

**IMPLEMENTATION PHASE
REVIEW PLAN**

FOR

**SOO LOCKS COMPLEX
NEW LOCK CHAMBER,
APPROACH WALLS, AND CHANNEL DEEPENING
SAULT STE. MARIE, MICHIGAN**

Detroit District

Initial MSC Approval Date

June 2013

Last Revision Date

None



**US Army Corps
of Engineers** ®

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1. PURPOSE AND REQUIREMENTS

a. Purpose. This Review Plan (RP) is an implementation phase document that defines the scope and level of peer review for the design and construction activities of the Soo Lock Complex New Lock Chamber, Approach Walls, and Channel Deepening Projects.

b. References

- (1) Engineer Circular (EC) 1165-2-214, Civil Works Review Policy, 31 January 2010
- (2) Engineer Regulation (ER) 1110-1-12, Quality Management, 31 July 2006
- (3) CELRE Quality Management Plan, CELRE DC 5-1-1 and, in particular, Appendix C-3 – Engineering Subplan dated November 30, 1998
- (4) CELRH Engineering and Construction Procedure 3.2, Quality Control/Quality Assurance
- (5) Limited Reevaluation Report, Replacement Lock, Sault Ste. Marie, Michigan dated October 2000.
- (6) Great Lakes Connecting Channels and Harbors, Final Interim Feasibility Report and Environmental Impact Statement, March 1985.
- (7) Soo Replacement Lock, Quality Assurance Plan (QAP), November 2000
- (8) Soo Replacement Lock, Quality Control Plan (QCP), 03 September 2009

c. Requirements. This review plan was developed in accordance with EC 1165-2-214, which establishes an accountable, comprehensive, life-cycle review strategy for Civil Works products by providing a seamless process for review of all Civil Works projects from initial planning through design, construction, and Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R). It provides the procedures for ensuring the quality and credibility of U.S. Army Corps of Engineers (USACE) decision, implementation, and operations and maintenance documents and work products. The EC outlines three levels of review: District Quality Control, Agency Technical Review, and Independent External Peer Review.

- (1) District Quality Control (DQC). DQC is an internal review process of basic science and engineering work products focused on fulfilling the project quality requirements defined in the Project Management Plan (PMP). Basic quality control tools include a Quality Management Plan providing for seamless review, quality checks and reviews, supervisory reviews, Project Delivery Team (PDT) reviews, etc. It is managed in the home district. 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 should not be performed by the same people who performed the original work, including managing/reviewing the work in the case of contracted efforts. Additionally, the PDT is 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 before approval by the District Commander. The Major Subordinate Command (MSC)/District Quality Management Plans address the conduct and documentation of this fundamental level of review. DQC is addressed later in this review plan.
- (2) Agency Technical Review (ATR). ATR is an in-depth review, managed within USACE, and conducted by a qualified team outside of the home district that is not involved in the day-to-day production of the project/product. The purpose of this review is to ensure the proper application of clearly established criteria, regulations, laws, codes, principles and professional practices. The ATR team reviews the various work products and assures that all the parts fit together in a coherent whole. ATR teams will be comprised of senior USACE personnel,

preferably recognized subject matter experts with the appropriate technical expertise such as regional technical specialists (RTS), and may be supplemented by outside experts as appropriate. To assure independence, the leader of the ATR team shall be from outside the home MSC.

- (3) Independent External Peer Review (IEPR). IEPR is the most independent level of review, and is applied in cases that meet certain criteria where the risk and magnitude of the proposed project are such that a critical examination by a qualified team outside of USACE is warranted. For clarity, IEPR is divided into two types, Type I is generally for decision documents and Type II is generally for implementation documents.

A Type II IEPR (SAR) shall be conducted on design and construction activities for hurricane and storm risk management and flood risk management projects, as well as other projects where potential hazards pose a significant threat to human life. This applies to new projects and to the major repair, rehabilitation, replacement, or modification of existing facilities. External panels will review the design and construction activities prior to initiation of physical construction and periodically thereafter until construction activities are completed. The review shall be on a regular schedule sufficient to inform the Chief of Engineers on the adequacy, appropriateness, and acceptability of the design and construction activities for the purpose of assuring that good science, sound engineering, and public health, safety, and welfare are the most important factors that determine a project's fate.

