



US Army Corps
of Engineers®

Prepared by:

Pittsburgh District Great Lakes and Ohio River Division

Olean, NY - Left Bank Olean Creek Quantitative Risk Assessment

Review Plan – QRA

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Section 1

Purpose and Requirements

1.1 Purpose

This Review Plan for the Olean, NY - Left Bank Olean Creek (NLD ID# 4905000008) local flood protection project Quantitative Risk Assessment (QRA) will ensure a quality-engineering product is developed by the Corps of Engineers in accordance with EC 1165-2-217, "Review Policy for Civil Works". The Review Plan (RP) shall layout a value-added process and describe the scope of review for the QRA.

1.2 References

- ER 5-1-11, USACE Business Process
- ER 500-1-1/EP 500-1-1
- EC 1165-2-217, Review Policy for Civil Works, 20 February 2018
- ER 1110-1-12, Quality Management, 31 Mar 2011
- ER 1110-2-1156, Safety of Dams – Policy and Procedure, 31 Mar 2014
- Olean, NY - Left Bank Olean Creek Right Bank Kings; HQ LSO Approved 10 May 2016 Screening Level Risk Assessment

1.3 Requirements

This RP was developed in accordance with EC 1165-2-217, which establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products. This RP will be provided to the Project Delivery Team (PDT), the District Review Team, Hydrologic Hazards and Loading Curve Reviewer, and Agency Technical Review (ATR) Team.

1.4 Review Management Organization

The USACE Risk Management Center (RMC) is the Review Management Organization (RMO) for this project. The Pittsburgh District (LRP) is the home district and Great Lakes and Ohio River Division (LRD) is the home Major Subordinate Command (MSC). This RP has been coordinated with the RMC and the MSC. Coordination with the LRD will occur throughout the risk assessment, including briefings to LRD Levee Safety and Program Review Board (PRB) updates. In-Progress Review (IPR) team meetings with the RMC, LRD, and Headquarters USACE (HQUSACE) will be scheduled to discuss programmatic, policy, and technical matters. The LRD Levee Safety Program Manager (LSPM) will be the point-of-contact for LRD vertical team coordination. This Review Plan will be updated for additional project phases.

Section 2

Project Background and Information

2.1 Project Background

This system consists of approximately 15,605 feet of new or improved earthen levee along the left bank of Olean Creek and the right bank of Allegheny River upstream of Olean Creek; it also includes approximately 1,655 feet of floodwall along the left bank of Olean Creek upstream of the State Street Bridge and along the right bank of Allegheny River upstream of Kings Brook. Several figures from the as-built drawings are provided below for reference.

