DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DIVISION, GREAT LAKES AND OHIO RIVER
CORPS OF ENGINEERS
550 MAIN STREET
CINCINNATI, OH 45202-3222

CELRD-PD-G

21 FEB 2013

MEMORANDUM FOR Commander, U.S. Army Engineer District, Chicago (Susanne Davis/CELRC-PM-PL), 111 N. Canal, Suite 600, Chicago, IL, 60606-7206

SUBJECT: Review Plan for Chicago Sanitary & Ship Canal Aquatic Nuisance Species Dispersal Barriers

1. The attached Review Plan (RP) for Chicago Sanitary & Ship Canal (CSSC) Aquatic Nuisance Species Dispersal Barriers was presented to the Great Lakes and Ohio River Division for approval in accordance with EC 1165-2-214 "Civil Works Review" dated 15 Dec 2012.

2. The CSSC Dispersal Barriers project consists of the electrical barriers, the Efficacy Study, and Asian Carp location monitoring. Products planned and currently under development are a decision document, plans and specifications, operations and maintenance, and other products including hydroacoustics and monitoring summary reports.

The decision document is the *Comprehensive Efficacy Report*, to include a summary of all interim reports completed to date and will include a summary of the efforts underway by the other agencies making up the Asian Carp Regional Coordinating Committee. The report will document the improvements made to increase the efficacy of the electric barriers. Further, the report will contain evaluation of additional risk reduction measures to specifically address the open pathways to Lake Michigan: the Grand Calumet River which outlets at the Indiana Harbor and Canal; and the Little Calumet River, which outlets at Burns Ditch.

Plans and Specifications refers to the construction of a permanent Barrier I facility, and studies performed on the Barrier II electrical upgrades in order to determine the cause of power quality issues at Barriers IIA and IIB and develop solutions.

Operations and Maintenance references the active and continuously operation of the barriers, 24 hours a day, 7 days a week. The electric and structural barriers must be maintained to insure their continued effectiveness.

Hydroacoustics is a monitoring technology that can detect fish in a water column. A hydroacoutics systems will be designed, tested, and installed around the electric barriers that will allow monitoring to determine whether fish (if any) are crossing over the barriers. A pilot program is currently under development to research available systems and determine which is most suitable for application at the Barriers. Finally, Monitoring Summary Reports will include a summary of USACE work on the telemetry and eDNA programs.

CELRD-PD-G
SUBJECT: Review Plan for Chicago Sanitary & Ship Canal Aquatic Nuisance Species Dispersal Barriers

3. The RP defines the scope and level of peer review for the activities to be performed for the subject project. The USACE LRD Review Management Organization (RMO) has reviewed the attached RP and concurs that it describes the scope of review for work phases and addresses all appropriate levels of review consistent with the requirements described in EC 1165-2-214.

4. I concur with the recommendations of the RMO and approve the enclosed RP for CSSC Barriers project.

5. The District is requested to post the RP to its website. Prior to posting, the names of all individuals identified in the RP and the dollar values of all project costs should be removed.

6. If you have any questions please contact Dr. Hank Jarboe, CELRD-PDP, at (513) 684-6050.

ROBERT D. PETERSON
Colonel, USA
Acting Commander

Encl
1. Review Plan
2. Memo from Jodi Creswell (ECO PCX), 11 Dec 2012

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REVIEW PLAN

for the

Decision Document, Implementation Phase, and Operations and Maintenance

of the

Chicago Sanitary & Ship Canal Aquatic Nuisance Species Dispersal Barriers
Chicago District

MSC Approval Date: *21 February 2013*
Last Revision Date: 5 February 2013

US Army Corps
of Engineers ®

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1. PURPOSE AND REQUIREMENTS

a. Purpose. This Review Plan defines the scope and level of peer review for the Barrier Efficacy, Risk Reduction Study and integrated environmental assessment, design, construction, operation, and maintenance of the Chicago Sanitary and Ship Canal (CSSC) Aquatic Nuisance Species Dispersal Barriers located in Romoeville, IL.

b. References

(1) EC 1165-2-214, Civil Works Review Policy, 15 Dec 2012
(2) EC 1105-2-412, Assuring Quality of Planning Models, 31 Mar 2011
(3) ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment #1, 20 Nov 2007
(4) ER 1110-1-12, Quality Management, 30 Sep 2006
(5) CSSC Aquatic Nuisance Species Dispersal Barrier Project Management Plan, 30 September 2011
(6) Great Lakes and Ohio River Division, Chicago District Program Management Plan for Quality Management Program, 24 March 2008
(7) Dispersal Barrier Efficacy Quality Control Plan September 2009
(8) CSSC Permanent Electrical Dispersal Barrier I Quality Control Plan, 3 October 2011

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). The EC outlines four general levels of review: District Quality Control/Quality Assurance (DQC), Agency Technical Review (ATR), Independent External Peer Review (IEPR), and Policy and Legal Compliance Review. In addition to these levels of review, decision documents are subject to cost engineering review and certification (per EC 1165-2-214) and ensuring that planning models and analysis are compliant with Corps policy, theoretically sound, computationally accurate, transparent, described to address any limitations of the model or its use, and documented in study reports (per EC 1105-2-412).

(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 a Quality Control Plan (QCP) and Quality Assurance Plan (QAP) 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 are 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) Regional Buisness Process/District Quality Control addresses the conduct and documentation of this fundamental level of review.

(2) Agency Technical Review (ATR). EC 1165-2-214 requires that USACE Risk Management Center (RMC) shall serve as the RMO for Dam Safety Modifications projects and Levee Safety Modification projects. For all other projects, the MSC shall serve as the RMO. 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 assure 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.

(4) 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. REVIEW MANAGEMENT ORGANIZATION (RMO) COORDINATION

The RMO is responsible for managing the overall peer review effort described in this Review Plan. The RMO for decision documents is typically either a Planning Center of Expertise (PCX) or the Risk Management Center (RMC), depending on the primary purpose of the decision document. The RMO for the peer review effort described in this Review Plan related to the Efficacy Studies is the Planning Center of Expertise for Ecosystem Restoration (ECO-PCX).The RMO for ATR reviews shall be the MSC. The RMO for the Type II IEPR shall be USACE Risk Management Center (RMC).

The RMO will coordinate with the Cost Engineering Directory of Expertise (DX) for the decision documents to ensure the appropriate expertise is included on the review teams to assess the adequacy of cost estimates, construction schedules and contingencies.

The home district will post the approved review plan on its public website. A copy of the approved review plan (and any updates) will be provided to the ECO-PCX and RMC.

3. PROJECT INFORMATION

The CSSC Dispersal Barriers project consists of the electrical barriers, the Efficacy Study, and Asian Carp location monitoring.

a. Electric Barriers. The Electric Dispersal Barriers deter the inter-basin establishment of Asian carp and other aquatic nuisance species via the Chicago Sanitary and Ship Canal (CSSC) through pulsed direct current in the water from steel electrodes secured to the bottom of the canal that discourages fish from crossing. The Barrier system currently consists of three separate barriers.

The first dispersal barrier was authorized as a demonstration project under section 1202(i)(3) of the Aquatic Nuisance Prevention and Control Act P.L. 101-646, and has been in operation since April 2002. The second dispersal barrier was initially implemented by Section 1135 of WRDA 1986, P.L. 99-662, as further authorized by section 345 of the District of Columbia Appropriations Act of 2005, P.L. 108-335. Barrier II is a set of two barriers, Barrier IIA and Barrier IIB. Barrier IIA has been in operation since April 2009, Barrier IIB has been operational since April 2011. Construction of a fourth barrier, Permanent Barrier I, was authorized in Section 3061(b)(1)(A) of the Water Resources Development Act (WRDA) of 2007, and is scheduled to begin in 2013. A map depicting the layout of the barrier system is provided as Figure 1. A detailed description of the electric barriers is provided as Appendix A.

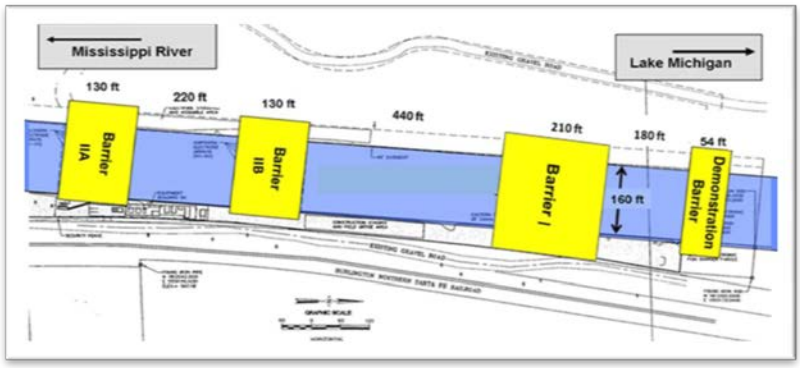

Figure 1 - Barrier Layout

b. Efficacy Stucy (Decision Documents). The Efficacy Study was originally authorized in Section 3061(b)(1)(D) of WRDA 2007. Additional authority is included in Section 105 of the Energy and Water Development and Related Agencies Appropriations Act for FY 2012 Section 105 states: "During the fiscal year period covered by this Act, the Secretary of the Army is authorized to implement measures recommended in the efficacy study authorized under Section 3061 of the Water Resources Development Act of 2007, (121 Stat. 1121) or in interim reports, which such modifications or emergency measures as the Secretary of the Army determine to be appropriate, to prevent aquatic nuisance species from dispersing into the Great Lakes by way of any hydrologic connection between the Great Lakes and the Mississippi River Basins."

The efficacy Study evaluates hazards and potential risk reductions associated with the Barriers Project. The current plan is for the efficacy study to be presented in five separate reports: *Dispersal Barrier Bypasses (Interim I); Optimal Operating Parameters (Interim IIA); Modified Structures and Operations (Interim III); Fish Dispersal Deterrents (Interim IIIA)* and the *Comprehensive Efficacy Report.* A detailed description of these reports is provided in Appendix B.

c. Asian Carp Location Monitoring. Asian carp location monitoring is being conducted by an interagency working group using monitoring tools such as traditional netting, emitting an electric current from a boat and netting the stunned fish (electrofishing), extracting genetic material from water samples to identify the presence of Asian carp DNA in an area (eDNA), observing real-time fish behavior from an underwater acoustic camera (DIDSON) and tracking tagged fish through underwater stationary and mobile receivers (telemetry). Members of this interagency group, referred to as the Monitoring and Rapid Response Work Group (MRRWG), include U.S. Fish and Wildlife Service, Illinois Department of Natural Resources, Great Lakes Fisheries Commission, USACE and others.

4. PRODUCT DESCRIPTIONS

Products planned and currently under development are described below. Please refer to the appendices for a description of completed products.

a. Decision Document. *The Comprehensive Efficacy Report* will include a summary of all interim reports completed to date and will include a summary of the efforts underway by the other agencies making up the Asian Carp Regional Coordinating Committee. The report will document the improvements made to increase the efficacy of the electric barriers. Further, the report will contain evaluation of additional risk reduction measures to specifically address the open pathways to Lake Michigan: the Grand Calumet River which outlets at the Indiana Harbor and Canal; and the Little Calumet River, which outlets at Burns Ditch. The Comprehensive Efficacy Report is currently scheduled for completion in FY13. The PDT may choose to develop additional efficacy studies as new issues arise and opportunities for improved performance of the Barriers Project become available. If additional interim reports are identified, this review plan will be updated and submitted for re-approval. Current projected cost of the Barriers Project is approximately $220M.

b. Plans and Specifications.

Permanent Barrier I - In 2007 Congress authorized construction of a permanent Barrier I facility. The permanent Barrier I will be similar to Barrier II in capacity and design, and will provide the necessary backup for the future barrier maintenance. The design of the permanent barrier is underway and will be completed in several phases. The first contract, Site Prep A, was awarded in September 2012 and includes roadwork and site grading in preparation for the construction of the permanent building. Additional contracts to be awarded in FY 13 include Site Prep B for installation of electrodes and parasitics (in-water activities); Site Prep C for completion of the roadwork and relocation of utility poles; power supply; and the supply and installation of Barrier I Electronics. A contract to construct the building that will house the electronics is scheduled for award in FY 14. Similar to Barrier IIB, design will be completed by the Chicago District with coordination with Smith-Root for the design and installation of the electrical components and operating system. DQC and ATR were completed for the Site Prep A with ATR certification dated on 31 July 2012. DQC and ATR for the projects are on-going or will be completed for the remaining products discussed above.