2. PROJECT INFORMATION

- a. **Project.** The Soo Lock complex consists of four locks. The Poe (1968) and MacArthur (1947) Locks are located in the South Canal. The older Davis (1913) and Sabin (1917) Locks are located in the North Canal. The largest ships on the Great Lakes, which carry the bulk of the commodities, can only use the Poe Lock because of size and draft requirements. These ships are solely dependent on the operation of the Poe Lock. If the Poe Lock is shut down for maintenance, these ships are essentially out of business. The new proposed lock will be a "Poe Class" chamber. The chamber dimensions are 110-ft wide, 1200-ft long with a draft of 30-ft. The layout of the new lock chamber will eliminate the smaller Davis and Sabin Locks. Three lock alignments are currently being considered: a southern, a northern, and a skewed alignment.
- b. **General Site Location and Description.** The Soo Locks is located at the St. Marys Falls Canal on the St. Marys River adjacent to the cities of Sault Ste. Marie, Michigan and Ontario, Canada. There are four parallel locks on the U.S. side and one on the Canadian side. The four existing U.S. locks are located in two canals and accommodate approximately 80-90 million tons of bulk, general, and containerized cargo annually. The Davis and Sabin Locks are located in the north canal and were built during World War I. The MacArthur and Poe Locks are located in the south canal and were built to replace smaller locks. The Poe Lock is the only lock at the Soo Locks Complex that has the length, width, and draft needed to accommodate the Great Lakes system's largest vessels. These vessels account for a significant portion of the potential carrying capacity of the Great Lakes fleet. The MacArthur Lock has the depth but neither the length nor the width required by these vessels. The Davis and Sabin Locks have neither the width nor the depth to accommodate the passage of the contemporary vessels.
- c. **Factors Affecting the Scope and Level of Review.** The existing lock wall monoliths are unstable due to significant erosion in the bed rock and deterioration and loss of fill in the existing timber crib under the monoliths. This is a high risk condition; therefore the design and construction of the proposed SSP walls and the anchoring system require an ATR review.

d. Recommended Plan. The construction of the new replacement lock will be accomplished by constructing a new lock chamber, deepening the existing lock channel, and constructing new lock approach walls.

- **New Lock Chamber.** The new proposed lock will be a “Poe Class” chamber. The chamber dimensions are 110-ft wide, 1200-ft long with a draft of 30-ft. The layout of the new lock chamber will eliminate the smaller Davis and Sabin Locks. Three lock alignments are currently being considered: a southern, a northern, and a skewed alignment.
- **Channel Deepening.** The deepening of the existing lock channel will be accomplished by deepening the upstream and the downstream approach channels. The new upstream approach channel design project depth will be 29 feet below Low Water Datum (LWD). Therefore the upstream approach channel will be excavated to an elevation of 571.4 feet International Great Lakes Datum (IGLD 1985). A 1 foot overdepth will be allowed bringing the total project depth to 30 feet below LWD or elevation 570.4 ft IGLD 85. Excavation of the upstream approach channel will include the removal of both loose overburden material and bedrock. The new downstream approach channel design project depth will be 28.5 feet below LWD. Therefore the downstream approach channel will be excavated to an elevation of 550.2 feet IGLD 85. A 1 foot overdepth will be allowed bringing the total project depth to 29.5 feet below LWD or elevation 549.2 ft IGLD 85. Excavation of the downstream approach channel will include removal of both loose overburden material and bedrock.
- **Approach Walls.** The approach walls will be constructed of granular filled sheet pile cells, steel sheet pile walls with an anchor wall, and steel sheet pile walls anchored to existing monoliths. Approach transition areas will be constructed of steel sheet piles anchored to existing structures or to an anchor wall. The space between the existing walls and the new approach walls will be filled with granular material.

e. In-Kind Contributions. None for this project.