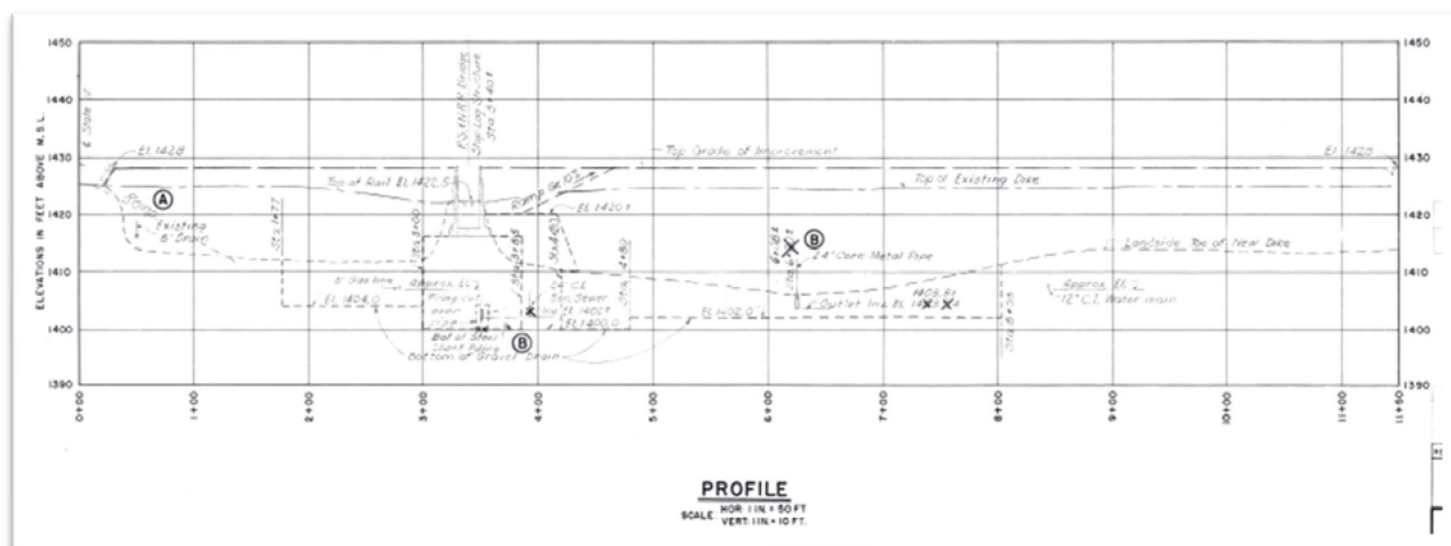


Figure 1: Longitudinal Profile along Olean Creek starting at STA 0+00 (E. State Street)