Barrier II Electrical Upgrades – Studies are underway to determine the cause of power quality issues at Barriers IIA and IIB, and to develop solutions to address the issue. An A/E firm, Black and Veatch, is currently under contract to perform this investigation and develop plans and specifications for the solution. As part of their contract, Black and Veatch will conduct its own Quality Control. USACE will conduct the ATR, which is scheduled for completion in April 2013.

c. Operations and Maintenance. The electric barriers are designated to be active and continuously operating, 24 hours a day, 7 days a week. The electric and structural barriers must be maintained to insure their continued effectiveness. The Operations Section (TS-C-T) supervises and administers a contract to provide support for a number of operations & maintenance (O&M) activities including, but not limited to, the following:

- 24/7 Caretaker Services – around-the-clock caretaker services for the electric barriers and all related facilities and equipment.
- O&M Support Contracts – TS-C-T supervises and administers contracts with Smith-Root, Inc., the contractor who designed the electronics for each barrier, to support in operating and maintaining the barriers.
- Spill Prevention, Control and Countermeasures (SPCC) Plan – A SPCC plan for the Dispersal Barriers site is currently being finalized. The Plan will be used to help, prepare and respond quickly and safely to hazardous spill incidents. If implemented appropriately, the plan will ensure an effective, comprehensive response to prevent injury or damage to the facility, support staff, public, and environment during continuous operation of the barriers.
- Barrier Life Cycle Investment Plan – This plan details the expected life span of critical barrier components such as electrodes and pulsers, and estimates the cost of replacement over the life of the project. This plan is intended to be a comprehensive examination of long term project funding requirements.
- Power quality/harmonics investigation – At Barrier IIA, the local electrical utility, ComEd, has indicated that flickering or power disturbances are occurring on the power grid within the vicinity of the Fish Barrier. The Chicago District and Smith-Root determined that barrier operations may be pushing power back into the power grid. This is defined as harmonics. A study is underway to determine why the power disturbances are occurring and how to reduce or eliminate them. The harmonics testing was done primarily to determine why the generators cannot support the operation of two pulsers simultaneously. The flicker issue may be addressed as a side effect of the study.

d. Other.

Hydroacoustics – Is a monitoring technology that can detect fish in a water column. A hydroacoutics systems will be designed, tested, and installed around the electric barriers that will allow monitoring to determine whether fish (if any) are crossing over the barriers. A pilot program is currently under development to research available systems and determine which is most suitable for application at the Barriers. The pilot program will be initiated in FY13, with design and installation of a more permanent system to follow in FY14.

Monitoring Summary Reports - The MRRWG publishes a report each year summarizing the results of Asian carp location monitoring efforts. As a member of the workgroup, the USACE team will prepare a summary of its work on the telemetry and eDNA programs.

e. Factors Affecting the Scope and Level of Review. Barrier IIA and IIB are completed and operational. However, there are few issues that are being addressed with the operations and maintenance of the Barriers.

(1) The Efficacy Study is likely to include significant challenges to the PDT because of the high level of concern regarding the potential bypasses of the Barriers Project, as well as the high level of interest the project has elicited from other federal, state, local agencies and the public.

(2) The Electric Barriers Project can provide protection to the significant environmental and economic resources of the Great Lakes. The passage of the Asian Carp (or other ANS) into the Great Lakes could pose a very high risk to one of the most significant environmental resources in the United States.

(3) While the use of electric dispersal barriers is not wide spread, the current installations in the CSSC are not the only examples of this technology world-wide. The PDT is considering many different types of controls and technologies to enhance the performance of the system. Some applications may be new and novel for the current situation.

(4) A Type I IEPR is recommended for the Comprehensive Efficacy Study. A determination on the need for Type I IEPR on any subsequent Efficacy studies will be coordinated with RMO and the ECO-PCX.

(5) There is a high level of public concern related to the potential for Asian carp to become established in the Great Lakes. On July 19, 2010, the states of Michigan, Minnesota, Ohio, Wisconsin, & Pennsylvania filed suit against the Corps & MWRD in the U.S. District Court for the Northern District of Illinois, Case No. 1:10-cv-04457 requesting preliminary and permanent injunctive relief measures to prevent Asian Carp migration into the Great Lakes. The efficacy of the electric barriers and the timeline for the completion of GLMRIS were key issues in the litigation. The case was dismissed on December 10, 2012, but the plaintiffs filed an appeal two days later.

(6) Site Safety – There are three important safety concerns for operation of this project. The first is the potential risk of a person to fall in the water near the Barriers. The second concern is the ground stray currents while working near or around metallic objects in the vicinity of the barriers. The third concern is the exposure to electromagnetic fields. Various activities are being completed to identify risks and implement solutions to the operations of the barriers and modifications of the surrounding features to help reduce the risks.

(7) Barrier IIA Improvements –The operations and maintenance group is working with the design team to determine the retrofit activities to be performed on the barrier to improve the access, safety, performance and reliability.

(8) Efficacy Studies – The results and recommendations of the studies may affect the operations and maintenance of Barrier I, Barrier IIA and IIB.

(9) Barrier Design and Operations – the recommendations inherent in the on-going and future studies may affect the design of Barrier I and operations of the all the barriers.

(10) Real Estate – The electrical barriers are located on properties currently owned by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC), BSNF Railroad and others. Permanent or long-term real estate arrangements are being made with the property owners and the outcome can affect the use of the property.

f. In-Kind Contributions. Products and analyses provided by non-Federal sponsors as in-kind services are subject to DQC, ATR, and IEPR. The Electric Barriers, Efficacy Studies and resulting facilities, and monitoring activities are 100% Federal.

5. DISTRICT QUALITY CONTROL (DQC)

All design and decision documents (including supporting data, analyses, environmental compliance documents, etc.) shall undergo DQC. DQC efforts will include the necessary expertise to address compliance with published Corps policy and will be performed on all work products of the project. DQC was performed on all of the completed projects and will be performed on all the remaining work products of the project.

a. Documentation of DQC. Comments and responses from peer and Chief's reviews for the studies and design products shall be documented and maintained in shared electronic folders. The design product PDT member checklist will be completed and signed by the Section Chiefs. All calculations will be checked and initialed by the reviewer.

b. Products to Undergo DQC. Each of the Efficacy Interim Reports is/was subject to Chicago District Quality Control processes. DQC shall be performed on all design products consistent with the Regional Business Processes.

6. AGENCY TECHNICAL REVIEW (ATR)

ATR is mandatory for all decision documents (including supporting data, analyses, environmental compliance documents, etc) and design products and will be in accordance with EC 1165-2-214. The objective of ATR is to ensure consistency 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 results in a reasonably clear manner for the public and decision makers. ATR is managed within USACE by the designated RMO and is conducted by a qualified team from outside the home district that is not involved in the day-to-day production of the project/product. ATR teams will be comprised of senior USACE personnel and may be supplemented by outside experts as appropriate. The ATR team lead will be from outside the home MSC. The ATR is intended to be on going throughout product development, using a team concept, not a cumulative process performed at the end.

a. Products to Undergo ATR. ATR reviews will be conducted separately for each product. The Chicago District will maintain the same ATR reviewer for each product if their discipline is required for the product.

The ATR team will review the following documents:

(1) Comprehensive Efficacy Study and Integrated Environmental Assessment (EA)

(2) Plans and specifications for Permanent Barrier I
   (a) Site Prep B for installation of electrodes and parasitic (in-water activities)
   (b) Site Prep C for completion of the roadwork and relocation of utility poles; power supply
   (c) Supply and installation of Barrier I Electronics
   (d) Building
(3) Permanent Barrier I EA
(4) Plans and specifications for Barrier II Electrical Upgrades

ATR has been completed on the following products:
(1) Efficacy Interim Report I – December 2009
(2) Efficacy Interim Report III – May 2010
(3) Efficacy Interim Report IIIA – April 2010
(4) Barrier IIA design – September 2004
(5) Barrier IIB design – June 2009
(6) Site Security – April 2012
(7) Barrier IIA Improvements – June 2012
(8) Permanent Barrier I Site Prep A – July 2012

b. Required ATR Team Expertise. ATR teams will comprise senior USACE personnel (Regional Technical Specialists (RTS), Subject Matter Expect (SME), 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. The ATR disciplines will be assembled during the development of the Quality Control Plan for each study and product. A list of the ATR disciplines is provided in Attachment 1. The chief criterion for being a member of the ATR team is knowledge of the technical discipline and relevant experience.

c. 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, policy, guidance, or procedure that has not be 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 the reporting officers 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, including any vertical team coordination

(the vertical team includes the district, RMO, MSC, and HQUSACE), and the agreed upon resolution. If an ATR concern cannot be satisfactorily resolved between the ATR team and the PDT, it will be elevated to the vertical team for further resolution in accordance with the policy issue resolution process described in either ER 1110-1-12 or ER 1105-2-100, Appendix H, as appropriate. Unresolved concerns can be closed in DrChecks with a notation that the concern has been elevated to the vertical team for resolution.

At the conclusion of each ATR effort, the ATR team will prepare a Review Report summarizing the review. Review Reports will be considered an integral part of the ATR documentation and shall:

- Identify the document(s) reviewed and the purpose of the review;
- Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
- Include the charge to the reviewers;
- Describe the nature of their review and their findings and conclusions;
- Identify and summarize each unresolved issue (if any); and
- Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and dissenting views.

ATR may be certified when all ATR concerns are either resolved or referred to the vertical team for resolution and the ATR documentation is complete. The ATR Lead will prepare a Statement of Technical Review certifying that the issues raised by the ATR team have been resolved (or elevated to the vertical team). A Certification of ATR should be completed, based on work reviewed to date, draft report, and final report. A Certification of ATR is included in Attachment 2.

7. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)

IEPR may be required for decision documents under certain circumstances. 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. A risk-informed decision, as described in EC 1165-2-214, is made as to whether IEPR is appropriate. IEPR panels will consist of independent, recognized experts from outside of the USACE in the appropriate disciplines, representing a balance of areas of expertise suitable for the review being conducted. There are two types of IEPR:

- Type I IEPR. Type I IEPR reviews are managed outside the USACE and are conducted on project studies. Type I IEPR panels assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, economic analysis, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, models used in the evaluation of environmental impacts of proposed projects, and biological opinions of the project study. Type I IEPR will cover the entire decision document or action and will address all underlying engineering, economics, and environmental work, not just one aspect of the study. For decision documents where a Type II IEPR (Safety Assurance Review) is anticipated during project implementation, safety assurance shall also be addressed during the Type I IEPR per EC 1165-2-214.

- Type II IEPR. Type II IEPR, or Safety Assurance Review (SAR), are managed outside the USACE and are conducted on design and construction activities for hurricane, storm, and flood risk management projects or other projects where existing and potential hazards pose a significant threat to human life. Type II IEPR panels will conduct reviews of the design and construction activities prior to initiation of physical construction and, until construction activities are completed, periodically thereafter on a regular schedule. The reviews shall consider the adequacy, appropriateness, and acceptability of the design and construction activities in assuring public health safety and welfare.

a. Decision on Type I IEPR. Type I IEPR is recommended for the Comprehensive Efficacy Report. Safety issues related to ground current, EMF and navigation should be addressed in addition to the review of the Comprehensive Efficacy Study.

b. Products to Undergo Type I IEPR. The Comprehensive Efficacy Study including the safety issues, ground current, EMF and navigation safety issues will be subject to IEPR. While current estimated project costs for recommendations in combined Efficacy Studies does not exceed $45M, the cost of the entire CSSC Barriers project is approximately $220M. The issues to be reviewed will focus on the design of the solution to address the efficacy of the barriers project, including the evaluation and recommendation of Risk Reduction Measures as relates to ANS species, in addition to the safety assurance review.

A Type I IEPR was conducted on the eDNA Science and Methodology. The final agency responses were submitted on 18 March 2011.

c. Documentation of Type I IEPR. The IEPR panel will be selected and managed by an Outside Eligible Organization (OEO) per EC 1165-2-214, Appendix D. Panel comments will be compiled by the OEO and should address the adequacy and acceptability of the economic, engineering and environmental methods, models, and analyses used. IEPR comments should generally include the same four key parts as described for ATR comments in Section 4.c above. The OEO will prepare a final Review Report that will accompany the publication of the final decision document and shall:

- Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
- Include the charge to the reviewers;
- Describe the nature of their review and their findings and conclusions; and
- Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and dissenting views.