3. RMO COORDINATION

The review management organization will be the Great Lakes & Ohio River Division (MSC).

4. DISTRICT QUALITY CONTRL (DQC)

DQC is an internal review process of basic science and engineering work products focused on fulfilling the project quality requirements defined in the Project Management Plan (PMP). Basic quality control tools include a Quality Management Plan providing for seamless review, quality checks and reviews, supervisory reviews, and Project Delivery Team (PDT) reviews throughout the life of the project. DQC efforts will include the necessary expertise to address compliance with published Corps policy.

Detroit District will develop a Quality Control Plan (QCP) for the Approach Walls and Channel Deepening as part of the design.

Huntington District will develop a Quality Control Plan (QCP) for the New Lock Chamber design and will conduct an internal DQC.

5. AGENCY TECHNICAL REVIEW (ATR)

- a. **General.** ATR will be managed and performed outside of the Detroit District. EC 1165-2-214 requires the MSC to serve as the RMO for this project. There shall be appropriate coordination and processing through CoPs; relevant PCXs, and other relevant offices to ensure that a review team with appropriate independence and expertise is assembled and a cohesive and comprehensive review is accomplished. The ATR shall ensure that the product is consistent with established criteria, guidance, procedures, and policy. The ATR will assess whether the analyses presented are technically correct and comply with published USACE guidance, and that the document explains the analyses and the results in a reasonably clear manner for the public and decision makers. Members of the ATR team will be from outside the Detroit District and the Huntington District. The ATR lead will be from outside the Great Lakes & Ohio River Division.
- b. **Products for Review.** The ATR team will be reviewing the Design Documentation Report and the Plans & Specifications.
- c. **Required ATR Team Expertise.** ATR teams will be comprised of senior USACE personnel (Regional Technical Specialists (RTS), etc.), and may be supplemented by outside experts as appropriate. The disciplines represented on the ATR team will reflect the significant disciplines involved in the planning, engineering, design, and construction effort. These disciplines include civil, geology, structural, mechanical, hydraulics, environmental and archeological, electrical, cost engineering and construction. To assure independence, the leader of the ATR team will be outside of the MSC. A list of the ATR members and disciplines is provided in ATTACHMENT 1. The chief criterion for being a member of the ATR team is knowledge of the technical discipline and marine design experience.
- d. **Documentation of ATR.** DrChecks review software will be used to document all ATR comments, responses and associated resolutions accomplished throughout the review process. Comments should be limited to those that are required to ensure adequacy of the product. The four key parts of a quality review comment will normally include:
 - (1) The review concern – identify the product’s information deficiency or incorrect application of policy, guidance, or procedures;
 - (2) The basis for the concern – cite the appropriate law, ASA (CW)/USACE policy, guidance or procedure that has not been properly followed;
 - (3) The significance of the concern – indicate the importance of the concern with regard to its potential impact on the plan selection, recommended plan components, efficiency (cost), effectiveness (function/outputs), implementation responsibilities, safety, Federal interest, or public acceptability; and
 - (4) The probable specific action needed to resolve the concern – identify the action(s) that must take to resolve the concern.

In some situations, especially addressing incomplete or unclear information, comments may seek clarification in order to then assess whether further specific concerns may exist. The ATR documentation in DrChecks will include the text of each ATR concern, the PDT response, a brief summary of the pertinent points in any discussion, and lastly the agreed upon resolution. The ATR team will prepare a Review Report which includes a summary of each unresolved issue; each unresolved issue will be raised to the vertical team for resolution. Review Reports will be considered an integral part of the ATR documentation.

ATR may be certified when all ATR concerns are either resolved or referred to HQUSACE for resolution and the ATR documentation is complete. Certification of ATR should be completed, based on work reviewed to date, for the DDR and Plans and Specifications. See ATTACHMENT 2.

6. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)

- a. General.** Type I and Type II IEPRs are conducted in accordance with the guidance promulgated in EC 1165-2-214. Type I IEPRs are conducted on project studies. It is of critical importance for those decision documents and supporting work products where there are public safety concerns, significant controversy, a high level of complexity, or significant economic, environmental and social effects to the nation. However, it is not limited to only those cases and most studies should undergo Type I IEPR. In accordance with EC 1165-2-214 a Type II IEPR (SAR) shall be conducted on design and construction activities for hurricane and storm risk management and flood risk management projects, as well as other projects where potential hazards pose a significant threat to human life. This applies to new projects and to the major repair, rehabilitation, replacement, or modification of existing facilities.
- b. Decision on Type II IEPR.** In accordance with EC 1165-2-214 a Type II IEPR (SAR) is not required for the following reasons: The project is not a hurricane, storm risk management or flood risk management project. The project is an inland navigation project that doesn't have potential hazards that pose a significant threat to human life. Therefore, a Type II IEPR waiver is requested.
- c. Decision on Type I IEPR.** This document is not a decision document. Therefore, Type I IEPR is not required.

7. VALUE ENGINEERING

Value Engineering (VE) studies will be performed for this project in accordance with ER 11-1-321, 01 Jan11, change 1 and ER 1110-2-1150, Para. 14.7, 31Aug 99

8. BCOE (BIDDABILITY, CONSTRUCTIBILITY, OPERABILITY, AND ENVIRONMENTAL REVIEW)

BCOE reviewers will be performed for each contract (prior to contracting) in accordance with ER 415-1-11.

9. MODEL CERTIFICATION AND APPROVAL

EC 1105-2-412 mandates the use of certified or approved models for all planning activities to ensure the models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. Planning models, for the purposes of the EC, are defined as any models and analytical tools that planners use to define water resource management problems and opportunities, to formulate potential alternatives to address the problems and take advantage of the opportunities, to evaluate potential effects of alternatives and to support decision making. The use of certified/approved planning model does not constitute technical review of the planning product. The selection and application of the model and the input and output data still are the responsibility of the users and is subject to DQC, ATR, and IEPR reviews (if required).

EC 1105-2-412 does not cover engineering models used in planning. The responsible use of well-known and proven USACE-developed and commercially available engineering software will continue and the professional practice of documenting the application of the software and modeling

results will be followed. As part of the USACE Scientific and Engineering Technology (SET) Initiative, many engineering models have been identified as preferred or acceptable for use on Corps studies and these models should be used whenever appropriate. 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, ATR, and IEPR reviews. All appropriate reviews were conducted in accordance with policy during the completed phases of the project.

Model Certification/Approval Schedule and Cost

For implementation documents prepared under the model National Programmatic Review Plan, use of existing certified or approved planning models is encouraged. Where uncertified or unapproved models are used, approval of the model for use will be accomplished through the ATR process. The ATR team will apply the principles of EC 1105-2-412 during the ATR to ensure the model is theoretically and computationally sound, consistent with USACE policies, and adequately documented. If specific uncertified models are identified or repetitive use within a specific district or region, the appropriate PCX, MSC(s), and home District(s) will identify a unified approach to seek certification of these models.

Models Used for Lock Replacement

The models listed below were used in the design of the lock replacement project. Any models required for new work packages will be identified in the package-specific QCP. This may include engineering and cost models. Certifications for those models will be addressed at that time.

Model Name	Model description	Model Type
MCACES or MII	These are cost estimating models. This is a cost estimating model that was developed by Building System Design Inc. Crystal Ball risk analyses software will also be used.	Cost Engineering
Waterway Analysis Model (WAM)	The Waterway Analysis Model (WAM) is a discrete event vessel lock transit simulation. It simulates vessel chamber packing and chamber choice, estimates vessel processing time, queuing, and delay times to quantify lock performance under a user specified operating policy and / or service disruption scenario. Initially developed in 1976 as part of the U.S. Army Corps of Engineers Inland Navigation Systems Analysis Program (INSA) for the Office of the Chief of Engineers by CACI, Inc., a Deep-Draft version of the WAM was modified specifically for use in the Soo analysis. This Soo WAM was modified to summarize vessel processing and delay costs by fleet flag (U.S. and Canada).	Economics