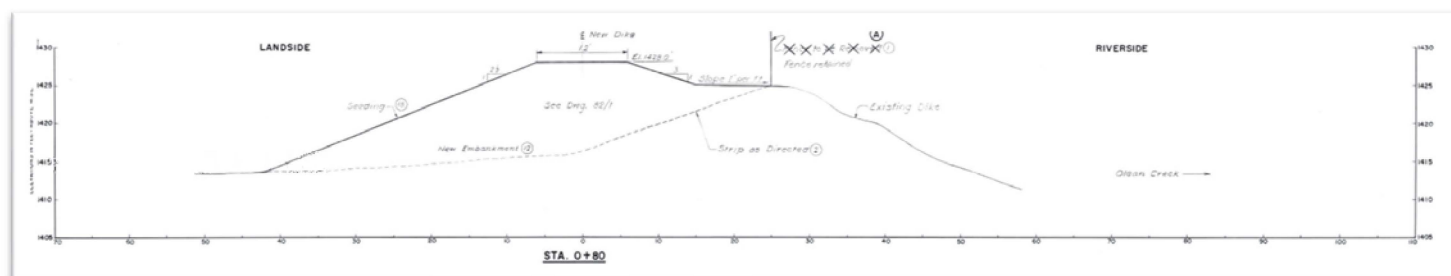


Figure 2: Cross section view at STA 0+80

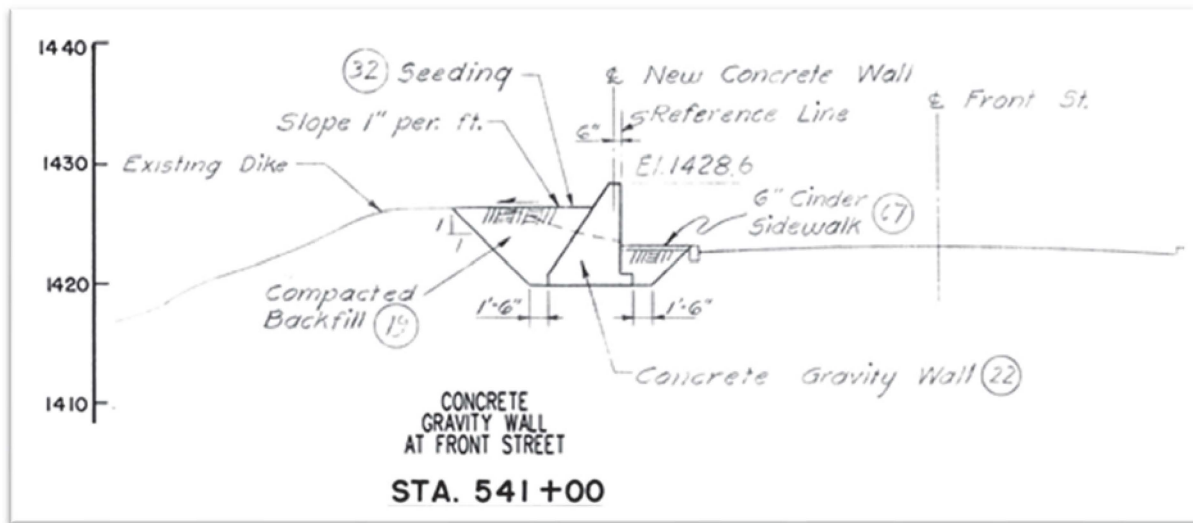


Figure 3: Typical gravity floodwall

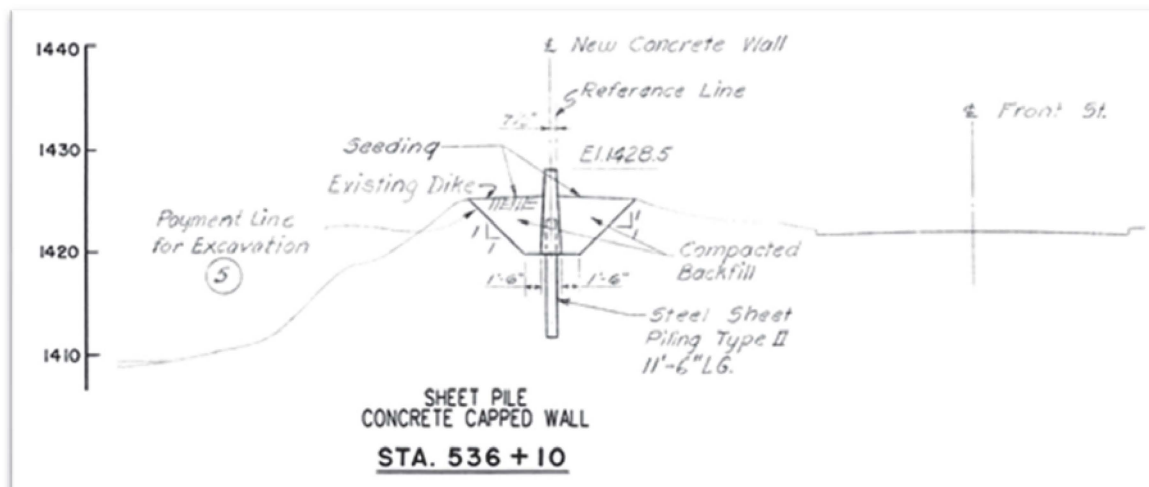


Figure 4: Typical I-wall along Olean Creek (left bank)



Figure 5: Overview of leveed area as shown on the National Levee Database

2.2 Project Sponsor

The New York State Environmental Conservation is the local sponsor for the project and will assist the PDT as a non-federal sponsor. Products and analyses provided by non-Federal sponsors as in-kind services are subject to District Review, ATR, and policy and legal compliance reviews. Sponsor Peer Review of In-Kind Contributions will be allowed as there will be in-kind contributions for this effort. In-Kind contributions will include providing of pertinent background and performance data related to the project, participation in the risk assessment sessions and review of draft report.

Section 3

District Quality Control

3.1 Requirements

All work products (including supporting data, analyses, reports, etc.) shall undergo District Review in accordance with EC 1165-2- 217. District Review is an internal review process of basic science and engineering work products focused on fulfilling the project quality requirements. All work products undergo District Review. Basic quality control tools include quality checks and reviews, supervisory reviews, and Project Delivery Team (PDT) review, etc. LRP will manage and document the District Review. As a part of District Review, the RMC Senior Advisor will review the QRA report prior to submission for ATR to ensure completeness.

Quality Checks and reviews occur during the development process and are carried out as a routine management practice. Quality checks may be performed by staff responsible for the work, such as supervisors, work leaders, team leaders, designated individuals from the senior staff, or other qualified personnel. However, they will not be performed by the same people who performed the original work, including managing/reviewing the work in the case of contracted efforts.