The final Review Report will be submitted by the OEO no later than 60 days following the close of the public comment period for the draft decision document. USACE shall consider all recommendations contained in the Review Report and prepare a written response for all recommendations adopted or not adopted. The final decision document will summarize the Review Report and USACE response. The Review Report and USACE response will be made available to the public, including through electronic means on the internet.

d. Decision on Type II IEPR. In accordance with EC 1165-2-214 a Type II IEPR (SAR) shall be conducted on the design and construction activities for the Fish Barrier project. This applies to new projects

and to the major repair, rehabilitation, replacement, or modification of existing facilities. Type II IEPR will be performed on all the barrier design products and Operations and Maintenance activities of the Barriers.

e. Products to Undergo Type II IEPR. Type II IEPR will be performed on the following:

(1) Plans and specifications for Permanent Barrier I
  (a) Site Prep B for installation of electrodes and parasitics (in-water activities)
  (b) Site Prep C for completion of the roadwork and relocation of utility poles; power supply
(c) Supply and installation of Barrier I Electronics
(d) Barrier I Building
(2) Operations and Maintenance Plan of the Barriers
(3) Barrier II Electrical Upgrades

f. Required Type II IEPR Panel Expertise. The SAR Type II IEPR Review Team will be established in consultation with the RMC, and will comprise of independent, recognized experts from outside of the USACE in the appropriate disciplines, representing a balance of areas of expertise suitable for the review being conducted. The Review Team will be selected based on their technical qualifications and experience. The Review Team will be able to evaluate whether the interpretation of analysis and conclusions based on analysis are reasonable. The Review Team will be given the flexibility to bring important issues to the attention of decision makers. However, the Review Team will be instructed to not make a recommendation on whether a particular alternative should be implemented, as the Chief of Engineers is ultimately responsible for the final decision on a planning or reoperations study. The Review Team may, however, offer their opinion as to whether there are sufficient analyses upon which to base a recommendation. The Review Team will have experience in design and construction of projects similar in scope to the Project. The Review Team shall be registered professional engineers in the United States, or similarly credentialed in their home country. The Review Team members must also have engineering degrees. A Master's degree in engineering is preferable, but not required, as hands-on relevant engineering experience in the listed disciplines is more important. The Review Team members shall have a minimum of 7-10 years experience and responsible charge of engineering work. See ATTACHMENT 1 for the required experience in the required disciplines.

g. Documentation of Type II IEPR. Dr Checks review software will be used to document IEPR comments and aid in the preparation of the Review Report. Comments should address the adequacy and acceptability of the economic, engineering and environmental methods, models, and analyses used. IEPR comments should generally include the same four key parts as described for ATR comments in Section 3. The IEPR team will be responsible for compiling and entering comments into DrChecks. The team will prepare a final Review Report that will accompany the publication of the final design documents and shall:

- Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
- Include the charge to the reviewers;
- Describe the nature of their review and their findings and conclusions; and
- Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and

dissenting views.

8. 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 during throughout the study and P&S phase of the products. Quality checks and reviews occur during the development process, and are carried out as a routine management practice. The schedule of the PDT review of the design products will be determined during the development of the product Quality Control Plans.

b. ATR Schedule and Cost. The estimated cost for the ATR study and design products is approximately $70,000 and $100,000 respectively. The product Quality Control Plan will include documentation of the estimate. The schedule for the ATR reviews will also be included in the product Quality Control Plan. Face-to-Face comment resolution meetings will be scheduled with the ATR team, if necessary.

ATR Milestones	
Comprehensive Efficacy Report	January 2013
Permanent Barrier I, Site Prep B 50%	December 2012
Permanent Barrier I, Site Prep B 100%	March 2013
Permanent Barrier I EA	April 2013
Permanent Barrier I, Site Prep C	June 2013
Permanent Barrier I, Building	September 2013
Plans and Specifications for Barrier II Electrical Upgrades	TBD

c. Type I IEPR Schedule and Cost. A Type I IEPR is scheduled for February 2013 with an estimated cost of $200,000. The SOW will be developed after the completion of the Comprehensive Efficacy Report.

d. Model Certification/Approval Schedule and Cost. The HEC-FDA model is an approved model. It is not anticipated that any other planning models will be utilized for the study.

e. Type II IEPR Schedule and Cost. The estimate cost for the Type II IEPR (SAR), including the costs for the RMO to administer and manage the review, is in the range of $200,000 to $300,000. The IEPR for the products listed have not been scheduled at this time. The review timeline will be scheduled with the RMO upon review and approval of this review plan. Face-to-Face comment resolution meetings will be scheduled with the IEPR team, if necessary.

Type II IEPR Milestones	
Permanent Barrier I, Site Prep B	TBD
Permanent Barrier I, Site Prep C	TBD
Permanent Barrier I, Electronics	TBD
Permanent Barrier I, Building	TBD
Operations and Maintenance of the Barriers	TBD
Barrier II Electrical Upgrades	TBD

9. POLICY AND LEGAL COMPLIANCE REIVEW

All decision documents 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. These reviews culminate in determinations that the recommendations in the reports and the supporting analyses and coordination comply with law and policy, and warrant approval or further recommendation to higher authority by the home MSC Commander. 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.

10. COST ENGINEERING DIRECTORY OF EXPERTISE (DX) REVIEW AND CERTIFICATION

All decision documents shall be coordinated with the Cost Engineering DX, located in the Walla Walla District. The DX will assist in determining the expertise needed on the ATR team and Type I IEPR and in the development of the review charge(s). The DX will also provide the Cost Engineering DX certification. The RMO is responsible for coordination with the Cost Engineering DX.

11. 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 resources 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 a 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 is still the responsibility of the users and is subject to DQC, ATR, and IEPR (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 commercial 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 (if required).

The PDT will coordinate approval of engineering models used beyond the planning phase of this project with the RMO. Additionally, scope of the Type II IEPR will include an evaluation of these models.

a. Planning Models. The following planning models are anticipated to be used:

Model Name and Version	Brief Description of the Model and How It Will Be Applied in the Study	Certification / Approval Status
HEC-FDA 1.2.4	The Hydrologic Engineering Center's Flood Damage Reduction Analysis (HEC-FDA) program provides the capability for integrated hydrologic engineering and economic analysis for formulating and evaluating flood risk management plans using	Certified

	risk-based analysis methods. HEC-FDA will be used to determine the likelihood of overtopping associated with varying levels of "protection" that would be achieved by constructing a berm, raising the existing road, or installing some other physical means to keep the ANS from bypassing the Barriers Project via the Des Plaines River. Risk factors will be utilized in combination with best professional judgment from SME on Asian Carp to determine acceptable levels of risk. HEC-FDA will utilize factors from the hydrologic and hydraulic models, as well as input based on the risk related to overtopping from fisheries in a Monte Carlo simulation. As for levee analysis, the HEC-FDA runs will assist the PDT in setting the final elevation of the protection based on an acceptable level of uncertainty.	

b. Engineering Models. The following engineering models are anticipated to be used:

Model Name and Version	Brief Description of the Model and How It Will Be Applied in the Study	Approval Status
HEC-RAS 4.0.	The Hydrologic Engineering Center's River Analysis System (HEC-RAS) program provides the capability to perform one-dimensional steady and unsteady flow river hydraulics calculations. The program was used for steady flow analysis to evaluate the future without- and with-project conditions along the Chicago Sanitary and Ship Canal. The modeling will be used to develop water surface profiles for with- and without project conditions for the purposes of overtopping associated risk analysis, and to address floodway permitting requirements. The PDT will also utilize existing HEC-2 models (FIS) for portions of the analysis.	HH&C CoP Preferred Model
CDEGS	The Current Distribution, Electromagnetic Fields, Grounding and Soil Structure Analysis (CDEGS) software was used to model different fish barrier operating scenarios and possible mitigations. Barriers 2A and 2B were evaluated in the Sep. 2010 Report. Permanent Barrier I was evaluated in the Feb. 2011 Report. The program was used to evaluate the existing and future electrical signal that will be introduced into the earth from the fish barrier system. The intent of the modeling is to verify the distance from the canal that an electrical signature can be detected, to evaluate the impacts of future fish barrier construction on the magnitude of the electrical signature and to evaluate how the mitigation strategies reduce the electrical potentials. CDEGS is commercially available and well used within the electrical engineering community for analyzing grounding system performance, cathodic protection systems, and effects of sinusoidal current or voltage source on	Pending

	grounded structures.	
COMSOL Multiphysics	COMSOL Multiphysics is a commercially available software package used to model a wide range of physics which include electromagnetics, heat transfer, fluid flow and solid mechanics. It is being used to model electromagnetic fields generated by the barriers and possible means to attenuate or shield against their propogation.	Pending
MATLAB	MATLAB is a commercially available software package used for numerical computation and visualization. For the barriers it is primarily used to support the design of the electrical systems.	Pending
PSpice	The Personal Simulation Program with Integrated Circuit Emphasis (PSpice) is a commercially available native analog and mixed-circuit and digital logic simulation program. For the barriers it is being used to support the design of the electrical systems.	Pending
SolidWorks	SolidWorks is a commercially available 3D mechanical computer aided design program that can model 3D structures, solids, and sheet metal components or assemblies. It is being used in mechanical design and fabrication to evaluate components for size, fit, strength, and ease of installation, and to provide visual representations.	Pending
TRACE 700 Load Design	TRACE 700 Load Design is commercially available software for modeling heating, ventilation, and air conditioning (HVAC) systems. It is being used to design the HVAC system for the Pemanent Barrier I building.	Pending

12. PUBLIC PARTICIPATION

The Chicago District intends that communication about the products will be an open and transparent process. However for patent reasons, some information may be proprietary and will not be open to public review. The District regularly provides updates to the various stakeholder groups, which include Federal, state, local and regional agencies, and subject matter experts. Some of these groups host sessions that are open to the general public. The Barrier Project Communication Plan provides for regular opportunities for information sharing with the public as well as opportunities for soliciting community input. The Review Plan will be posted on the District's web site, and the stakeholder groups will be notified of opportunities to provide input. Information available on the district's web site as relates to the Barriers Project will also be used to convey information on the Efficacy Study and design products.

13. REVIEW PLAN APPROVAL AND UPDATES

The LRD Commander is responsible for approving this Review Plan. The Commander's approval reflects vertical team input (involving district, MSC, RMO, and HQUSACE members) as to the appropriate scope and level of review for the decision document. Like the PMP, the Review Plan is a living document and may change as the study progresses. The home district is responsible for keeping the Review Plan up to date. Minor changes to the review plan since the last MSC Commander approval are documented in

Attachment 3. Significant changes to the Review Plan (such as changes to the scope and/or level of review) should be re-approved by the MSC Commander following the process used for initially approving the plan. The latest version of the Review Plan, along with the Commanders' approval memorandum, should be posted on the Home District's webpage. The latest Review Plan should also be provided to the RMO and home MSC.

14. REVIEW PLAN POINTS OF CONTACT

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

- Susanne Davis, Chief, Planning Branch, Chicago District, 312-846-5580
- Joseph Schmidt P.E., Chief, Design Branch, Chicago District, 312-846-5410
- Felicia Kirksey PMP, AIS Program Manager, Chicago District, 312-846-5556
- Charles Shea P.E., Project Manager, Chicago District, 312-846-5568
- Hank Jarboe, Great lakes and Ohio River Division, 513-684-6050
- Roger Zemba P.E., Senior Regional Engineer, Great lakes and Ohio River Division, 513-684-3018
- Thomas Bishop P.E, Senior Review Manager, Risk Management Center, 303-963-4556
- Michael Scuderi, LRD Account Manager, ECO PCX, 206-764-7205
- Jodi Creswell, Mississippi River Division, ECO-PCX, 309-794-5448

ATTACHMENT 1: TEAM ROSTERS

TABLE 2: Agency Technical Review Team Expertise	
ATR Team Disciplines	**Expertise Required**
ATR Lead	The ATR lead shall be a senior professional with extensive experience in preparing Civil Works decision documents and conducting ATR. The lead should also 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 (such as Planning, Economics, Environmental Resources, Electrical Engineer, Mechanical Engineer, Structural Engineer, etc).
Planning/Environmental Assessment	Review team lead will be a Subject Matter Expert (SME) or Regional Technical Specialist (RTS) in the field of aquatic ecosystem restoration in the Illinois River or Great Lakes Basins with an understanding of Aquatic Invasive Species.
Economic Analysis/Risk and Uncertainty	Team member(s) will be an expert in the field of Risk and Uncertainty, Navigation Economics and the use of HEC-FDA to look at exceedance probabilities. The team member should be a RTS or equivalent. Economics reviewers will be included for the Interim III and Final Efficacy Reviews.
NEPA Compliance	Team member will be an expert in the field of NEPA compliance and all appropriate laws and regulations, with extensive experience on a variety of Corps of Engineers projects. The team member should be a RTS or equivalent.
Fisheries	Team member will have expertise ichthyology/fisheries biology for Midwestern fisheries, including ANS, fish characteristics, T&E species, etc. including both riverine and Great Lakes fisheries. The team member should be a RTS or equivalent.
Electrical Engineering	The reviewer should either be a subject matter expert or a regional technical specialist with extensive knowledge of electrical in-water systems. The reviewer shall be a registered professional engineer.
Architect	The Architect shall be a senior architect with knowledge in mechanical and electrical layout designs as well as applicable building codes. The Architect shall be a licensed in the field.

