



DEPARTMENT OF THE ARMY
U. S. ARMY CORPS OF ENGINEERS, MISSISSIPPI VALLEY DIVISION
1400 WALNUT STREET
VICKSBURG, MS 39180-3262

CEMVD-RB

MEMORANDUM FOR Commander, St. Louis District

SUBJECT: Monarch-Chesterfield Levee System, Saint Louis County, MO, Semi-Quantitative Risk Assessment Review Plan

1. References:

- a. Memorandum, St. Louis District, 28 September 2020, subject as above (encl).
- b. EC 1165-2-217, Review Policy for Civil Works, 20 February 2018.

2. The enclosed Review Plan (RP) for the Semi-Quantitative Risk Assessment has been prepared in accordance with EC 1165-2-217. Also, it has been coordinated with the District Support Team, the Engineering and Construction Division, and the Risk Management Center who endorsed the RP.

a. The MVD hereby approves this RP, which is subject to change as circumstances require, consistent with project development under the Project Delivery Business Process. Non-substantive changes to this RP do not require further approval. Substantive revisions to this RP or its execution will require new written approval from this office. The district should post the approved RP to its public website, with sensitive information removed.

b. The MVD point of contact for this action is [REDACTED]

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Encl

[REDACTED]
Director, Regional Business
Mississippi Valley Division



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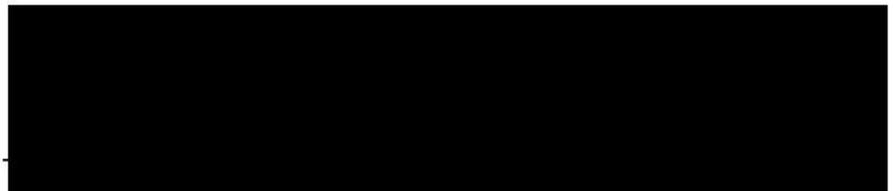
Prepared by:

St. Louis District
Mississippi Valley
Division

Monarch-Chesterfield Semi-Quantitative Risk Assessment

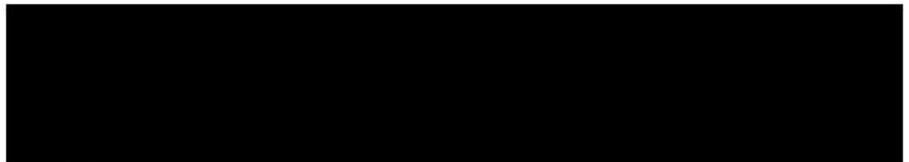
Review Plan

APPROVAL
RECOMMENDED BY:



Chief, Engineering and Construction Division / Levee Safety
Officer
MVS USACE

ENDORSED BY:



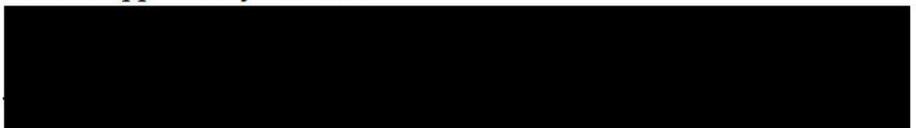
Chief, Eastern Division
Risk Management Center

APPROVAL
RECOMMENDED BY:



Chief, Engineering & Construction Division
Mississippi Valley Division

APPROVED BY:



Director, Regional Business
Mississippi Valley Division

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of Engineers®**

Prepared by:

**St. Louis District
Mississippi Valley
Division**

MSC Approval Date: *pending*

Last Revision Date: *none*

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Section 1

Purpose and Requirements

1.1 Purpose

This Review Plan for Monarch-Chesterfield Semi-Quantitative Risk Assessment (SQRA) 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 shall layout a value added process and describe the scope of review for the SQRA.

1.2 References

- 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
- MVS District Quality Management Plan(s)
- Monarch-Chesterfield – Screening Level Risk Assessment, 2018

1.3 Requirements

This Review Plan was developed in accordance with EC 1165-2-217, which establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products. This Review Plan will be provided to Project Delivery Team (PDT), District Quality Control (DQC), 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. This Review Plan will be updated for additional project phases.