PDT reviews are performed by members of the PDT, which includes the risk cadre, to ensure consistency and effective coordination across all project disciplines. Additionally, the PDT and RMC-assigned advisors are responsible for a complete reading of any reports and accompanying appendices prepared by or for the PDT to assure the overall coherence and integrity of the report, technical appendices, and the recommendations.

All District Review comments and responses will be documented in accordance with the District Quality Management Plan. Microsoft Word (using track changes) or Adobe Acrobat may be used to provide typographical comments and edits. The District Review comments and responses will be part of the District Review documentation and provided to the ATR team to assess appropriateness and effectiveness of the District Review activities. Documentation and certification of District Review will be completed by the district lead in accordance with EC 1165-2-217. The District Review Lead will ensure that any significant issues and risk informed decisions will be communicated to the ATR Lead and documented in the report and certification of District Review.

Allowing for concurrent DQC and ATR review start times will increase review efficiencies. To ensure clarity between the DQC and ATR teams, the PDT will ensure the DQC Comments/Responses (and certification) is provided to the ATR team for consideration prior to the completion of the ATR process. The purpose of this cross-team coordination will be to mitigate risks associated with the potential of comments and/or technical details being missed during the respective concurrent team reviews.

See Attachment 1, Table 6 for the District Review Lead, reviewers, and reviewer's disciplines.

3.2 Documentation

Documentation of District Review activities is required and will be implemented by the process described in paragraph 3.1.

3.3 District Review Schedule and Estimated Cost

The District Review will have the same start date as the ATR and end 2 weeks prior to the ATR end date as listed below in Table 1. The cost for District Review will be approximately \$50,000.

Table 1 District Review Schedule

Project Phase/Submittal	Review Start Date	Review End Date
District Review	12-July-2021	20-August-2021

Section 4

Agency Technical Review

4.1 Requirements

All Civil Works products (including supporting data, analyses, environmental compliance documents, water control manuals, etc.) shall undergo ATR in accordance with EC 1165-2-217. ATR reviews will occur seamlessly, including early involvement of the ATR team for key decisions, and at the scheduled milestones as shown in Table 2 ATR schedule. The ATR will be scaled to the appropriate level of technical effort required to evaluate the project findings and recommendations based on the complexity of the project and the level of risk assessment that was conducted. A site visit will not be scheduled for the ATR Team.

4.1.1 ATR Requirements for Hydrologic Hazards, Loading Curves, and Levee Breach Modeling

The Hydrologic Hazards Assessment and Loading Curve will undergo an Agency Technical Review by an RMC Hydrology and Hydraulic (H&H) Advisor or designated Alternate prior to the Risk Assessment Elicitation, or as directed by the Levee Safety Center (LSC).

For this project, review of the Hydrologic Hazards and Loading Curves will be separated from the review of the levee breach modeling and will be performed by two separate reviewers. The reviewers will provide advance review of these work products to avoid unnecessary delays to the completion of the risk analysis and QRA report. Ideally, these reviewers will serve as the H&H ATR team members for the QRA Report. The reviewers are shown in **Attachment 1**. If the assigned Hydrologic Hazards reviewer differs from the H&H ATR reviewer, all names will be provided.

The reviewer will provide advance review of this work product to avoid unnecessary delays to the completion of the risk analysis and IES report. Ideally, this reviewer will serve as the H&H ATR team member for the QRA Report. The reviewer is shown in Attachment 1. If the assigned Hydrologic Hazards reviewer differs from the H&H ATR reviewer, both names will be provided.

4.1.2 ATR Requirements for QRA Reports

ATR for Quantitative Risk Assessment (QRA) conducted using quantitative risk methodology will consist of a review of the technical products by an independent ATR team of USACE levee safety professionals who have past experience with levee safety projects and work products. The ATR Team Lead and ATR team shall be selected by the RMO.