Geotechnical Engineering	The Geotechnical Engineer shall be a senior engineer, an expert in the field of engineering, and have knowledge of advance engineering concepts, principles and practices of geotechnical engineering. The reviewer shall have thorough understanding of soil mechanics, subsurface investigation, groundwater hydrology and seepage, slope stability analyses, earthwork construction and other geotechnical applications. The geotechnical engineer shall be a licensed Professional Engineer.
Structural Engineering	The structural engineer shall be a senior engineer, an expert in the field of structural engineering, and have thorough knowledge of stability analyses and structural design of buildings. The structural engineer shall be familiar with current design software. The structural engineer shall be a licensed Professional Engineer and/or Structural Engineer.
Mechanical Engineering	The mechanical engineer shall be a senior engineer with a thorough knowledge of HVAC systems and other mechanical support systems for buildings and electrical generation. The mechanical engineer shall be a licensed Professional Engineer.
Cost Engineering	Cost_DX will provide a team member for the review of the Cost Estimates.
Real Estate	The real estate reviewer must be selected from the current Real Estate ATR roster and have expertise with ecosystem restoration and inland navigation projects.

[1]Reviewers of Efficacy Studies

TABLE 4: Independent External Peer Review Team	
IEPR Panel Members/Disciplines	**Expertise Required**
Fisheries	The Panel member should be an ichthyologist/fisheries biologist with extensive expertise related to Midwestern fisheries (both riverine and Great Lakes), ANS, and Asian Carp.
Environmental Compliance	The panel member should be an expert in environmental compliance and the development of NEPA documents.
Mechanical Engineer	Extensive experience in the analyses of mechanical system components as it relates to capacities, loads, and pressure requirements and safety factors. The mechanical engineer must have performed work in mechanical functions and system design and demonstrate knowledge in the operation and maintenance on the mechanical systems. The mechanical engineer shall have a working knowledge of all applicable USACE design criteria and industry building codes. The mechanical engineer shall also be a license Professional Engineer.
Electrical Engineer	Team member shall have extensive experience in the field of electrical engineering and knowledge of in-water electrical system designs. The electrical engineer must have at least 10-year experience in electrical design with knowledge of all USACE and industry electrical codes and standards. The electrical engineer shall demonstrate knowledge of mechanical and structural engineering principles to assure optimum integration of electrical systems within total design of structures and equipments. The electrical engineer shall be a license Professional engineer.
Structural Engineer	Extensive experience in the field of structural engineering. The Structural Engineer should be experienced in the stability analysis and structural design of vertical buildings including retaining walls. Structural Engineer should have a working knowledge of applicable Corps of Engineers design criteria as well as industry design criteria. The Structural Engineer shall be a licensed Professional Engineer.
Civil Engineer	Team member shall have extensive experience in the design, layout, and construction of vertical structures. The Civil Engineer should have a demonstrated knowledge regarding hydraulic structures, erosion control, earthwork, concrete placement, design of access roads, and relocation of underground utilities. The Civil Engineer shall be a licensed Professional Engineer, familiar with USACE regulations and industry building codes.

Vertical Team

The Vertical Team consists of members of the HQUSACE, ECO-PCX, Risk Management Center, and Great Lakes & Ohio River Division Offices. The Vertical Team plays a key role in facilitating execution of the project in accordance with the PMP. The Vertical Team is responsible for providing the PDT with Issue Resolution support and guidance as required. The Vertical Team will remain engaged seamlessly throughout the project via monthly telecoms as required and will attend In Progress Reviews and other key decision briefings as required. The District Liaison Pauline Thorndike, CELRD-PD-R, is the District PM's primary Point of Contact on the Vertical Team.

ATTACHMENT 2: ATR CERTIFICATION TEMPLATE

COMPLETION OF AGENCY TECHNICAL REVIEW

The Agency Technical Review (ATR) has been completed for the *<type of product>* for *<project name and location>*. 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 _____ Date _____
Name
ATR Team Leader
Office Symbol/Company

SIGNATURE _____ Date _____
Name
Project Lead/Quality Manager
Office Symbol

NA _____ Date _____
Name
Architect Engineer Project Manager[1]
Office Symbol

SIGNATURE _____ Date _____
Name
Review Management Office Representative
Office Symbol

CERTIFICATION OF AGENCY TECHNICAL REVIEW

Significant concerns and the explanation of the resolution are as follows: *Describe the major technical concerns and their resolution.*

As noted above, all concerns resulting from the ATR of the project have been fully resolved.

SIGNATURE _____ Date _____
Joseph J. Schmidt
Chief, Design Branch
CELRC-TS-D

SIGNATURE _____ Date _____
Susanne J. Davis
Chief, Planning Branch
CELRC-PM-PL

[1] Only needed if some portion of the ATR was contracted

ATTACHMENT 3: REVIEW PLAN REVISIONS

Revision Date	Description of Change	Page / Paragraph Number

ATTACHMENT 4: ACRONYMS AND ABBREVIATIONS

Term	Definition	Term	Definition
AFB	Alternative Formulation Briefing	NED	National Economic Development
ASA(CW)	Assistant Secretary of the Army for Civil Works	NER	National Ecosystem Restoration
ATR	Agency Technical Review	NEPA	National Environmental Policy Act
CAP	Continuing Authorities Program	O&M	Operation and maintenance
CSDR	Coastal Storm Damage Reduction	OMB	Office and Management and Budget
DPR	Detailed Project Report	OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
DQC	District Quality Control/Quality Assurance	OEO	Outside Eligible Organization
DX	Directory of Expertise	OSE	Other Social Effects
EA	Environmental Assessment	PCX	Planning Center of Expertise
EC	Engineer Circular	PDT	Project Delivery Team
EIS	Environmental Impact Statement	PAC	Post Authorization Change
EO	Executive Order	PMP	Project Management Plan
ER	Ecosystem Restoration	PL	Public Law
FDR	Flood Damage Reduction	QMP	Quality Management Plan
FEMA	Federal Emergency Management Agency	QA	Quality Assurance
FRM	Flood Risk Management	QC	Quality Control
FSM	Feasibility Scoping Meeting	RED	Regional Economic Development
GRR	General Reevaluation Report	RMC	Risk Management Center
HQUSACE	Headquarters, U.S. Army Corps of Engineers	RMO	Review Management Organization
IEPR	Independent External Peer Review	RTS	Regional Technical Specialist
ITR	Independent Technical Review	SAR	Safety Assurance Review
LRR	Limited Reevaluation Report	USACE	U.S. Army Corps of Engineers
MSC	Major Subordinate Command	WRDA	Water Resources Development Act

APPENDIX A: Electric Dispersal Barriers

Barrier I - also known as the *Demonstration Barrier,* is located in the CSSC at approximate river mile 296.5 in Romeoville, IL. It consists of twelve steel cables secured at the bottom of the canal. The upstream-to-downstream length of the barrier is 54 feet. Rapidly pulsed DC current is sent through the cables creating an electric field in the water that extends to the water surface. The field is designed to deter fish rather than kill them. It is weaker at the upstream and downstream ends and stronger in the center. As fish swim into the field they feel increasingly uncomfortable. When the sensation is too intense, the fish turns back in the direction from which it came. Operation of Barrier I began in April 2002 and currently operates at 1 volt per inch, with a pulse frequency of 5 Hertz, and a pulse length of 4 milliseconds. The equipment for controlling the electric pulses is housed in a building on the east side of the canal. The Demostration Barrier was designed and installed by the Smith-Rook Inc. (SRI) of Vancouver, Washington, based on their patented fish deterrent technology. Because of this patent, SRI remains under contract to provide Operations and Maintenance support. A telemetry system on the equipments allows LRC and SRI to monitor and operate the barrier remotely. Construction of the barrier was completed in January 2002.

At the request of a non-Federal sponsor, the Illinois Department of Natural Resources (IDNR), Chicago District initiated planning of a second, larger and more permanent barrier, Barrier II, in 2002. Barrier II was designed to be two independent barriers. This was done to provide redundancy, so that if one is off-line for maintenance, whether scheduled or unscheduled, the other can be operational. The two barriers are known as *Barrier IIA* and *Barrier IIB*. Each electrical barrier is similar in principle to the Demonstration Barrier, but both are larger than the Demonstration Barrier and able to generate more powerful electric fields over a larger area.

Barrier IIA - is located in the CSSC approximately 1,150 feet downstream of the Demonstration Barrier and was placed into service in April 2009 with operating setting at 1.0 volt per inch with a pulse frequency of 5 Hertz and a pulse length of 4 milliseconds. The operational settings were increased in August 2009, in response to a positive eDNA result upstream of the barrier, to 2.0 volts per inch, 15 Hertz, and 6.5 milliseconds. The electrode array consists of 32 electrodes over 130 feet upstream-to-downstream on the canal bottom. The array has two sub-parts known as the wide and narrow arrays. The narrow array extends over approximately 50 feet upstream-to-downstream in the canal and is where the maximum electric field strength of the barrier can be generated. The wide array extends over approximately 80 feet upstream-to-downstream, but can't generate field strengths as high as the narrow array. The wide array is downstream of the narrow array. Fish moving upstream will first encounter the wide array which should deter many of the fish. Any fish that proceeds through the wide array will encounter the stronger narrow array, which is currently operated at a level that is capable of stunning (rendering unconscious) most fish. Design and installation of Barrier IIA were completed by Smith-Root. QC and ITR for the design were completed by Smith-Root. ITR certification was completed on 24 September 2004. Construction of Barrier IIA was completed January 2006.

Retrofits are underway to improve the performance and reliability of Barrier IIA including, power quality improvements, transformer upgrades, extension of the east bank sidewalk, and access platform for the generators. This contract (Barrier IIA Improvements) was awarded in September 2012. DQC and ATR for the design features were completed. ATR certification was dated 20 June 2012.

Barrier IIB - is located in the CSSC approximately 800 feet downstream of the Demonstration Barrier and 220 feet upstream of Barrier IIA. Refer to Figure 3 below for the Barriers Layout Map. It has the same type, number, and spacing of electrodes as Barrier IIA. However, the on-land control building, electrical systems, and cooling systems incorporate improvements identified from lessons learned from operation of Barrier IIA. Design of Barrier IIB was completed by the Chicago District with coordination with Smith-Root for the design and installation of the electrical components and operating system. QC and ITR on the design were completed. ITR certification was completed on 1 June 2009. Barrier IIB construction was completed and became operational in April 2011.

Site Security - The purpose of this effort is to assess the current security situation and design system upgrades to enhance the current 24/7 manned operations presence. This design analysis serves to define the new Electronic Security System (ESS) and Physical Security System (PSS). The proposed new security system will combine physical and electronic attributes into one system to provide an appropriate cohesive and reliable security system. DQC and ATR were completed on this product. ATR certificated was completed on 25 April 2012. The contract for installation of the site security system was awarded in May 2012 and work is scheduled for completion in 2013.

APPENDIX B: Efficacy Study

Interim I - *Dispersal Barrier Bypasses* proposed the construction of measures to prevent Asian carp from bypassing the electrical barrier system during flood events on the Des Plaines River and through culverts in the I&M Canal in the report approved by the ASA (CW) in January 2010. The Des Plaines River and Illinois & Michigan (I&M) Canal run parallel to the CSSC to the west and east, respectively. In flood events, water from the Des Plaines River could potentially flow overland and into the CSSC upstream of the barriers. To minimize the probability of fish bypassing the electric barriers via overland flow, a 13 mile long barrier was constructed along the Des Plaines River, consisting of fencing and concrete barricades. Flow in the I&M Canal is often discontinuous, but at times flow does exist throughout the canal. To reduce the risk of fish migration through the I&M canal past the barriers, the canal was filled with stone rip-rap at the location of a natural flow divide west of I-355 in Lemont. ITR was completed in December 2009. . Construction was completed in October 2010.

Interim IIA/Interim IIB - *Optimal Operating Parameters* - The electric barriers operate by creating a waterborne pulsed direct current electric field in the Chicago Sanitary and Ship Canal. The barrier electric field can be characterized by the equipment parameters of frequency, length (duration) and amplitude (voltage) of the direct current pulses. The objective of Interim II is to recommend the optimal combination of these parameters to maximize fish deterrence. The report made this recommendation by evaluating the results of laboratory testing on operating parameters completed at USACE-ERDC, along with the potential safety impacts of altering operating parameters, the potential short- and long-term operation and maintenance costs of altering operating parameters, and information on the location of different sizes of bighead and silver carp (as barrier effectiveness varies with fish size). The Interim IIA report was approved by LRD and released in September 2011. The operating parameters of Barrier II were changed in October 2011 as a result of this report.