Soo Expected Disruption Cost (EDC) Model	The EDC Model is an EXCEL workbook utilizing a Palisade @RISK add-in, which allows cells to be defined as a distribution instead of as a point value. This simulation model combines the closure impacts developed out of the WAM with the probabilities of accident events to calculate expected closure impact costs at various traffic levels; the expected disruption costs avoided benefit.	Economics
Soo Benefit-Cost Uncertainty (BCU) Model	The BCU is also an EXCEL workbook model utilizing the Palisade @RISK add-in. The BCU utilizes the EDC output and simulates future traffic, project construction costs, rehabilitation costs, decommissioning costs, recreation benefits, O&M costs, and area redevelopment costs (which are a function of construction costs) to estimate project cost-benefits and the benefit-cost ratio (BCR). The BCU: 1) estimates and amortizes the expected disruption costs avoided benefits for the analysis period given the infinite number of traffic level permutations given the various commodity level traffic forecast scenarios; 2) combines the disruption cost avoided benefits with the other benefit categories (i.e. recreation benefits & area redevelopment benefits); 3) estimates and amortizes costs (i.e. construction, rehabilitation, decommissioning & O&M costs); and 4) summarizes the benefit and costs probabilistically.	Economics
Microsoft Excel	Computational Analysis	Engineering
STAAD.Pro V8i	Structural analysis and design	Engineering
Mathcad	Minor Input Structural Load Development	Engineering
CSlide	Sliding Analysis of Structures	Engineering
3DSAD	3-Dimensional Stability Analysis	Engineering
CCell	Analysis of Cellular Cofferdams	Engineering
Geo Studio	2D slope stability	Engineering

10. REVIEW SCHEDULES AND COSTS

- a. **DQC Schedule and Cost.** The cost for DQC is included in the costs for PDT activities and is not broken out separately. DQC will occur seamlessly throughout the DDR and the P&S. Quality checks and reviews occur during the development process and are carried out as a routine management practice.

b. ATR Schedule and Cost. The estimated cost for ATR depends on the scope of work for each contract that is broken out (New Lock Chamber, approach walls & channel deepening contracts). ATR will occur during key stages in the DDR and the P&S. The ATR team will be invited to take part in weekly team meetings. ATR for the DDR and P&S package for the New Lock Chamber construction and Approach Walls & Channel deepening will be started and completed upon the authorization and receipt of funding. The total ATR cost for this project is from \$300,000 to \$500,000.

ATR Milestones New Lock Chamber	
90% -100% DDR Review	TBD
90% Plans Review	TBD
100% P&S Review	TBD

ATR Milestones Approach Walls	
90% -100% DDR Review	TBD
90% Plans Review	TBD
100% P&S Review	TBD

ATR Milestones Channel Deepening	
90% -100% DDR Review	TBD
90% Plans Review	TBD
100% P&S Review	TBD

Note: As of May 2013, funding to complete design, perform ATR, and commence construction is not available. Upon funding availability, the review plan will be revised and updated to reflect the budgeted amount for ATR and schedule of ATR, for each of the three main areas (i.e., New Lock Chamber, Approach Walls, and Channel Deepening). Also at the time funding is available; the ATR Team Member table which is currently comprised of one table (only) will be reviewed to determine if each of the three major areas may have different ATR needs relative to one another.

11. PUBLIC PARTICIPATION

The 2005 limited Re-Evaluation Report (LRR) was provided to stakeholders for comment. All comments were resolved. Public involvement for this project is considered to be complete.

12. MSC APPROVAL

The Great Lakes and Ohio River Division is responsible for approving the review plan. Approval is provided by the MSC Commander. The commander's approval should reflect vertical team input (involving district, MSC, and HQUSACE members) as to the appropriate scope and level of review for the project. Like the PMP, the review plan is a living document and may change as the study progresses. The review plan must be updated and approved by the MSC throughout the PED phase (and the construction Phase, as applicable). Changes to the review plan should be approved by following the process used for initially approving the plan. In all cases the MSCs will review the decision on the level of review and any changes made in updates to the project.