4.2 Documentation of ATR

4.2.1 Documentation of Hydrologic Hazards Review

Hydrologic Hazards review comments are documented in the form of a Word document or DrChecks, as specified below. After resolution of the comments, the reviewer will sign the ATR completion form, and this is to be included in the Olean Left Bank QRA review documentation. This signature will ensure all comments have been addressed during ATR and signify concurrence.

4.2.2 Documentation of Quantitative Risk Assessment ATR

Documentation of the ATR for a QRA will be performed using the requirements of EC 1165-2-217. This should include the four-part comment structure and the use of DrChecks for comment collaboration, response, and back checking. Documentation of the review findings shall be in written format and in accordance with the A-E contract or Agency Scope of Work. The Panel's responses to the charge questions will be included in the final ATR documentation of the QRA Report.

4.3 Products to Undergo ATR

- QRA report
- Supporting H&H modeling
- Consequence modeling

4.4 Required Team Expertise and Requirements

4.4.1 QRA ATR Team

ATR teams will be established in accordance with EC 1165-2-217. For consistency and efficiency, the ATR team members from the Olean, NY – Right Bank Allegheny and Olean Creek QRA will be utilized to the maximum extent available. The following disciplines will be required for ATR of the QRA:

ATR Lead: The ATR team leader will be a senior USACE levee safety professional and will have experience leading and conducting ATR for similar projects and work products. The ATR lead will direct the scope and focus of review efforts by each discipline. The ATR team leader will be from outside the home MSC and will have the necessary skills and experience to lead a virtual team through the ATR process. The ATR Lead may also serve as a reviewer for a specific discipline, in this case, Structural Engineering, Geotechnical Engineering, and Hydraulic Engineering.

Geotechnical Engineer - The geotechnical engineer will have experience in the design, construction, and evaluation of embankment levees, potential failure mode analysis, and levee safety risk analysis. The geotechnical engineer will have experience in subsurface investigations, rock and soil mechanics, internal erosion evaluation, slope stability evaluation, and earthwork construction.

Engineering Geologist - The engineering geologist will have experience in assessing the geologic setting, bedrock geology, unconsolidated deposits, and hydrogeology and correlating the performance of foundations with the significant engineering properties. The engineering geologist will have specialized experience with embankment dam founded on glacial outwash and alluvium.

Hydrology and Hydraulic (H&H) Engineer – The H&H engineer will have experience in the evaluation of annual exceedance probability of an overtopping event, development of the flood hazard/loading (i.e., stage-frequency and duration relationships), USACE hydrologic and hydraulic modeling, and breach and non-breach inundation for levee safety risk analysis. (This may be two separate reviewers and will be split if needed)

Structural Engineer – The structural engineer will have experience evaluating the design, construction, and evaluation of floodwalls (including gates/closure structures and penetrations), potential failure mode analysis, and levee safety risk analysis.

Consequences (Economist) – The economist (or consequence specialist) will have experience evaluating flood risk management projects in accordance with ER 1105-2-100 and USACE models and techniques to estimate population at risk, life loss, and economic damages for dam safety risk analysis.

4.5 Statement of Technical Review Report

4.5.1 Quantitative Risk Assessment Review Report

At the conclusion of each ATR effort, the ATR team will prepare a Statement of Technical Review Report with a completion and certification memo. The report will be prepared in accordance with EC 1165-2-217.

4.6 ATR Schedule and Estimated Cost

The preliminary ATR schedule is listed in Table 2 below and is estimated to cost approximately \$50,000. The ATR team is listed in Table 8 and will include these team members into the Dr. Checks review system for review consistency.

Table 2 ATR Schedule

Project Phase/Submittal	Review Start Date	Review End Date
ATR	12-July-2021	3-SEP-2021

Section 5 LSOG Review

5.1 Requirements

All QRA work products will undergo a review by the Levee Senior Oversight Group (LSOG). The LSOG is provided an advanced copy of the final report approximately four weeks prior to the LSOG Panel Discussion. The PDT will prepare LSOG Briefing Slides summarizing the project Risk, the report findings, and recommendations. These slides will be reviewed by the RMC Program Manager prior to presentation to LSOG for clarity and conciseness. These slides will be prebriefed to the LRD LSO and LSPM a minimum of two weeks prior to the LSOG Panel Discussion; LRD reserves the right to postpone if necessary.