Section 2

Project Background and Information

2.1 Project Background

The Monarch-Chesterfield levee system is a federally authorized and non-federally operated and maintained urban levee. The system is operated and maintained by the nonfederal sponsor, Monarch-Chesterfield Levee District. The levee is authorized to provide flood risk reduction to

portions of the City of Chesterfield, Missouri for up to a 500-year flood event, or a frequency of 0.2% chance of occurrence in any given year, plus three feet of freeboard.

The Monarch-Chesterfield levee is located in west St. Louis County, Missouri, within the boundaries of the City of Chesterfield. The nearest major city is St. Louis, Missouri, located 15 miles to the east. The 12-mile system provides risk reduction to approximately 4,700 acres of Chesterfield Valley. The leveed area is bounded on the north by the Missouri River, on the west by the St. Louis County line, on the south by St. Louis Southwestern Railroad, and on the east by Bonhomme Creek. The levee system is located along the right descending bank of the Missouri River between river miles 38.4 and 46.5. The system consists of one segment including earthen embankment, four closure structures, four short segments of floodwall, sixteen relief wells, and six pump stations. The National Levee Database (NLD) system identification number is 5605050001; the Segment identification number is 5604050001.



Figure 2.1 Project Vicinity Map

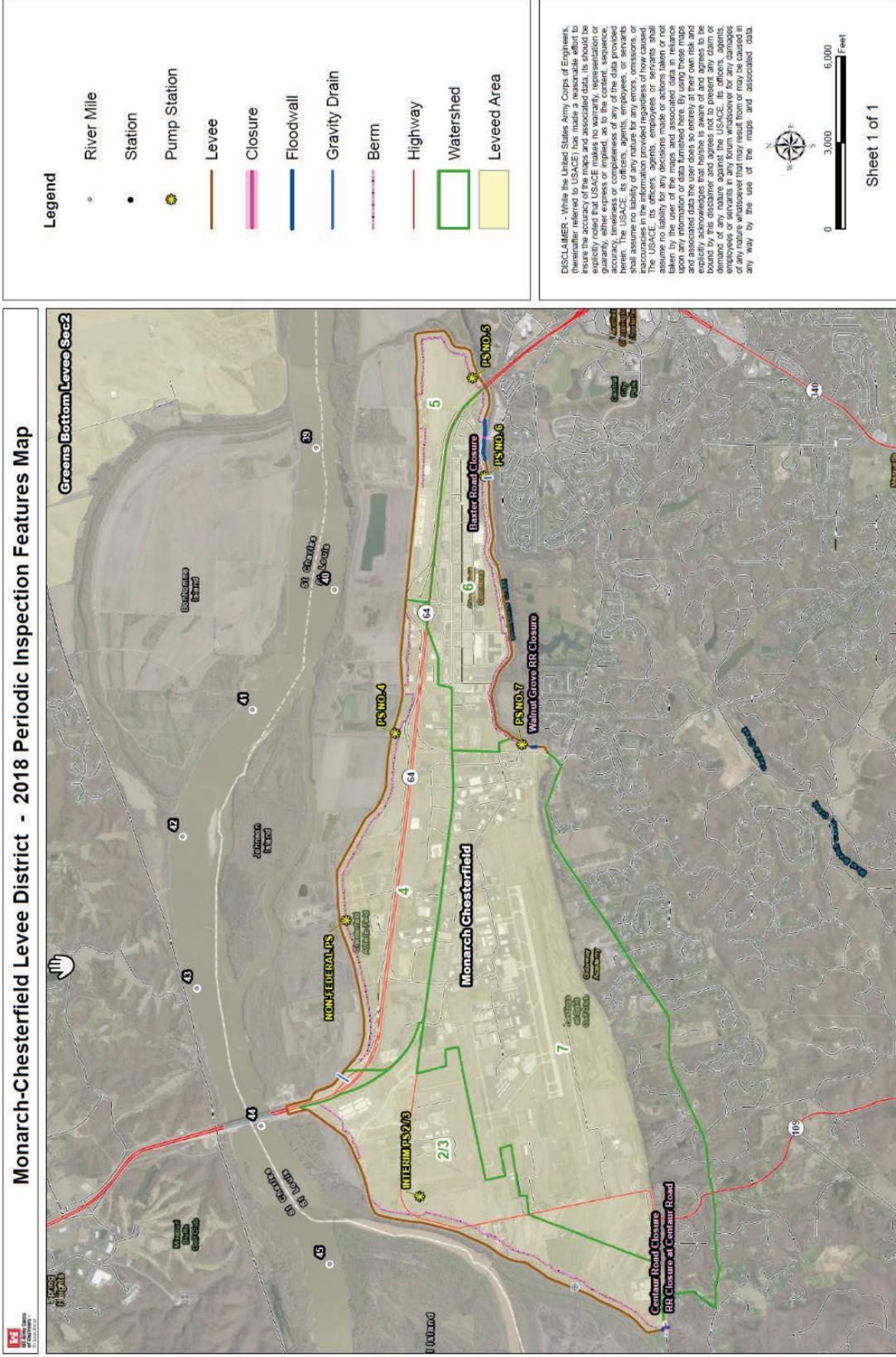


Figure 2. 2 Feature Map

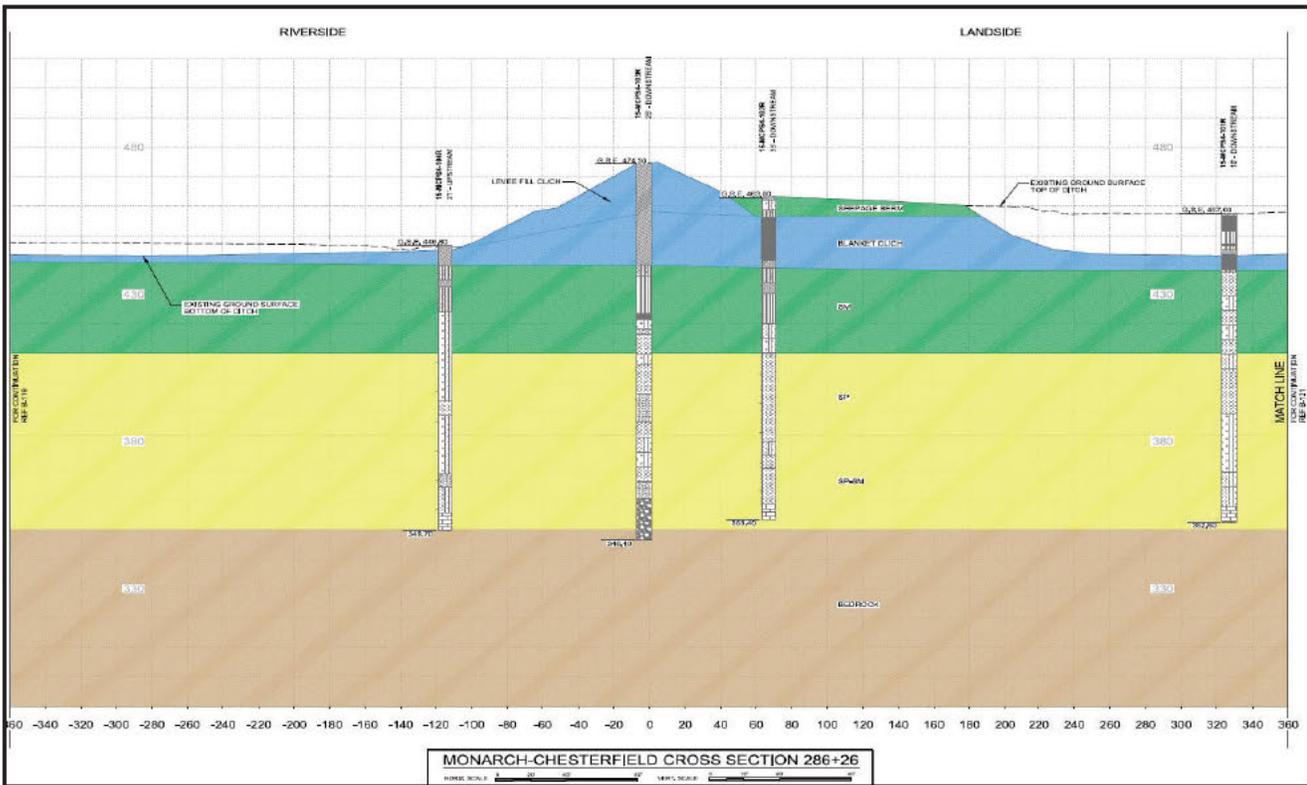


Figure 2.3: Typical Riverfront Section Detail

2.2 Project Sponsor

Products and analyses provided by non-Federal sponsors as in-kind services are subject to DQC, ATR, and policy and legal compliance reviews. There will not be in-kind contributions for this effort. The Monarch-Chesterfield Levee District is the non-federal sponsor. The non-federal sponsor and its engineering firm Horner and Shifrin are willing to provide the USACE with any information needed pertaining to the levee system and the leveed area and will be participants in the probable failure mode analysis (PFMA) and SQRA sessions.