Interim III - *Modified Structures and Operations, Chicago Area Waterways* evaluated how potential changes in the operation of the Chicago-area locks, dams and associated structures might reduce the risk of Asian carp migrating into Lake Michigan. The report includes an assessment of operational changes that could be implemented as needed by agencies that are responsible for fish management efforts such as electro-fishing and intensive commercial fishing efforts by the U.S. Fish and Wildlife (USFWS) and Illinois Department of Natural Resources (IDNR). ATR was completed on the report in May 2010. The Interim III Report was approved by the ASA(CW) in July 2010. Installation of bar screens on the sluice gates at T.J. O'Brien Lock and Dam, recommended in the report, was completed in January 2011.

Interim IIIA - *Fish Dispersal Deterrents, Illinois and Chicago Area Waterways* recommended construction of a demonstration acoustic bubble strobe (ABS) barrier in the Des Plaines River downstream of the Brandon Road Lock & Dam. ATR was completed on the report in April 2010. The implementation of a demonstration behaviorial barrier was approved by the ASA(CW) however, funding has been prioritized to complete design and construction of the electric barriers, barrier operations and ongoing monitoring and telemetry. The Interim IIIA Report was approved by the ASA(CW) in July 2010.

The Comprehensive Efficacy Report will include a summary of all interim reports completed to dateand will include a summary of the efforts underway by the other agencies making up the Asian

Carp Regional Coordinating Committee. The report will document the improvements made to increase the efficacy of the electric barriers. Further, the report will contain evaluation of additional risk reduction measures to specifically address the open pathways to Lake Michigan: the Grand Calumet River which outlets at the Indiana Harbor and Canal; and the Little Calumet River, which outlets at Burns Ditch. The Comprehensive Efficacy Report is currently scheduled for completion in FY13.

Interim reports I, III and IIIA included integrated environmental assessments. Each of the Interim Reports were subject to District Quality Control Review, Agency Technical Review and Policy Compliance Review. The Comprehensive Efficacy Report will undergo Type I Independent External Peer Review.

REVIEW PLAN

for the

Decision Document, Implementation Phase, and Operations and Maintenance

of the

Chicago Sanitary & Ship Canal Aquatic Nuisance Species Dispersal Barriers
Chicago District

MSC Approval Date: *21 February 2013*
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US Army Corps
of Engineers ®

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1. PURPOSE AND REQUIREMENTS

a. Purpose. This Review Plan defines the scope and level of peer review for the Barrier Efficacy, Risk Reduction Study and integrated environmental assessment, design, construction, operation, and maintenance of the Chicago Sanitary and Ship Canal (CSSC) Aquatic Nuisance Species Dispersal Barriers located in Romoeville, IL.

b. References

(1) EC 1165-2-214, Civil Works Review Policy, 15 Dec 2012
(2) EC 1105-2-412, Assuring Quality of Planning Models, 31 Mar 2011
(3) ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment #1, 20 Nov 2007
(4) ER 1110-1-12, Quality Management, 30 Sep 2006
(5) CSSC Aquatic Nuisance Species Dispersal Barrier Project Management Plan, 30 September 2011
(6) Great Lakes and Ohio River Division, Chicago District Program Management Plan for Quality Management Program, 24 March 2008
(7) Dispersal Barrier Efficacy Quality Control Plan September 2009
(8) CSSC Permanent Electrical Dispersal Barrier I Quality Control Plan, 3 October 2011

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). The EC outlines four general levels of review: District Quality Control/Quality Assurance (DQC), Agency Technical Review (ATR), Independent External Peer Review (IEPR), and Policy and Legal Compliance Review. In addition to these levels of review, decision documents are subject to cost engineering review and certification (per EC 1165-2-214) and ensuring that planning models and analysis are compliant with Corps policy, theoretically sound, computationally accurate, transparent, described to address any limitations of the model or its use, and documented in study reports (per EC 1105-2-412).

(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 a Quality Control Plan (QCP) and Quality Assurance Plan (QAP) 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 are 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) Regional Buisness Process/District Quality Control addresses the conduct and documentation of this fundamental level of review.

(2) Agency Technical Review (ATR). EC 1165-2-214 requires that USACE Risk Management Center (RMC) shall serve as the RMO for Dam Safety Modifications projects and Levee Safety Modification projects. For all other projects, the MSC shall serve as the RMO. 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 assure 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.

(4) 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. REVIEW MANAGEMENT ORGANIZATION (RMO) COORDINATION

The RMO is responsible for managing the overall peer review effort described in this Review Plan. The RMO for decision documents is typically either a Planning Center of Expertise (PCX) or the Risk Management Center (RMC), depending on the primary purpose of the decision document. The RMO for the peer review effort described in this Review Plan related to the Efficacy Studies is the Planning Center of Expertise for Ecosystem Restoration (ECO-PCX).The RMO for ATR reviews shall be the MSC. The RMO for the Type II IEPR shall be USACE Risk Management Center (RMC).

The RMO will coordinate with the Cost Engineering Directory of Expertise (DX) for the decision documents to ensure the appropriate expertise is included on the review teams to assess the adequacy of cost estimates, construction schedules and contingencies.

The home district will post the approved review plan on its public website. A copy of the approved review plan (and any updates) will be provided to the ECO-PCX and RMC.

3. PROJECT INFORMATION

The CSSC Dispersal Barriers project consists of the electrical barriers, the Efficacy Study, and Asian Carp location monitoring.

a. **Electric Barriers.** The Electric Dispersal Barriers deter the inter-basin establishment of Asian carp and other aquatic nuisance species via the Chicago Sanitary and Ship Canal (CSSC) through pulsed direct current in the water from steel electrodes secured to the bottom of the canal that discourages fish from crossing. The Barrier system currently consists of three separate barriers.

The first dispersal barrier was authorized as a demonstration project under section 1202(i)(3) of the Aquatic Nuisance Prevention and Control Act P.L. 101-646, and has been in operation since April 2002. The second dispersal barrier was initially implemented by Section 1135 of WRDA 1986, P.L. 99-662, as further authorized by section 345 of the District of Columbia Appropriations Act of 2005, P.L. 108-335. Barrier II is a set of two barriers, Barrier IIA and Barrier IIB. Barrier IIA has been in operation since April 2009, Barrier IIB has been operational since April 2011. Construction of a fourth barrier, Permanent Barrier I, was authorized in Section 3061(b)(1)(A) of the Water Resources Development Act (WRDA) of 2007, and is scheduled to begin in 2013. A map depicting the layout of the barrier system is provided as Figure 1. A detailed description of the electric barriers is provided as Appendix A.

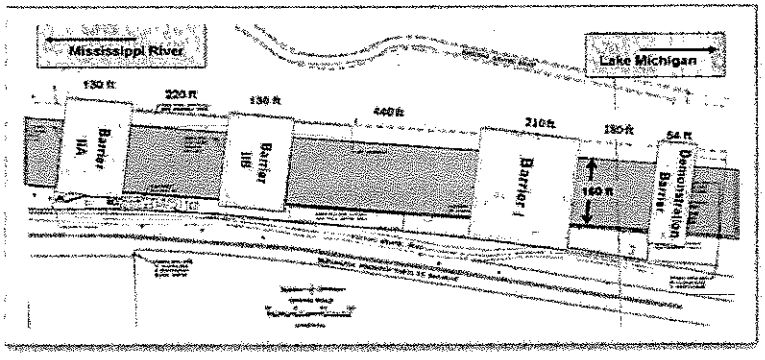

Figure 1 - Barrier Layout

b. **Efficacy Stucy (Decision Documents).** The Efficacy Study was originally authorized in Section 3061(b)(1)(D) of WRDA 2007. Additional authority is included in Section 105 of the Energy and Water Development and Related Agencies Appropriations Act for FY 2012 Section 105 states: "During the fiscal year period covered by this Act, the Secretary of the Army is authorized to implement measures recommended in the efficacy study authorized under Section 3061 of the Water Resources Development Act of 2007, (121 Stat. 1121) or in interim reports, which such modifications or emergency measures as the Secretary of the Army determine to be appropriate, to prevent aquatic nuisance species from dispersing into the Great Lakes by way of any hydrologic connection between the Great Lakes and the Mississippi River Basins."

The efficacy Study evaluates hazards and potential risk reductions associated with the Barriers Project. The current plan is for the efficacy study to be presented in five separate reports: *Dispersal Barrier Bypasses (Interim I); Optimal Operating Parameters (Interim IIA); Modified Structures and Operations (Interim III); Fish Dispersal Deterrents (Interim IIIA)* and the *Comprehensive Efficacy Report.* A detailed description of these reports is provided in Appendix B.

c. **Asian Carp Location Monitoring.** Asian carp location monitoring is being conducted by an interagency working group using monitoring tools such as traditional netting, emitting an electric current from a boat and netting the stunned fish (electrofishing), extracting genetic material from water samples to identify the presence of Asian carp DNA in an area (eDNA), observing real-time fish behavior from an underwater acoustic camera (DIDSON) and tracking tagged fish through underwater stationary and mobile receivers (telemetry). Members of this interagency group, referred to as the Monitoring and Rapid Response Work Group (MRRWG), include U.S. Fish and Wildlife Service, Illinois Department of Natural Resources, Great Lakes Fisheries Commission, USACE and others.

4. PRODUCT DESCRIPTIONS

Products planned and currently under development are described below. Please refer to the appendices for a description of completed products.

a. **Decision Document.** *The Comprehensive Efficacy Report* will include a summary of all interim reports completed to date and will include a summary of the efforts underway by the other agencies making up the Asian Carp Regional Coordinating Committee. The report will document the improvements made to increase the efficacy of the electric barriers. Further, the report will contain evaluation of additional risk reduction measures to specifically address the open pathways to Lake Michigan: the Grand Calumet River which outlets at the Indiana Harbor and Canal; and the Little Calumet River, which outlets at Burns Ditch. The Comprehensive Efficacy Report is currently scheduled for completion in FY13. The PDT may choose to develop additional efficacy studies as new issues arise and opportunities for improved performance of the Barriers Project become available. If additional interim reports are identified, this review plan will be updated and submitted for re-approval. Current projected cost of the Barriers Project is approximately $220M.

b. **Plans and Specifications.**

Permanent Barrier I - In 2007 Congress authorized construction of a permanent Barrier I facility. The permanent Barrier I will be similar to Barrier II in capacity and design, and will provide the necessary backup for the future barrier maintenance. The design of the permanent barrier is underway and will be completed in several phases. The first contract, Site Prep A, was awarded in September 2012 and includes roadwork and site grading in preparation for the construction of the permanent building. Additional contracts to be awarded in FY 13 include Site Prep B for installation of electrodes and parasitics (in-water activities); Site Prep C for completion of the roadwork and relocation of utility poles; power supply; and the supply and installation of Barrier I Electronics. A contract to construct the building that will house the electronics is scheduled for award in FY 14. Similar to Barrier IIB, design will be completed by the Chicago District with coordination with Smith-Root for the design and installation of the electrical components and operating system. DQC and ATR were completed for the Site Prep A with ATR certification dated on 31 July 2012. DQC and ATR for the projects are on-going or will be completed for the remaining products discussed above.

Barrier II Electrical Upgrades – Studies are underway to determine the cause of power quality issues at Barriers IIA and IIB, and to develop solutions to address the issue. An A/E firm, Black and Veatch, is currently under contract to perform this investigation and develop plans and specifications for the solution. As part of their contract, Black and Veatch will conduct its own Quality Control. USACE will conduct the ATR, which is scheduled for completion in April 2013.

c. **Operations and Maintenance.** The electric barriers are designated to be active and continuously operating, 24 hours a day, 7 days a week. The electric and structural barriers must be maintained to insure their continued effectiveness. The Operations Section (TS-C-T) supervises and administers a contract to provide support for a number of operations & maintenance (O&M) activities including, but not limited to, the following:

- 24/7 Caretaker Services – around-the-clock caretaker services for the electric barriers and all related facilities and equipment.
- O&M Support Contracts – TS-C-T supervises and administers contracts with Smith-Root, Inc., the contractor who designed the electronics for each barrier, to support in operating and maintaining the barriers.
- Spill Prevention, Control and Countermeasures (SPCC) Plan – A SPCC plan for the Dispersal Barriers site is currently being finalized. The Plan will be used to help, prepare and respond quickly and safely to hazardous spill incidents. If implemented appropriately, the plan will ensure an effective, comprehensive response to prevent injury or damage to the facility, support staff, public, and environment during continuous operation of the barriers.
- Barrier Life Cycle Investment Plan – This plan details the expected life span of critical barrier components such as electrodes and pulsers, and estimates the cost of replacement over the life of the project. This plan is intended to be a comprehensive examination of long term project funding requirements.
- Power quality/harmonics investigation – At Barrier IIA, the local electrical utility, ComEd, has indicated that flickering or power disturbances are occurring on the power grid within the vicinity of the Fish Barrier. The Chicago District and Smith-Root determined that barrier operations may be pushing power back into the power grid. This is defined as harmonics. A study is underway to determine why the power disturbances are occurring and how to reduce or eliminate them. The harmonics testing was done primarily to determine why the generators cannot support the operation of two pulsers simultaneously. The flicker issue may be addressed as a side effect of the study.

d. **Other.**

Hydroacoustics – Is a monitoring technology that can detect fish in a water column. A hydroacoutics systems will be designed, tested, and installed around the electric barriers that will allow monitoring to determine whether fish (if any) are crossing over the barriers. A pilot program is currently under development to research available systems and determine which is most suitable for application at the Barriers. The pilot program will be initiated in FY13, with design and installation of a more permanent system to follow in FY14.