5.2 Documentation

At the conclusion of the LSOG briefing, a memo will be prepared by the LSOG Chairperson that summarizes the risk characterization of the levee, confirms or adjusts the recommended LSAC, proposes Levee Safety and Operations and Maintenance (O&M) actions to reduce risk and is signed by the Headquarters Levee Safety Officer.

Section 6

Public Posting of Review Plan

As required by EC 1165-2-217, the approved Review Plan will be posted on the district public website <https://www.lrp.usace.army.mil/Missions/Planning-Programs-Project-Management/Project-Review-Plans/>. This is not a formal comment period and there is no set timeframe for the opportunity for public comment. When comments are received, the PDT will consider them and decide if revisions to the Review Plan are necessary.

Section 7

Review Plan Approval and Updates

RMO endorsed Review Plans are reviewed and approved by LRD. The LRD Commander, delegated to the LRD Programs SES official, is responsible for approving this RP. The SES's approval reflects vertical team input (involving the district, RMC, LRD, and HQUSACE members) as to the appropriate scope, level of review, and endorsement by the RMC. The RP is a living document, all changes made to the approved RP will be documented in Attachment 2 - RP Revisions. Re-approval of review plans by the MSC, with re-endorsement by the RMO, will be required when there are significant changes. Some projects with small changes will not require re-approval and re-endorsement. The latest version of the RP, along with the Commanders' approval memorandum will be posted on the district's webpage and linked to the HQUSACE webpage. The approved RP should be provided to the RMO.

Section 8

Engineering Model Certification and Approval

The use of certified or approved engineering models is required for all activities to ensure the models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. The responsible use of well-known and proven USACE developed and commercial engineering software will continue and the professional practice of documenting the application of the software and modeling results will be followed. The selection and application of the model and the input and output data is still the responsibility of the users and is subject to District Review and ATR. Where such validations have not been completed, appropriate independent checks of critical calculations will be performed and documented as part of District Review. The following engineering models, software, and tools are anticipated to be used:

Table 3 Models and Status

Model Name	Status
USACE risk analysis spreadsheet tool	
USACE internal erosion spreadsheet tools	
HEC-RAS	
HEC-LifeSim	
SEEP/W (Geo Studio)	

Team Rosters (CUI)

(To be Removed Prior to Posting on District Website)

Table 5 PDT Members

PDT Member	Organization	Role
Casey Cummins	LRL-1	Geotechnical Engineer, Cadre Lead and PM
David Robison	LRL-1	Geologist, Cadre Co-Lead
Samantha Schardein	LRL-1	Geotechnical Engineer
Nick Beckmann	LRL-1	Geotechnical Engineer
Anthony Paschall	LRL-1	Geologist
Jessica Fox	LRL-1	H&H Engineer
Sarah Mattingly	LRL-2	Economist
Damon Amlung	RMC	Geotechnical Engineer, Technical Advisor
Tom Brown	LRP	LSPM/Geotechnical
Joseph Bossard	LRP	LRP Lead - District Review Lead
Josh Shaffer	LRP	Project Manager

Table 6 District Review Reviewers

District Review Member	Organization	Role
Morgan Hoge	LRP	Structural
Jim James	LRP	Geotechnical
Cody Crone	LRP	Mechanical
Emidio Mosca	LRP	Electrical
Hillary Shipps	LRP	H&H
Jemie Dabaneh	LRP	Hydrologic Hazards Reviewer

Table 7 Hydrologic Hazard and Levee Breach Modeling Reviewers

ATR Member	Organization	Role
Kari Hauck	CEMVP-EC-H	Hydrology and Hydraulic Reviewer
Huan Tran	CELRP-ECG-I	Levee Breach Modeling Reviewer