13. REVIEW PLAN POINTS OF CONTACT / VERTICAL TEAM CONTACTS

Questions and/or comments on this review plan can be directed to the following points of contact:

ATTACHMENT 1: TEAMS ROSTERS

TABLE 1: Product Delivery Team		
Functional Area	Names	Office
Project Manager	TBD	CELRE
Lead Engineer / Civil Design	TBD	CELRE
Real Estate	TBD	CELRE
Contracting	TBD	CELRE
Operations	TBD	CELRE
Public Affairs	TBD	CELRE
Geology	TBD	CELRE
Cost Engineering	TBD	CELRE
Hydraulics	TBD	CELRE
Structural	TBD	CELRE
Geotechnical	TBD	CELRE
Mechanical Engineer	TBD	CELRE
Construction	TBD	CELRE
Environmental	TBD	CELRE
Electrical	TBD	CELRE

TABLE 2: District Quality Control Team		
Functional Area	Names	Office
Project Manager	TBD	CELRH
Lead Engineer / Civil Design	TBD	CELRH
Real Estate	TBD	CELRH
Contracting	TBD	CELRH
Operations	TBD	CELRH
Public Affairs	TBD	CELRH
Geology	TBD	CELRH
Cost Engineering	TBD	CELRH
Hydraulics	TBD	CELRH
Structural	TBD	CELRH
Geotechnical	TBD	CELRH
Mechanical Engineer	TBD	CELRH
Construction	TBD	CELRH
Environmental	TBD	CELRH
Electrical	TBD	CELRH

NAMES	DISCIPLINE	OFFICE
TBD	Team Leader	CESPK-ED-DS
TBD	Structural	CELRP-EC-NS
TBD	Civil/Site	CELRP-EC-NC
TBD	Hydrology and Hydraulics	CELRP-EC-DH
TBD	Electrical	CELRP-EC-NT
TBD	Operations and Maintenance	CELRP-OP
TBD	Mechanical	CELRP-EC-NT
TBD	Cost Engineering (<i>If required by the Cost DX</i>)	CELRP-EC-NT
TBD	Engineering Geology	CELRP-EC-DS
TBD	Real Estate	CEMVM-RE-E

Name	Location	Phone	Email
Chief of Engineering and Construction	Headquarters		
Deputy Chief, LRD RIT	Headquarters		
Program Manager, RIT	Headquarters		
Chief of Ops and Reg Div, CELRD, RIT leader Acting	Headquarters		
Peer Review Account Manager, PCX	LRH		

ATTACHMENT 2: REVIEW PLAN REVISIONS

REVISION DATE	DESCRIPTION OF CHANGE	PAGE / PARAGRAPH NUMBER

ATTACHMENT 3: ATR CERTIFICATION TEMPLATE

COMPLETION OF AGENCY TECHNICAL REVIEW

The Agency Technical Review (ATR) has been completed for the Soo Lock Complex New Lock Chamber, Approach Walls and Channel Deepening Projects (*DDR/P&S*). The ATR was conducted as defined in the project’s Review Plan to comply with the requirements of EC 1165-2-214. During the ATR, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of: assumptions, methods, procedures, and material used in analyses, alternatives evaluated, the appropriateness of data used and level obtained, and reasonableness of the results, including whether the product meets the customer’s needs consistent with law and existing US Army Corps of Engineers policy. The ATR also assessed the District Quality Control (DQC) documentation and made the determination that the DQC activities employed appear to be appropriate and effective. All comments resulting from the ATR have been resolved and the comments have been closed in DrChecks sm.

(Signature)
Agency Technical Review Team Leader

(Date)

(Signature)
Project Manager

(Date)

(Signature)
Senior Regional Engineer
Review Management Office Representative
CELRD-BTD

(Date)

CERTIFICATION OF AGENCY TECHNICAL REVIEW

Significant concerns and the explanation of the resolution are as follows:

As noted above, all concerns resulting from the agency technical review of the Soo Replacement Lock and Channel Deepening Project (*DDR / P&S*) have been fully resolved.

(Signature)
Chief, Engineering & Construction Division

(Date)