Monitoring Summary Reports - The MRRWG publishes a report each year summarizing the results of Asian carp location monitoring efforts. As a member of the workgroup, the USACE team will prepare a summary of its work on the telemetry and eDNA programs.

e. **Factors Affecting the Scope and Level of Review.** Barrier IIA and IIB are completed and operational. However, there are few issues that are being addressed with the operations and maintenance of the Barriers.

(1) The Efficacy Study is likely to include significant challenges to the PDT because of the high level of concern regarding the potential bypasses of the Barriers Project, as well as the high level of interest the project has elicited from other federal, state, local agencies and the public.

(2) The Electric Barriers Project can provide protection to the significant environmental and economic resources of the Great Lakes. The passage of the Asian Carp (or other ANS) into the Great Lakes could pose a very high risk to one of the most significant environmental resources in the United States.

(3) While the use of electric dispersal barriers is not wide spread, the current installations in the CSSC are not the only examples of this technology world-wide. The PDT is considering many different types of controls and technologies to enhance the performance of the system. Some applications may be new and novel for the current situation.

(4) A Type I IEPR is recommended for the Comprehensive Efficacy Study. A determination on the need for Type I IEPR on any subsequent Efficacy studies will be coordinated with RMO and the ECO-PCX.

(5) There is a high level of public concern related to the potential for Asian carp to become established in the Great Lakes. On July 19, 2010, the states of Michigan, Minnesota, Ohio, Wisconsin, & Pennsylvania filed suit against the Corps & MWRD in the U.S. District Court for the Northern District of Illinois, Case No. 1:10-cv-04457 requesting preliminary and permanent injunctive relief measures to prevent Asian Carp migration into the Great Lakes. The efficacy of the electric barriers and the timeline for the completion of GLMRIS were key issues in the litigation. The case was dismissed on December 10, 2012, but the plaintiffs filed an appeal two days later.

(6) Site Safety – There are three important safety concerns for operation of this project. The first is the potential risk of a person to fall in the water near the Barriers. The second concern is the ground stray currents while working near or around metallic objects in the vicinity of the barriers. The third concern is the exposure to electromagnetic fields. Various activities are being completed to identify risks and implement solutions to the operations of the barriers and modifications of the surrounding features to help reduce the risks.

(7) Barrier IIA Improvements –The operations and maintenance group is working with the design team to determine the retrofit activities to be performed on the barrier to improve the access, safety, performance and reliability.

(8) Efficacy Studies – The results and recommendations of the studies may affect the operations and maintenance of Barrier I, Barrier IIA and IIB.

(9) Barrier Design and Operations – the recommendations inherent in the on-going and future studies may affect the design of Barrier I and operations of the all the barriers.

(10)Real Estate – The electrical barriers are located on properties currently owned by the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC), BSNF Railroad and others. Permanent or long-term real estate arrangements are being made with the property owners and the outcome can affect the use of the property.

f. **In-Kind Contributions.** Products and analyses provided by non-Federal sponsors as in-kind services are subject to DQC, ATR, and IEPR. The Electric Barriers, Efficacy Studies and resulting facilities, and monitoring activities are 100% Federal.

5. DISTRICT QUALITY CONTROL (DQC)

All design and decision documents (including supporting data, analyses, environmental compliance documents, etc.) shall undergo DQC. DQC efforts will include the necessary expertise to address compliance with published Corps policy and will be performed on all work products of the project. DQC was performed on all of the completed projects and will be performed on all the remaining work products of the project.

a. **Documentation of DQC.** Comments and responses from peer and Chief's reviews for the studies and design products shall be documented and maintained in shared electronic folders. The design product PDT member checklist will be completed and signed by the Section Chiefs. All calculations will be checked and initialed by the reviewer.

b. **Products to Undergo DQC.** Each of the Efficacy Interim Reports is/was subject to Chicago District Quality Control processes. DQC shall be performed on all design products consistent with the Regional Business Processes.

6. AGENCY TECHNICAL REVIEW (ATR)

ATR is mandatory for all decision documents (including supporting data, analyses, environmental compliance documents, etc) and design products and will be in accordance with EC 1165-2-214. The objective of ATR is to ensure consistency 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 results in a reasonably clear manner for the public and decision makers. ATR is managed within USACE by the designated RMO and is conducted by a qualified team from outside the home district that is not involved in the day-to-day production of the project/product. ATR teams will be comprised of senior USACE personnel and may be supplemented by outside experts as appropriate. The ATR team lead will be from outside the home MSC. The ATR is intended to be on going throughout product development, using a team concept, not a cumulative process performed at the end.

a. **Products to Undergo ATR.** ATR reviews will be conducted separately for each product. The Chicago District will maintain the same ATR reviewer for each product if their discipline is required for the product.

The ATR team will review the following documents:

(1) Comprehensive Efficacy Study and Integrated Environmental Assessment (EA)

(2) Plans and specifications for Permanent Barrier I
   (a) Site Prep B for installation of electrodes and parasitic (in-water activities)
   (b) Site Prep C for completion of the roadwork and relocation of utility poles; power supply
   (c) Supply and installation of Barrier I Electronics
   (d) Building
(3) Permanent Barrier I EA
(4) Plans and specifications for Barrier II Electrical Upgrades

ATR has been completed on the following products:
(1) Efficacy Interim Report I – December 2009
(2) Efficacy Interim Report III – May 2010
(3) Efficacy Interim Report IIIA – April 2010
(4) Barrier IIA design – September 2004
(5) Barrier IIB design – June 2009
(6) Site Security – April 2012
(7) Barrier IIA Improvements – June 2012
(8) Permanent Barrier I Site Prep A – July 2012

b. **Required ATR Team Expertise.** ATR teams will comprise senior USACE personnel (Regional Technical Specialists (RTS), Subject Matter Expect (SME), 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. The ATR disciplines will be assembled during the development of the Quality Control Plan for each study and product. A list of the ATR disciplines is provided in Attachment 1. The chief criterion for being a member of the ATR team is knowledge of the technical discipline and relevant experience.

c. **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, policy, guidance, or procedure that has not be 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 the reporting officers 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, including any vertical team coordination

(the vertical team includes the district, RMO, MSC, and HQUSACE), and the agreed upon resolution. If an ATR concern cannot be satisfactorily resolved between the ATR team and the PDT, it will be elevated to the vertical team for further resolution in accordance with the policy issue resolution process described in either ER 1110-1-12 or ER 1105-2-100, Appendix H, as appropriate. Unresolved concerns can be closed in DrChecks with a notation that the concern has been elevated to the vertical team for resolution.

At the conclusion of each ATR effort, the ATR team will prepare a Review Report summarizing the review. Review Reports will be considered an integral part of the ATR documentation and shall:

- Identify the document(s) reviewed and the purpose of the review;
- Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
- Include the charge to the reviewers;
- Describe the nature of their review and their findings and conclusions;
- Identify and summarize each unresolved issue (if any); and
- Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and dissenting views.

ATR may be certified when all ATR concerns are either resolved or referred to the vertical team for resolution and the ATR documentation is complete. The ATR Lead will prepare a Statement of Technical Review certifying that the issues raised by the ATR team have been resolved (or elevated to the vertical team). A Certification of ATR should be completed, based on work reviewed to date, draft report, and final report. A Certification of ATR is included in Attachment 2.

7. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)

IEPR may be required for decision documents under certain circumstances. 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. A risk-informed decision, as described in EC 1165-2-214, is made as to whether IEPR is appropriate. IEPR panels will consist of independent, recognized experts from outside of the USACE in the appropriate disciplines, representing a balance of areas of expertise suitable for the review being conducted. There are two types of IEPR:

- Type I IEPR. Type I IEPR reviews are managed outside the USACE and are conducted on project studies. Type I IEPR panels assess the adequacy and acceptability of the economic and environmental assumptions and projections, project evaluation data, economic analysis, environmental analyses, engineering analyses, formulation of alternative plans, methods for integrating risk and uncertainty, models used in the evaluation of environmental impacts of proposed projects, and biological opinions of the project study. Type I IEPR will cover the entire decision document or action and will address all underlying engineering, economics, and environmental work, not just one aspect of the study. For decision documents where a Type II IEPR (Safety Assurance Review) is anticipated during project implementation, safety assurance shall also be addressed during the Type I IEPR per EC 1165-2-214.

- Type II IEPR. Type II IEPR, or Safety Assurance Review (SAR), are managed outside the USACE and are conducted on design and construction activities for hurricane, storm, and flood risk management projects or other projects where existing and potential hazards pose a significant threat to human life. Type II IEPR panels will conduct reviews of the design and construction activities prior to initiation of physical construction and, until construction activities are completed, periodically thereafter on a regular schedule. The reviews shall consider the adequacy, appropriateness, and acceptability of the design and construction activities in assuring public health safety and welfare.

a. **Decision on Type I IEPR.** Type I IEPR is recommended for the Comprehensive Efficacy Report. Safety issues related to ground current, EMF and navigation should be addressed in addition to the review of the Comprehensive Efficacy Study.

b. **Products to Undergo Type I IEPR.** The Comprehensive Efficacy Study including the safety issues, ground current, EMF and navigation safety issues will be subject to IEPR. While current estimated project costs for recommendations in combined Efficacy Studies does not exceed $45M, the cost of the entire CSSC Barriers project is approximately $220M. The issues to be reviewed will focus on the design of the solution to address the efficacy of the barriers project, including the evaluation and recommendation of Risk Reduction Measures as relates to ANS species, in addition to the safety assurance review.

   A Type I IEPR was conducted on the eDNA Science and Methodology. The final agency responses were submitted on 18 March 2011.

c. **Documentation of Type I IEPR.** The IEPR panel will be selected and managed by an Outside Eligible Organization (OEO) per EC 1165-2-214, Appendix D. Panel comments will be compiled by the OEO and should address the adequacy and acceptability of the economic, engineering and environmental methods, models, and analyses used. IEPR comments should generally include the same four key parts as described for ATR comments in Section 4.c above. The OEO will prepare a final Review Report that will accompany the publication of the final decision document and shall:

   - Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
   - Include the charge to the reviewers;
   - Describe the nature of their review and their findings and conclusions; and
   - Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and dissenting views.

   The final Review Report will be submitted by the OEO no later than 60 days following the close of the public comment period for the draft decision document. USACE shall consider all recommendations contained in the Review Report and prepare a written response for all recommendations adopted or not adopted. The final decision document will summarize the Review Report and USACE response. The Review Report and USACE response will be made available to the public, including through electronic means on the internet.

d. **Decision on Type II IEPR.** In accordance with EC 1165-2-214 a Type II IEPR (SAR) shall be conducted on the design and construction activities for the Fish Barrier project. This applies to new projects

and to the major repair, rehabilitation, replacement, or modification of existing facilities. Type II IEPR will be performed on all the barrier design products and Operations and Maintenance activities of the Barriers.

e. **Products to Undergo Type II IEPR.** Type II IEPR will be performed on the following:

(1) Plans and specifications for Permanent Barrier I
  (a) Site Prep B for installation of electrodes and parasitics (in-water activities)
  (b) Site Prep C for completion of the roadwork and relocation of utility poles; power supply
(c) Supply and installation of Barrier I Electronics
(d) Barrier I Building
(2) Operations and Maintenance Plan of the Barriers
(3) Barrier II Electrical Upgrades

f. **Required Type II IEPR Panel Expertise.** The SAR Type II IEPR Review Team will be established in consultation with the RMC, and will comprise of independent, recognized experts from outside of the USACE in the appropriate disciplines, representing a balance of areas of expertise suitable for the review being conducted. The Review Team will be selected based on their technical qualifications and experience. The Review Team will be able to evaluate whether the interpretation of analysis and conclusions based on analysis are reasonable. The Review Team will be given the flexibility to bring important issues to the attention of decision makers. However, the Review Team will be instructed to not make a recommendation on whether a particular alternative should be implemented, as the Chief of Engineers is ultimately responsible for the final decision on a planning or reoperations study. The Review Team may, however, offer their opinion as to whether there are sufficient analyses upon which to base a recommendation. The Review Team will have experience in design and construction of projects similar in scope to the Project. The Review Team shall be registered professional engineers in the United States, or similarly credentialed in their home country. The Review Team members must also have engineering degrees. A Master's degree in engineering is preferable, but not required, as hands-on relevant engineering experience in the listed disciplines is more important. The Review Team members shall have a minimum of 7-10 years experience and responsible charge of engineering work. See ATTACHMENT 1 for the required experience in the required disciplines.

g. **Documentation of Type II IEPR.** Dr Checks review software will be used to document IEPR comments and aid in the preparation of the Review Report. Comments should address the adequacy and acceptability of the economic, engineering and environmental methods, models, and analyses used. IEPR comments should generally include the same four key parts as described for ATR comments in Section 3. The IEPR team will be responsible for compiling and entering comments into DrChecks. The team will prepare a final Review Report that will accompany the publication of the final design documents and shall:

- Disclose the names of the reviewers, their organizational affiliations, and include a short paragraph on both the credentials and relevant experiences of each reviewer;
- Include the charge to the reviewers;
- Describe the nature of their review and their findings and conclusions; and
- Include a verbatim copy of each reviewer's comments (either with or without specific attributions), or represent the views of the group as a whole, including any disparate and

dissenting views.