Table 8 ATR Members

Discipline	Name	Organization
ATR Lead/Geotechnical Engineering	Bart Best	CWIWR-RMC-ED (Geotechnical)
Geologist	Thom Davidson	CEIWR-RMC-WD
Hydrology and Hydraulics	Kari Hauck	CEMVP-EC-H
Consequences	Glenn Fulton	CESWF-PEP-E
Structural Engineering	Terry Sullivan	CEIWR-RMC-ED
Levee Safety	David Lasoski	CELRD-RBE

ATTACHMENT 1

Project Risk Information (CUI)

(To be Removed Prior to Posting on District Website)

Summary

The Olean, New York, Local Flood Protection Project (LFPP) Left Bank of Olean Creek, Right Bank Allegheny River East of Olean Creek and Right Bank of Kings Brook (OLN1- LST ID 4905000008) in Olean, New York, is a federally authorized project that is operated and maintained by the New York State Department of Environmental Conservation (NYSDEC). The levee consists of approximately 2.9 miles of embankment and floodwall along the east bank of Olean Creek, the right bank of the Allegheny River between Olean Creek and Kings Brook and the left bank of Kings Brook. The levee was designed between 1945 and 1950 and constructed between 1949 and 1951.

Population at Risk: 1,013 day (1,928 night)

Structures at Risk: 764 (Estimated Property Value: \$280,000,000)

Risk driving failure modes: Seepage, floodwall stability, floodwall under-seepage.

Evacuation Effectiveness: Breach prior to over-topping: 83% day / 75% night (Over-topping: 98% day/ 88% night)

Summary of 2012 Risk Screening:

The screening-level risk assessment of the Olean, NY - Left Bank Olean Creek was started in 2011. In 2012, it was determined that the then OLN2 and OLN3 levee systems, separated by Kings Brook, were a single hydraulic system due to the lower elevation of the Kings Brook levee crests. The Pittsburgh District completed the screening considering OLN2 and OLN3 as a single system.

Embankment seepage and piping was determined to be a risk driver due to pipe culvert corrosion and deterioration and an ineffective animal control program.

In 2014, the LSOG considered the risk associated with the system to be High (LSAC 2) for Prior to Overtopping based on anticipated poor performance with a very high annual likelihood of breach, low life safety and high property damage consequences and to be Low (LSAC 4) for Overtopping due to anticipated moderate annual likelihood of overtopping and associated low life safety and high property damage consequences. The risk was driven by uncertainties regarding seepage as the levee embankment and foundation was comprised of heterogeneous materials with pipe and culvert crossings that were known to be compromised. Seepage did occur during a high-water event in 1972 but has since been remediated. There was good evacuation effectiveness with short egress routes but in the event of breach, the potential for economic damages was high. Headquarters approved the LSOG recommendation for an overall LSAC 2 in 2016.

Major Contributors to Overall Risk Rating

Performance Type	Performance Index, %	Life Safety Index, %	Economic Index, %
	OLN1 (OLN2)	OLN1 (OLN2)	OLN1 (OLN2)
Embankment and Foundation Seepage and Piping	65.73 (79.65)	65.73 (79.97)	65.73 (79.65)
Embankment Stability	4.50 (3.45)	4.50 (3.47)	4.50 (3.45)
Embankment Erosion	5.36 (0.46)	5.36 (0.46)	5.36 (0.46)
Closure Systems	(0.44)	(0.05)	(0.44)
Floodwall Stability	10.05 (0.16)	10.05 (0.16)	10.05 (0.16)
Floodwall Underseepage and Piping	14.35 (15.84)	14.35 (15.90)	14.35 (15.84)

Figure 6: Olean left bank pipe remediation table

ATTACHMENT 2

Review Plan Revisions

Revision Date	Description of Change	Page/Paragraph Number
22-JUN-2021	Inclusion of language to address risk and mitigation strategy for concurrent DQC/ATR reviews.	Page #5, Section 3.1, Paragraph #5 (new language)

Table 1 RP Revisions