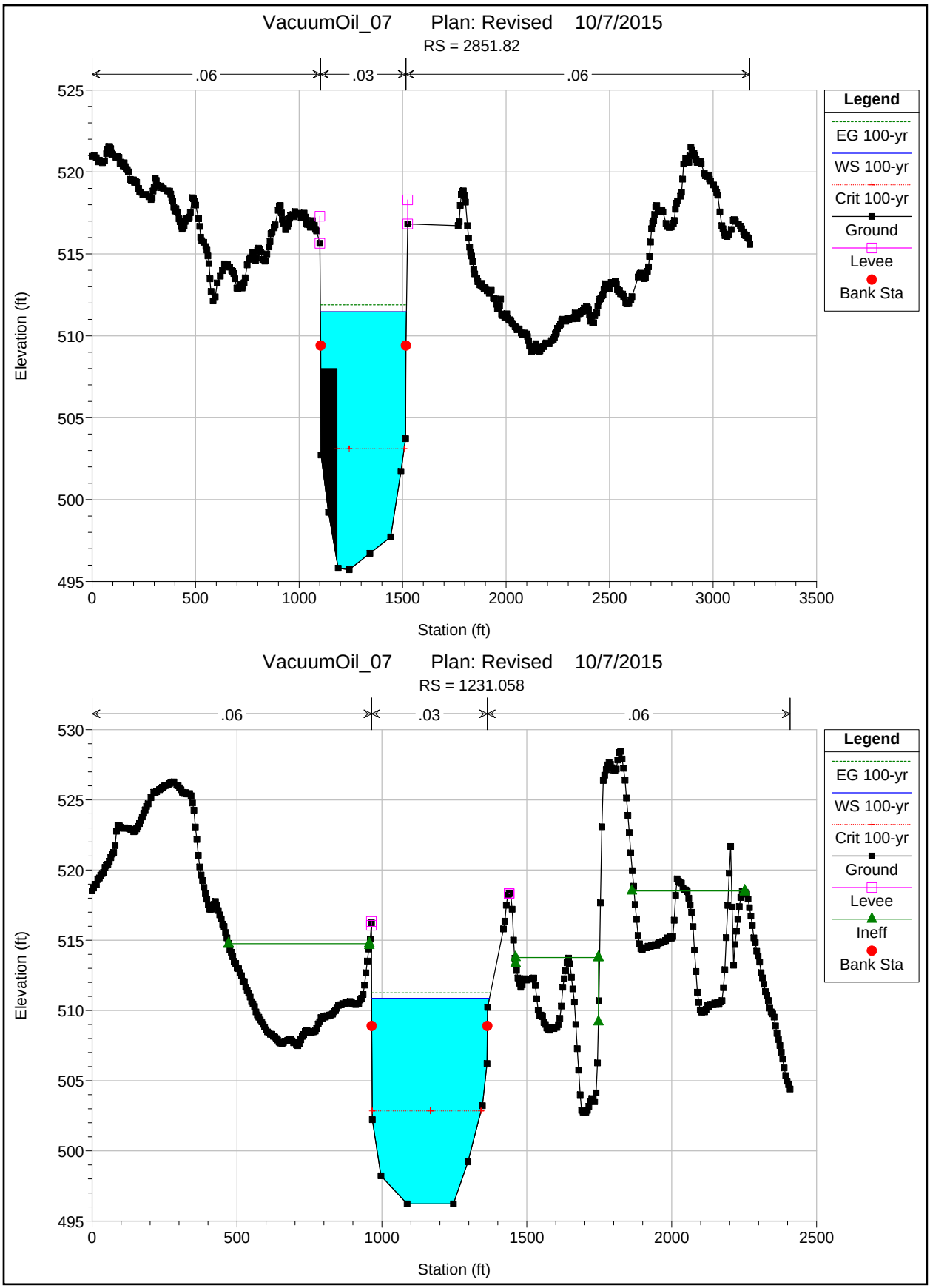

VacuumOil_07 Plan: Revised 10/7/2015
RS = 8735.671
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
VacuumOil_07 Plan: Revised 10/7/2015
RS = 6150.903
.12
.03
.12
Elevation (ft)
Station (ft)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta

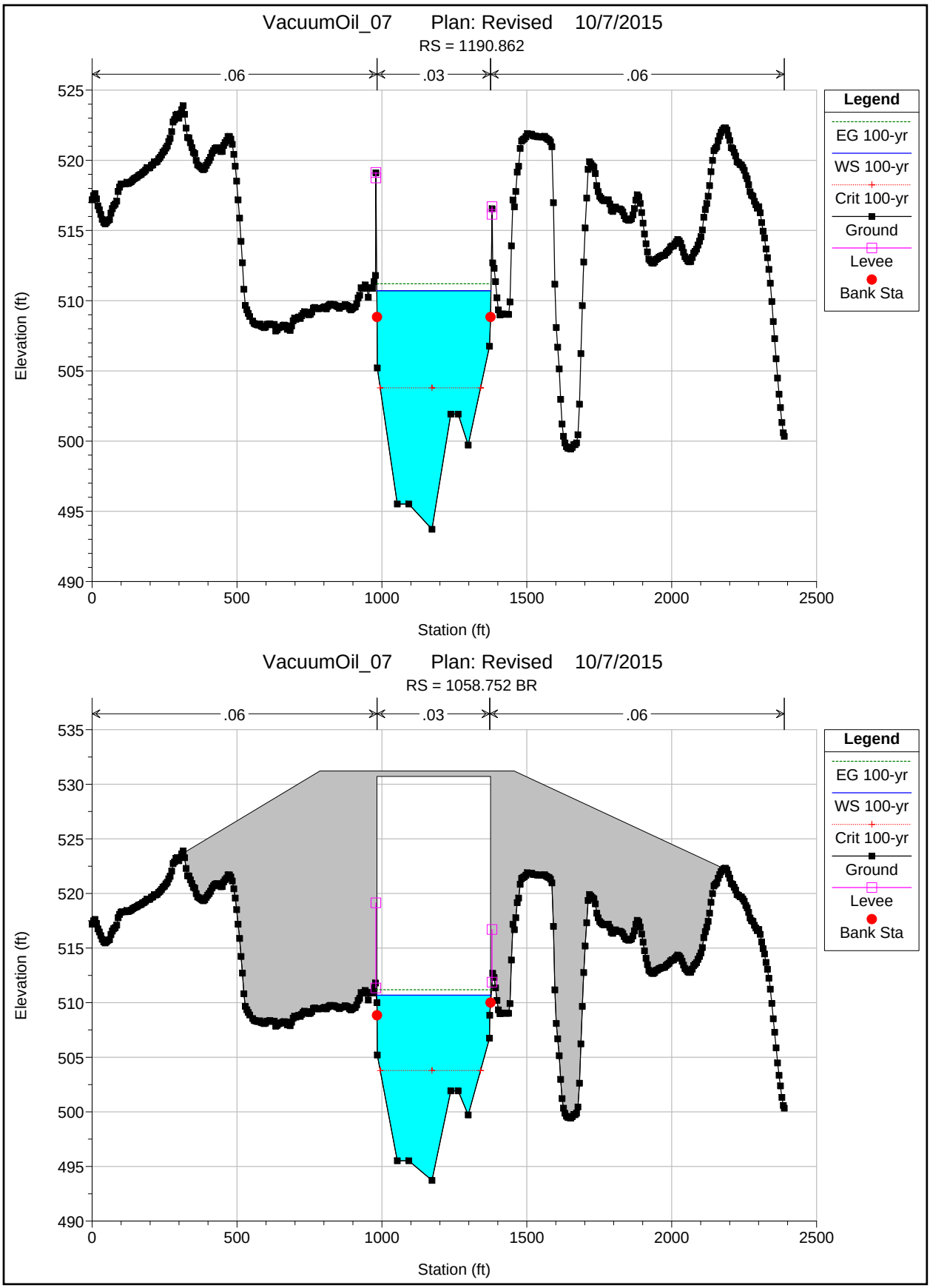

VacuumOil_07 Plan: Revised 10/7/2015
RS = 4882.973
.12
.025
.12
Elevation (ft)
525
520
515
510
505
500
495
490
1400
1600
1800
2000
2200
2400
Station (ft)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
VacuumOil_07 Plan: Revised 10/7/2015
RS = 4774.966
.12
.015
.12
Elevation (ft)
535
530
525
520
515
510
505
500
495
490
800
1000
1200
1400
1600
1800
2000
2200
2400
Station (ft)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta

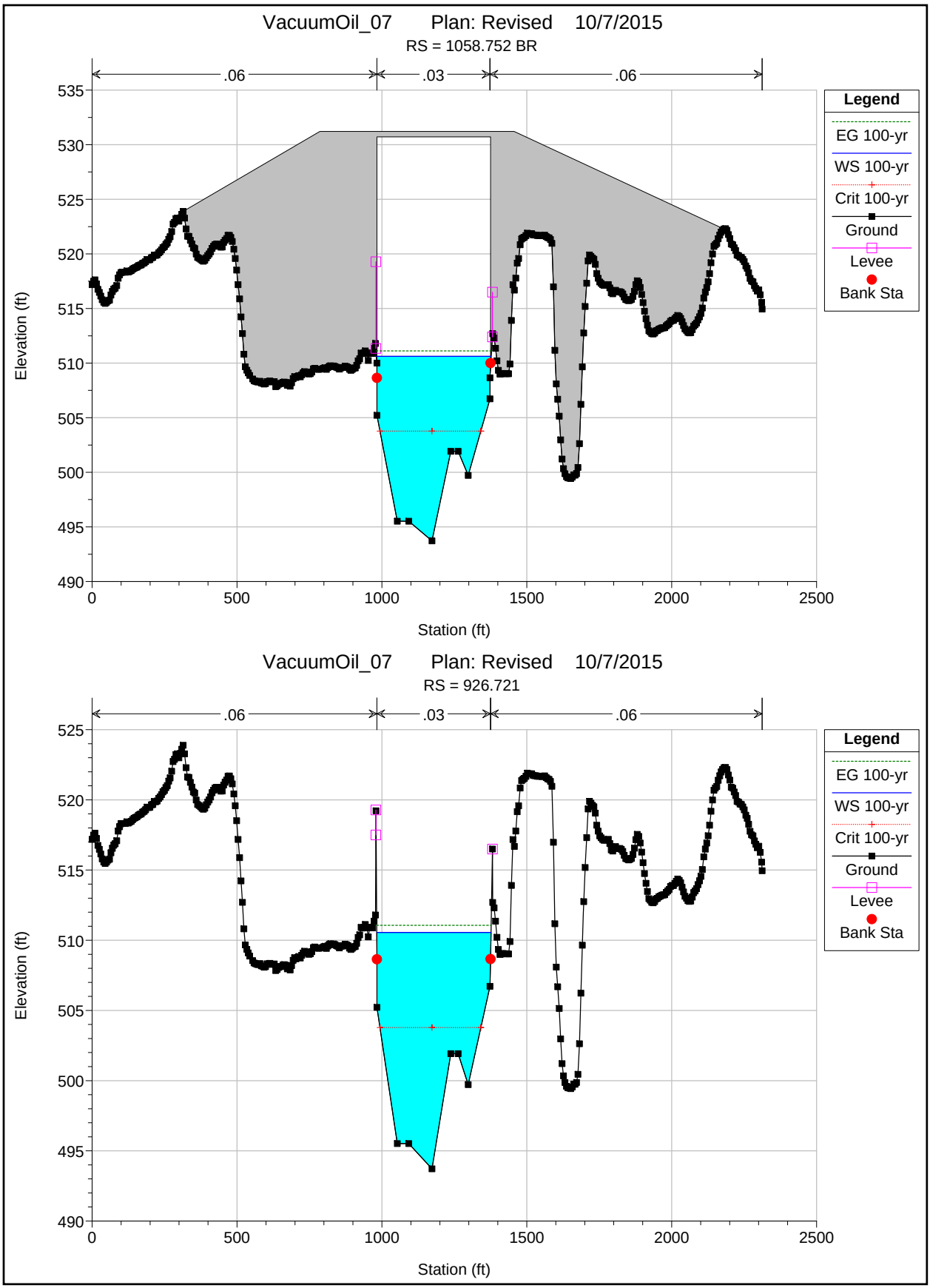

VacuumOil_07 Plan: Revised 10/7/2015
RS = 4745.265 BR
.12
.015
.12
Elevation (ft)
Station (ft)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta

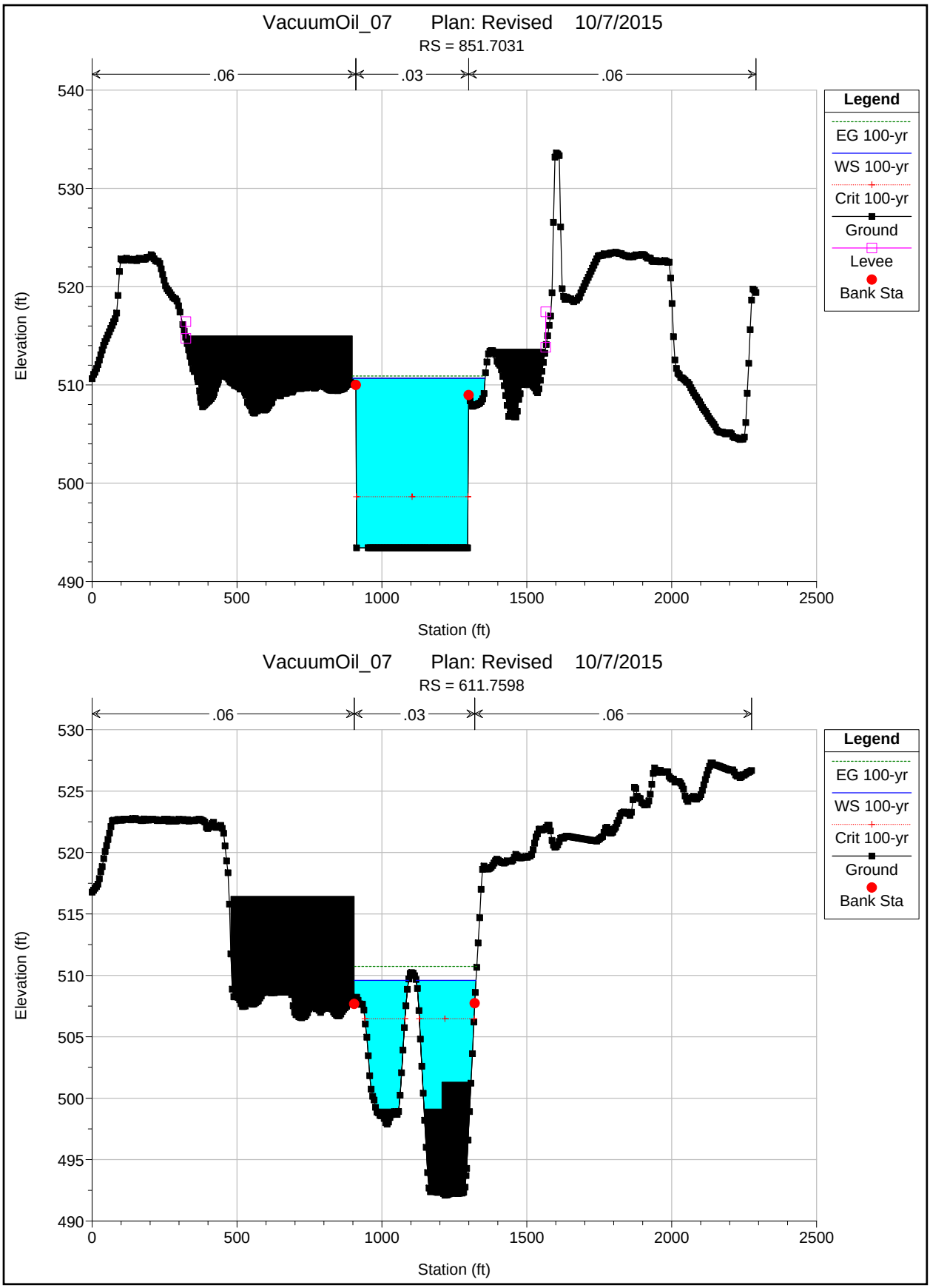

VacuumOil_07 Plan: Revised 10/7/2015
RS = 4745.265 BR
.12
.015
.12
Elevation (ft)
Station (ft)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta


VacuumOil_07 Plan: Revised 10/7/2015
RS = 4705
.12
.015
.12
Elevation (ft)
Station (ft)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
VacuumOil_07 Plan: Revised 10/7/2015
RS = 4704.674
.06
.03
.06
Elevation (ft)
Station (ft)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Levee
Bank Sta


VacuumOil_07 Plan: Revised 10/7/2015
RS = 2851.82
.06
.03
.06
Elevation (ft)
Station (ft)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Levee
Bank Sta
VacuumOil_07 Plan: Revised 10/7/2015
RS = 1231.058
.06
.03
.06
Elevation (ft)
Station (ft)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Levee
Ineff
Bank Sta


VacuumOil_07 Plan: Revised 10/7/2015
RS = 1190.862
.06
.03
.06
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
VacuumOil_07 Plan: Revised 10/7/2015
RS = 1058.752 BR
.06
.03
.06
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


VacuumOil_07 Plan: Revised 10/7/2015
RS = 1058.752 BR
.06
.03
.06
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
535
530
525
520
515
510
505
500
495
490
0
500
1000
1500
2000
2500
VacuumOil_07 Plan: Revised 10/7/2015
RS = 926.721
.06
.03
.06
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
525
520
515
510
505
500
495
490
0
500
1000
1500
2000
2500


VacuumOil_07 Plan: Revised 10/7/2015
RS = 851.7031
.06
.03
.06
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
VacuumOil_07 Plan: Revised 10/7/2015
RS = 611.7598
.06
.03
.06
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)