8. 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 during throughout the study and P&S phase of the products. Quality checks and reviews occur during the development process, and are carried out as a routine management practice. The schedule of the PDT review of the design products will be determined during the development of the product Quality Control Plans.

b. **ATR Schedule and Cost.** The estimated cost for the ATR study and design products is approximately and respectively. The product Quality Control Plan will include documentation of the estimate. The schedule for the ATR reviews will also be included in the product Quality Control Plan. Face-to-Face comment resolution meetings will be scheduled with the ATR team, if necessary.

ATR Milestones	
Comprehensive Efficacy Report	January 2013
Permanent Barrier I, Site Prep B 50%	December 2012
Permanent Barrier I, Site Prep B 100%	March 2013
Permanent Barrier I EA	April 2013
Permanent Barrier I, Site Prep C	June 2013
Permanent Barrier I, Building	September 2013
Plans and Specifications for Barrier II Electrical Upgrades	TBD

c. **Type I IEPR Schedule and Cost.** A Type I IEPR is scheduled for February 2013 with an estimated cost of . The SOW will be developed after the completion of the Comprehensive Efficacy Report.

d. **Model Certification/Approval Schedule and Cost.** The HEC-FDA model is an approved model. It is not anticipated that any other planning models will be utilized for the study.

e. **Type II IEPR Schedule and Cost.** The estimate cost for the Type II IEPR (SAR), including the costs for the RMO to administer and manage the review, is in the range of . The IEPR for the products listed have not been scheduled at this time. The review timeline will be scheduled with the RMO upon review and approval of this review plan. Face-to-Face comment resolution meetings will be scheduled with the IEPR team, if necessary.

Type II IEPR Milestones	
Permanent Barrier I, Site Prep B	TBD
Permanent Barrier I, Site Prep C	TBD
Permanent Barrier I, Electronics	TBD
Permanent Barrier I, Building	TBD
Operations and Maintenance of the Barriers	TBD
Barrier II Electrical Upgrades	TBD

9. POLICY AND LEGAL COMPLIANCE REIVEW

All decision documents 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. These reviews culminate in determinations that the recommendations in the reports and the supporting analyses and coordination comply with law and policy, and warrant approval or further recommendation to higher authority by the home MSC Commander. 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.

10. COST ENGINEERING DIRECTORY OF EXPERTISE (DX) REVIEW AND CERTIFICATION

All decision documents shall be coordinated with the Cost Engineering DX, located in the Walla Walla District. The DX will assist in determining the expertise needed on the ATR team and Type I IEPR and in the development of the review charge(s). The DX will also provide the Cost Engineering DX certification. The RMO is responsible for coordination with the Cost Engineering DX.

11. 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 resources 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 a 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 is still the responsibility of the users and is subject to DQC, ATR, and IEPR (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 commercial 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 (if required).

The PDT will coordinate approval of engineering models used beyond the planning phase of this project with the RMO. Additionally, scope of the Type II IEPR will include an evaluation of these models.

a. **Planning Models.** The following planning models are anticipated to be used:

Model Name and Version	Brief Description of the Model and How It Will Be Applied in the Study	Certification / Approval Status
HEC-FDA 1.2.4	The Hydrologic Engineering Center's Flood Damage Reduction Analysis (HEC-FDA) program provides the capability for integrated hydrologic engineering and economic analysis for formulating and evaluating flood risk management plans using	Certified

	risk-based analysis methods. HEC-FDA will be used to determine the likelihood of overtopping associated with varying levels of "protection" that would be achieved by constructing a berm, raising the existing road, or installing some other physical means to keep the ANS from bypassing the Barriers Project via the Des Plaines River. Risk factors will be utilized in combination with best professional judgment from SME on Asian Carp to determine acceptable levels of risk. HEC-FDA will utilize factors from the hydrologic and hydraulic models, as well as input based on the risk related to overtopping from fisheries in a Monte Carlo simulation. As for levee analysis, the HEC-FDA runs will assist the PDT in setting the final elevation of the protection based on an acceptable level of uncertainty.	

b. Engineering Models. The following engineering models are anticipated to be used:

Model Name and Version	Brief Description of the Model and How It Will Be Applied in the Study	Approval Status
HEC-RAS 4.0.	The Hydrologic Engineering Center's River Analysis System (HEC-RAS) program provides the capability to perform one-dimensional steady and unsteady flow river hydraulics calculations. The program was used for steady flow analysis to evaluate the future without- and with-project conditions along the Chicago Sanitary and Ship Canal. The modeling will be used to develop water surface profiles for with- and without project conditions for the purposes of overtopping associated risk analysis, and to address floodway permitting requirements. The PDT will also utilize existing HEC-2 models (FIS) for portions of the analysis.	HH&C CoP Preferred Model
CDEGS	The Current Distribution, Electromagnetic Fields, Grounding and Soil Structure Analysis (CDEGS) software was used to model different fish barrier operating scenarios and possible mitigations. Barriers 2A and 2B were evaluated in the Sep. 2010 Report. Permanent Barrier I was evaluated in the Feb. 2011 Report. The program was used to evaluate the existing and future electrical signal that will be introduced into the earth from the fish barrier system. The intent of the modeling is to verify the distance from the canal that an electrical signature can be detected, to evaluate the impacts of future fish barrier construction on the magnitude of the electrical signature and to evaluate how the mitigation strategies reduce the electrical potentials. CDEGS is commercially available and well used within the electrical engineering community for analyzing grounding system performance, cathodic protection systems, and effects of sinusoidal current or voltage source on	Pending

	grounded structures.	
COMSOL Multiphysics	COMSOL Multiphysics is a commercially available software package used to model a wide range of physics which include electromagnetics, heat transfer, fluid flow and solid mechanics. It is being used to model electromagnetic fields generated by the barriers and possible means to attenuate or shield against their propogation.	Pending
MATLAB	MATLAB is a commercially available software package used for numerical computation and visualization. For the barriers it is primarily used to support the design of the electrical systems.	Pending
PSpice	The Personal Simulation Program with Integrated Circuit Emphasis (PSpice) is a commercially available native analog and mixed-circuit and digital logic simulation program. For the barriers it is being used to support the design of the electrical systems.	Pending
SolidWorks	SolidWorks is a commercially available 3D mechanical computer aided design program that can model 3D structures, solids, and sheet metal components or assemblies. It is being used in mechanical design and fabrication to evaluate components for size, fit, strength, and ease of installation, and to provide visual representations.	Pending
TRACE 700 Load Design	TRACE 700 Load Design is commercially available software for modeling heating, ventilation, and air conditioning (HVAC) systems. It is being used to design the HVAC system for the Pemanent Barrier I building.	Pending

12. PUBLIC PARTICIPATION

The Chicago District intends that communication about the products will be an open and transparent process. However for patent reasons, some information may be proprietary and will not be open to public review. The District regularly provides updates to the various stakeholder groups, which include Federal, state, local and regional agencies, and subject matter experts. Some of these groups host sessions that are open to the general public. The Barrier Project Communication Plan provides for regular opportunities for information sharing with the public as well as opportunities for soliciting community input. The Review Plan will be posted on the District's web site, and the stakeholder groups will be notified of opportunities to provide input. Information available on the district's web site as relates to the Barriers Project will also be used to convey information on the Efficacy Study and design products.

13. REVIEW PLAN APPROVAL AND UPDATES

The LRD Commander is responsible for approving this Review Plan. The Commander's approval reflects vertical team input (involving district, MSC, RMO, and HQUSACE members) as to the appropriate scope and level of review for the decision document. Like the PMP, the Review Plan is a living document and may change as the study progresses. The home district is responsible for keeping the Review Plan up to date. Minor changes to the review plan since the last MSC Commander approval are documented in

Attachment 3. Significant changes to the Review Plan (such as changes to the scope and/or level of review) should be re-approved by the MSC Commander following the process used for initially approving the plan. The latest version of the Review Plan, along with the Commanders' approval memorandum, should be posted on the Home District's webpage. The latest Review Plan should also be provided to the RMO and home MSC.

14. REVIEW PLAN POINTS OF CONTACT

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

ATTACHMENT 1: TEAM ROSTERS

TABLE 2: Agency Technical Review Team Expertise	
ATR Team Disciplines	**Expertise Required**
ATR Lead	The ATR lead shall be a senior professional with extensive experience in preparing Civil Works decision documents and conducting ATR. The lead should also 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 (such as Planning, Economics, Environmental Resources, Electrical Engineer, Mechanical Engineer, Structural Engineer, etc).
Planning/Environmental Assessment	Review team lead will be a Subject Matter Expert (SME) or Regional Technical Specialist (RTS) in the field of aquatic ecosystem restoration in the Illinois River or Great Lakes Basins with an understanding of Aquatic Invasive Species.
Economic Analysis/Risk and Uncertainty	Team member(s) will be an expert in the field of Risk and Uncertainty, Navigation Economics and the use of HEC-FDA to look at exceedance probabilities. The team member should be a RTS or equivalent. Economics reviewers will be included for the Interim III and Final Efficacy Reviews.
NEPA Compliance	Team member will be an expert in the field of NEPA compliance and all appropriate laws and regulations, with extensive experience on a variety of Corps of Engineers projects. The team member should be a RTS or equivalent.
Fisheries	Team member will have expertise ichthyology/fisheries biology for Midwestern fisheries, including ANS, fish characteristics, T&E species, etc. including both riverine and Great Lakes fisheries. The team member should be a RTS or equivalent.
Electrical Engineering	The reviewer should either be a subject matter expert or a regional technical specialist with extensive knowledge of electrical in-water systems. The reviewer shall be a registered professional engineer.
Architect	The Architect shall be a senior architect with knowledge in mechanical and electrical layout designs as well as applicable building codes. The Architect shall be a licensed in the field.

Geotechnical Engineering	The Geotechnical Engineer shall be a senior engineer, an expert in the field of engineering, and have knowledge of advance engineering concepts, principles and practices of geotechnical engineering. The reviewer shall have thorough understanding of soil mechanics, subsurface investigation, groundwater hydrology and seepage, slope stability analyses, earthwork construction and other geotechnical applications. The geotechnical engineer shall be a licensed Professional Engineer.
Structural Engineering	The structural engineer shall be a senior engineer, an expert in the field of structural engineering, and have thorough knowledge of stability analyses and structural design of buildings. The structural engineer shall be familiar with current design software. The structural engineer shall be a licensed Professional Engineer and/or Structural Engineer.
Mechanical Engineering	The mechanical engineer shall be a senior engineer with a thorough knowledge of HVAC systems and other mechanical support systems for buildings and electrical generation. The mechanical engineer shall be a licensed Professional Engineer.
Cost Engineering	Cost_DX will provide a team member for the review of the Cost Estimates.
Real Estate	The real estate reviewer must be selected from the current Real Estate ATR roster and have expertise with ecosystem restoration and inland navigation projects.