Section 3

District Quality Control

3.1 Requirements

All work products (including supporting data, analyses, reports, etc.) shall undergo DQC in accordance EC 1165-2-217. The District shall perform these minimum required reviews in accordance with District's Quality Management Plan, [QMP](#). DQC is an internal review process of basic science and engineering work products focused on fulfilling the project quality requirements. All work products undergo DQC. Basic quality control tools include quality checks and reviews, supervisory reviews, and Project Delivery Team (PDT) review, etc. MVS will manage and document the DQC. As a part of DQC, the RMC Senior Advisor will review the SQRA report prior to submission for ATR to ensure completeness.

See Attachment 1, Team Rosters, for the DQC Lead, reviewers, and reviewer's disciplines.

3.1.1 DQC Requirements for HEC-RAS Breach Modeling

Hydraulic Modeling Advanced Review 1 – Once the hydraulic model geometry has been completed and representative Breach and Non Breach runs has been developed, the District will prepare a draft of the modeling revision summary document and coordinate with the MMC POC for an advanced review of the modeling.

Hydraulic Modeling Advanced Review 2 – After resolving any comments for the Hydraulic Modeling Advanced Review 1, the District will complete all of the modeling required for the SQRA, update the model documentation, and complete a draft of the hydraulic modeling report sections. The District will then coordinate with the MMC POC for Hydraulic Modeling Advanced Review 2 in conjunction with the SQRA DQC Review. Once complete, hydraulic model DQC will be satisfied, and review documentation will be placed in the Review Appendix.

3.2 Documentation

Documentation of DQC activities is required and will be implemented as described below.

All DQC review comments and responses will be documented in accordance with the District Quality Management Plan. Microsoft Word (using tracking changes) or Adobe Acrobat may be used to provide typographical comments and edits. The DQC comments and responses will be part of the DQC review documentation and provided to the ATR team to assess appropriateness and effectiveness of the DQC activities. Documentation and certification of DQC review will be completed by the DQC Lead in accordance with EC 1165-2-217. The DQC 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 DQC.

3.3 DQC Schedule and Estimated Cost

The following reviews are scheduled in **Table 1**. The cost for DQC is approximately [REDACTED] including reviewer and PDT costs.

Table 1 DQC Schedule

Project Phase/Submittal	Review Start Date	Review End Date
SQRA Chapter 6 H&H Advanced Review	01 October 2020	20 November 2020
SQRA Report DQC Review	27 April 2021	01 June 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**. ATR Reviews 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 and Loading Curves

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 RMC. The reviewer will provide advance review of this work product to avoid unnecessary delays to the completion of the risk analysis and SQRA report. Ideally, this reviewer will serve as the H&H ATR team member for the SQRA 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 HEC-LifeSim Modeling

The HEC-LifeSim Model (consequence modeling results) will undergo an Agency Technical Review by an MMC assigned experienced consequence specialist. The MMC will coordinate assignment of the reviewer with the RMC. The reviewer will provide an advance review of the draft modeling report to avoid unnecessary delays to the completion of the risk analysis and SQRA report. The consequence modeling reviewer will also serve as the Consequence ATR team member for the SQRA report. The reviewer is shown in Attachment 1.

4.1.3 ATR Requirements for SQRA Reports

ATR for Levee SQRA's will consist of a review of the technical products by an independent team of USACE levee safety professionals who have past experience with levee safety projects and work products. The team shall be selected by the RMO, and team members will have specialized experience in the analysis and assessment of the deficiencies and risk driver that were identified in the report.

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 DrChecksSM, as specified below. After resolution of the comments, the reviewer will sign the ATR completion form and this is to be included in the Monarch-Chesterfield SQRA review documentation. The signature will ensure all comments have been addressed during ATR and signify occurrence.

4.2.2 Documentation of SQRA ATR

The ATR team shall document comments, concerns, and recommendations, in written format using Microsoft Word or DrChecksSM, and should confirm comments have been adequately addressed in the report using approved back-checking procedures. Four-part comment structure shall be used or comments should be provided in a similar manor as directed by the ATR Lead.

4.3 Products to Undergo ATR

- SQRA Chapter 4 Hydrologic Hazards Assessment and Loading Curve Review
- SQRA Report and all appendices

4.4 Required Team Expertise and Requirements

4.4.1 SQRA ATR Team

ATR teams will be established in accordance with EC 1165-2-217. The following disciplines will be required for ATR of the SQRA:

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 the 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.

Geotechnical Engineer - The geotechnical engineer will have experience in the design, construction, and evaluation of levee systems, 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, and slope stability evaluation.

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 levee systems.

Hydrology and Hydraulic (H&H) Engineer – The H&H engineer will have experience in the analysis and design of hydraulic structures for levee systems and will be knowledgeable and experienced with, evaluation of flood events, 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 system 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 hydraulic structures for levee systems (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 levee safety risk analysis.

4.5 Statement of Technical Review Report

4.5.1 Semi Quantitative Risk Assessment Review Report

All comments and their resolutions, along with a review certification sheet, will be added to the review documentation appendix of the SQRA report. If there were any significant issues the ATR lead will document those in the comments.

4.6 ATR Schedule and Estimated Cost

The preliminary ATR schedule is listed in **Table 2**. The cost for the ATR is approximately [REDACTED]

Table 2 ATR Schedule

Project Phase/Submittal	Review Start Date	Review End Date
SQRA Chapter 4 Hydrologic Hazards Assessment and Loading Curve Review	6 November 2020	20 November 2020
SQRA ATR	02 June 2021	14 July 2021

Section 5 LSOG Review

5.1 Requirements

All SQRA work products will undergo a review by the Levee Safety Senior Oversight Group (LSOG). The LSOG is provided an advanced copy of the final report approximately four weeks prior to the LSOG Panel Discussion, or as directed by the Program Manager. The PDT will prepare LSOG Briefing Slides summarizing the project Risk, the report findings and recommendations. These slides will be reviewed by the Program Manager prior to presentation to LSOG for clarity and conciseness.

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

Policy and Legal Compliance Review

All SQRA products will be reviewed throughout the study process for their compliance with law and policy. Guidance for policy and legal compliance reviews is addressed in Appendix H, ER 1105-2-100 and Chapter 8 of ER 1110-2-1156. These reviews culminate in determinations that the recommendations in the reports and the supporting analyses and coordination comply with law and policy. DQC and ATR augment and complement the policy review processes by addressing compliance with pertinent published Army policies, particularly policies on analytical methods and the presentation of findings in decision documents. Initial and final policy compliance reviews will be conducted concurrently by the MSC and HQUSACE.

Section 7

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.mvs.usace.army.mil/>). This is not a formal comment period and there is no set timeframe for the opportunity for public comment. If and when comments are received, the PDT will consider them and decide if revisions to the Review Plan are necessary.

Section 8

Review Plan Approval and Updates

The MSC Commander, or delegated official, is responsible for approving this RP. The Commander's approval reflects vertical team input (involving the District, MSC, and RMC) 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 3, Table 7 RP Revisions. Re-approval of review plans by the MSC, with re-endorsement by the RMO, will be required when there are significant changes, such as if the project advances from an SQRA to a Quantitative Risk Assessment (QRA). 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 9

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 DQC and ATR. Where such validations have not been completed, appropriate independent checks of critical calculations will be performed and documented as part of DQC. The following engineering models, software, and tools are anticipated to be used:

Table 3 Models and Status

Model Name	Validation Date
HEC-RAS 5.0.3	April 2018
USACE risk analysis spreadsheet tool	Validation in progress
USACE internal erosion spreadsheet tools	Validation in progress
HEC-LifeSim V. 2.0,	Certification in progress, expected completion early 2021

Section 10

Review Plan Points of Contact

Table 4 Review Plan POC's

Title	Organization	Phone
Project Manager	CEMVS-PM-N	
Technical Lead	CEMVS-EC-GT	
LSPM	CEMVS-EC	
Risk Facilitator	CEMVD	
Senior Reviewer	CEIWR-RMC	