[1]Reviewers of Efficacy Studies

TABLE 4: Independent External Peer Review Team	
IEPR Panel Members/Disciplines	**Expertise Required**
Fisheries	The Panel member should be an ichthyologist/fisheries biologist with extensive expertise related to Midwestern fisheries (both riverine and Great Lakes), ANS, and Asian Carp.
Environmental Compliance	The panel member should be an expert in environmental compliance and the development of NEPA documents.
Mechanical Engineer	Extensive experience in the analyses of mechanical system components as it relates to capacities, loads, and pressure requirements and safety factors. The mechanical engineer must have performed work in mechanical functions and system design and demonstrate knowledge in the operation and maintenance on the mechanical systems. The mechanical engineer shall have a working knowledge of all applicable USACE design criteria and industry building codes. The mechanical engineer shall also be a license Professional Engineer.
Electrical Engineer	Team member shall have extensive experience in the field of electrical engineering and knowledge of in-water electrical system designs. The electrical engineer must have at least 10-year experience in electrical design with knowledge of all USACE and industry electrical codes and standards. The electrical engineer shall demonstrate knowledge of mechanical and structural engineering principles to assure optimum integration of electrical systems within total design of structures and equipments. The electrical engineer shall be a license Professional engineer.
Structural Engineer	Extensive experience in the field of structural engineering. The Structural Engineer should be experienced in the stability analysis and structural design of vertical buildings including retaining walls. Structural Engineer should have a working knowledge of applicable Corps of Engineers design criteria as well as industry design criteria. The Structural Engineer shall be a licensed Professional Engineer.
Civil Engineer	Team member shall have extensive experience in the design, layout, and construction of vertical structures. The Civil Engineer should have a demonstrated knowledge regarding hydraulic structures, erosion control, earthwork, concrete placement, design of access roads, and relocation of underground utilities. The Civil Engineer shall be a licensed Professional Engineer, familiar with USACE regulations and industry building codes.

Vertical Team

The Vertical Team consists of members of the HQUSACE, ECO-PCX, Risk Management Center, and Great Lakes & Ohio River Division Offices. The Vertical Team plays a key role in facilitating execution of the project in accordance with the PMP. The Vertical Team is responsible for providing the PDT with Issue Resolution support and guidance as required. The Vertical Team will remain engaged seamlessly throughout the project via monthly telecoms as required and will attend In Progress Reviews and other key decision briefings as required. The District Liaison is the District PM's primary Point of Contact on the Vertical Team.

ATTACHMENT 2: ATR CERTIFICATION TEMPLATE

COMPLETION OF AGENCY TECHNICAL REVIEW

The Agency Technical Review (ATR) has been completed for the *<type of product>* for *<project name and location>*. 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 _____ Date _____
Name
ATR Team Leader
Office Symbol/Company

SIGNATURE _____ Date _____
Name
Project Lead/Quality Manager
Office Symbol

NA _____ Date _____
Name
Architect Engineer Project Manager[1]
Office Symbol

SIGNATURE _____ Date _____
Name
Review Management Office Representative
Office Symbol

CERTIFICATION OF AGENCY TECHNICAL REVIEW

Significant concerns and the explanation of the resolution are as follows: *Describe the major technical concerns and their resolution.*

As noted above, all concerns resulting from the ATR of the project have been fully resolved.

_____ Date

_____ Date

[1] Only needed if some portion of the ATR was contracted

ATTACHMENT 3: REVIEW PLAN REVISIONS

Revision Date	Description of Change	Page / Paragraph Number

ATTACHMENT 4: ACRONYMS AND ABBREVIATIONS

Term	Definition	Term	Definition
AFB	Alternative Formulation Briefing	NED	National Economic Development
ASA(CW)	Assistant Secretary of the Army for Civil Works	NER	National Ecosystem Restoration
ATR	Agency Technical Review	NEPA	National Environmental Policy Act
CAP	Continuing Authorities Program	O&M	Operation and maintenance
CSDR	Coastal Storm Damage Reduction	OMB	Office and Management and Budget
DPR	Detailed Project Report	OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
DQC	District Quality Control/Quality Assurance	OEO	Outside Eligible Organization
DX	Directory of Expertise	OSE	Other Social Effects
EA	Environmental Assessment	PCX	Planning Center of Expertise
EC	Engineer Circular	PDT	Project Delivery Team
EIS	Environmental Impact Statement	PAC	Post Authorization Change
EO	Executive Order	PMP	Project Management Plan
ER	Ecosystem Restoration	PL	Public Law
FDR	Flood Damage Reduction	QMP	Quality Management Plan
FEMA	Federal Emergency Management Agency	QA	Quality Assurance
FRM	Flood Risk Management	QC	Quality Control
FSM	Feasibility Scoping Meeting	RED	Regional Economic Development
GRR	General Reevaluation Report	RMC	Risk Management Center
HQUSACE	Headquarters, U.S. Army Corps of Engineers	RMO	Review Management Organization
IEPR	Independent External Peer Review	RTS	Regional Technical Specialist
ITR	Independent Technical Review	SAR	Safety Assurance Review
LRR	Limited Reevaluation Report	USACE	U.S. Army Corps of Engineers
MSC	Major Subordinate Command	WRDA	Water Resources Development Act

APPENDIX A: Electric Dispersal Barriers

Barrier I - also known as the *Demonstration Barrier,* is located in the CSSC at approximate river mile 296.5 in Romeoville, IL. It consists of twelve steel cables secured at the bottom of the canal. The upstream-to-downstream length of the barrier is 54 feet. Rapidly pulsed DC current is sent through the cables creating an electric field in the water that extends to the water surface. The field is designed to deter fish rather than kill them. It is weaker at the upstream and downstream ends and stronger in the center. As fish swim into the field they feel increasingly uncomfortable. When the sensation is too intense, the fish turns back in the direction from which it came. Operation of Barrier I began in April 2002 and currently operates at 1 volt per inch, with a pulse frequency of 5 Hertz, and a pulse length of 4 milliseconds. The equipment for controlling the electric pulses is housed in a building on the east side of the canal. The Demostration Barrier was designed and installed by the Smith-Rook Inc. (SRI) of Vancouver, Washington, based on their patented fish deterrent technology. Because of this patent, SRI remains under contract to provide Operations and Maintenance support. A telemetry system on the equipments allows LRC and SRI to monitor and operate the barrier remotely. Construction of the barrier was completed in January 2002.

At the request of a non-Federal sponsor, the Illinois Department of Natural Resources (IDNR), Chicago District initiated planning of a second, larger and more permanent barrier, Barrier II, in 2002. Barrier II was designed to be two independent barriers. This was done to provide redundancy, so that if one is off-line for maintenance, whether scheduled or unscheduled, the other can be operational. The two barriers are known as *Barrier IIA* and *Barrier IIB*. Each electrical barrier is similar in principle to the Demonstration Barrier, but both are larger than the Demonstration Barrier and able to generate more powerful electric fields over a larger area.

Barrier IIA - is located in the CSSC approximately 1,150 feet downstream of the Demonstration Barrier and was placed into service in April 2009 with operating setting at 1.0 volt per inch with a pulse frequency of 5 Hertz and a pulse length of 4 milliseconds. The operational settings were increased in August 2009, in response to a positive eDNA result upstream of the barrier, to 2.0 volts per inch, 15 Hertz, and 6.5 milliseconds. The electrode array consists of 32 electrodes over 130 feet upstream-to-downstream on the canal bottom. The array has two sub-parts known as the wide and narrow arrays. The narrow array extends over approximately 50 feet upstream-to-downstream in the canal and is where the maximum electric field strength of the barrier can be generated. The wide array extends over approximately 80 feet upstream-to-downstream, but can't generate field strengths as high as the narrow array. The wide array is downstream of the narrow array. Fish moving upstream will first encounter the wide array which should deter many of the fish. Any fish that proceeds through the wide array will encounter the stronger narrow array, which is currently operated at a level that is capable of stunning (rendering unconscious) most fish. Design and installation of Barrier IIA were completed by Smith-Root. QC and ITR for the design were completed by Smith-Root. ITR certification was completed on 24 September 2004. Construction of Barrier IIA was completed January 2006.

Retrofits are underway to improve the performance and reliability of Barrier IIA including, power quality improvements, transformer upgrades, extension of the east bank sidewalk, and access platform for the generators. This contract (Barrier IIA Improvements) was awarded in September 2012. DQC and ATR for the design features were completed. ATR certification was dated 20 June 2012.

Barrier IIB - is located in the CSSC approximately 800 feet downstream of the Demonstration Barrier and 220 feet upstream of Barrier IIA. Refer to Figure 3 below for the Barriers Layout Map. It has the same type, number, and spacing of electrodes as Barrier IIA. However, the on-land control building, electrical systems, and cooling systems incorporate improvements identified from lessons learned from operation of Barrier IIA. Design of Barrier IIB was completed by the Chicago District with coordination with Smith-Root for the design and installation of the electrical components and operating system. QC and ITR on the design were completed. ITR certification was completed on 1 June 2009. Barrier IIB construction was completed and became operational in April 2011.

Site Security - The purpose of this effort is to assess the current security situation and design system upgrades to enhance the current 24/7 manned operations presence. This design analysis serves to define the new Electronic Security System (ESS) and Physical Security System (PSS). The proposed new security system will combine physical and electronic attributes into one system to provide an appropriate cohesive and reliable security system. DQC and ATR were completed on this product. ATR certificated was completed on 25 April 2012. The contract for installation of the site security system was awarded in May 2012 and work is scheduled for completion in 2013.

APPENDIX B: Efficacy Study

Interim I - *Dispersal Barrier Bypasses* proposed the construction of measures to prevent Asian carp from bypassing the electrical barrier system during flood events on the Des Plaines River and through culverts in the I&M Canal in the report approved by the ASA (CW) in January 2010. The Des Plaines River and Illinois & Michigan (I&M) Canal run parallel to the CSSC to the west and east, respectively. In flood events, water from the Des Plaines River could potentially flow overland and into the CSSC upstream of the barriers. To minimize the probability of fish bypassing the electric barriers via overland flow, a 13 mile long barrier was constructed along the Des Plaines River, consisting of fencing and concrete barricades. Flow in the I&M Canal is often discontinuous, but at times flow does exist throughout the canal. To reduce the risk of fish migration through the I&M canal past the barriers, the canal was filled with stone rip-rap at the location of a natural flow divide west of I-355 in Lemont. ITR was completed in December 2009. . Construction was completed in October 2010.

Interim IIA/Interim IIB - *Optimal Operating Parameters* - The electric barriers operate by creating a waterborne pulsed direct current electric field in the Chicago Sanitary and Ship Canal. The barrier electric field can be characterized by the equipment parameters of frequency, length (duration) and amplitude (voltage) of the direct current pulses. The objective of Interim II is to recommend the optimal combination of these parameters to maximize fish deterrence. The report made this recommendation by evaluating the results of laboratory testing on operating parameters completed at USACE-ERDC, along with the potential safety impacts of altering operating parameters, the potential short- and long-term operation and maintenance costs of altering operating parameters, and information on the location of different sizes of bighead and silver carp (as barrier effectiveness varies with fish size). The Interim IIA report was approved by LRD and released in September 2011. The operating parameters of Barrier II were changed in October 2011 as a result of this report.

Interim III - *Modified Structures and Operations, Chicago Area Waterways* evaluated how potential changes in the operation of the Chicago-area locks, dams and associated structures might reduce the risk of Asian carp migrating into Lake Michigan. The report includes an assessment of operational changes that could be implemented as needed by agencies that are responsible for fish management efforts such as electro-fishing and intensive commercial fishing efforts by the U.S. Fish and Wildlife (USFWS) and Illinois Department of Natural Resources (IDNR). ATR was completed on the report in May 2010. The Interim III Report was approved by the ASA(CW) in July 2010. Installation of bar screens on the sluice gates at T.J. O'Brien Lock and Dam, recommended in the report, was completed in January 2011.

Interim IIIA - *Fish Dispersal Deterrents, Illinois and Chicago Area Waterways* recommended construction of a demonstration acoustic bubble strobe (ABS) barrier in the Des Plaines River downstream of the Brandon Road Lock & Dam. ATR was completed on the report in April 2010. The implementation of a demonstration behaviorial barrier was approved by the ASA(CW) however, funding has been prioritized to complete design and construction of the electric barriers, barrier operations and ongoing monitoring and telemetry. The Interim IIIA Report was approved by the ASA(CW) in July 2010.

The Comprehensive Efficacy Report will include a summary of all interim reports completed to dateand will include a summary of the efforts underway by the other agencies making up the Asian

Carp Regional Coordinating Committee. The report will document the improvements made to increase the efficacy of the electric barriers. Further, the report will contain evaluation of additional risk reduction measures to specifically address the open pathways to Lake Michigan: the Grand Calumet River which outlets at the Indiana Harbor and Canal; and the Little Calumet River, which outlets at Burns Ditch. The Comprehensive Efficacy Report is currently scheduled for completion in FY13.

Interim reports I, III and IIIA included integrated environmental assessments. Each of the Interim Reports were subject to District Quality Control Review, Agency Technical Review and Policy Compliance Review. The Comprehensive Efficacy Report will undergo Type I Independent External Peer Review.