



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
NORTH ATLANTIC DIVISION, US ARMY CORPS OF ENGINEERS
FORT HAMILTON MILITARY COMMUNITY
BROOKLYN, NEW YORK 11252-6700

CENAD-PD-PP


10 January 2012

MEMORANDUM FOR Commander, New England District, ATTN: CENAE-EP

SUBJECT: Review Plan Approval for Connecticut River Ecosystem Restoration
Connecticut, Massachusetts, New Hampshire, and Vermont Watershed Study

1. The attached Review Plan for the subject study has been prepared in accordance with EC 1165-2-209, Civil Works Review Policy.
2. The Review Plan has been coordinated with the Ecosystem Restoration Planning Center of Expertise of the Mississippi Valley Division, which is the lead office to execute this plan. For further information, contact Ms. Jodi Creswell at 309-794-5448. As no specific projects for construction will be evaluated during this study, the Review Plan does not include independent external peer review.
3. I hereby approve this Review Plan, which is subject to change as study circumstances require, consistent with study development under the Project Management Business Process. Subsequent revisions to this Review Plan or its execution will require new written approval from this office.

Encl


Joseph R. Vietri
Chief, Planning & Policy Division
Programs Directorate



US Army Corps
of Engineers®
New England District

REVIEW PLAN

CONNECTICUT RIVER ECOSYSTEM RESTORATION
CONNECTICUT, MASSACHUSETTS, NEW HAMPSHIRE, AND
VERMONT

WATERSHED STUDY

NEW ENGLAND DISTRICT

June 2011

JAN 10 2012

MSC Approval Date: ~~Pending~~

Last Revision Date: None

REVIEW PLAN

**CONNECTICUT RIVER ECOSYSTEM RESTORATION
CONNECTICUT, MASSACHUSETTS, NEW HAMPSHIRE, AND VERMONT**

WATERSHED STUDY

TABLE OF CONTENTS

1. PURPOSE AND REQUIREMENTS 1

2. REVIEW MANAGEMENT ORGANIZATION (RMO) COORDINATION..... 1

3. STUDY INFORMATION 1

4. DISTRICT QUALITY CONTROL (DQC)..... 4

5. AGENCY TECHNICAL REVIEW (ATR) 5

6. INDEPENDENT EXTERNAL PEER REVIEW (IEPR)..... 7

7. POLICY AND LEGAL COMPLIANCE REVIEW 9

**8. COST ENGINEERING DIRECTORY OF EXPERTISE (DX) REVIEW AND
CERTIFICATION 9**

9. MODEL CERTIFICATION AND APPROVAL 9

10. REVIEW SCHEDULES AND COSTS 11

11. PUBLIC PARTICIPATION..... 12

12. REVIEW PLAN APPROVAL AND UPDATES..... 12

13. REVIEW PLAN POINTS OF CONTACT..... 12

ATTACHMENT 1: TEAM ROSTERS..... 13

**ATTACHMENT 2: SAMPLE STATEMENT OF TECHNICAL REVIEW FOR DECISION
DOCUMENTS..... 14**

ATTACHMENT 3: REVIEW PLAN REVISIONS..... 16

ATTACHMENT 4: ACRONYMS AND ABBREVIATIONS..... 17

1. PURPOSE AND REQUIREMENTS

a. Purpose. This Review Plan defines the scope and level of peer review for the Connecticut River Ecosystem Restoration Watershed Study in Connecticut, Massachusetts, New Hampshire and Vermont.

b. References

- (1) Engineering Circular (EC) 1165-2-209, Civil Works Review Policy, 31 Jan 2010
- (2) EC 1105-2-412, Assuring Quality of Planning Models, 31 Mar 2010
- (3) Engineering Regulation (ER) 1110-1-12, Quality Management, 30 Sep 2006
- (4) ER 1105-2-100, Planning Guidance Notebook, Appendix H, Policy Compliance Review and Approval of Decision Documents, Amendment #1, 20 Nov 2007
- (5) Connecticut River Ecosystem Restoration Study, Project Study Plan, August 2008
- (6) District Quality Management Plan, CENAER 5-2-7, 1 June 2000

c. Requirements. This review plan was developed in accordance with EC 1165-2-209, 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 1165-2-209) and planning model certification/approval (per EC 1105-2-412).

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 is the Ecosystem Restoration Center of Expertise.

The RMO will coordinate with the Cost Engineering Directory of Expertise (DX) to conduct ATR of cost estimates, construction schedules and contingencies. This study will not result in recommended projects that will require cost estimates. Therefore, coordination with the DX will not be necessary at this time.

3. STUDY INFORMATION

a. Decision Document. At this time, the study is anticipated to result in a watershed management plan that will be approved by Headquarters, similar to a Section 729 study. Since the study will not result in a decision document for a Corps implemented project, IEPR is not required. It is not anticipated that the study will require NEPA documentation as flow changes should fall within existing operational ranges. If the study were to recommend

operational changes that require the development of an Environmental Assessment (EA) and Finding of No Significant Impacts (FONSI), the review plan will be amended to reflect that. We are about half way through the study at this time. None of the work to date (modeling efforts) indicates that the statements above are otherwise.

- b. Study/Project Description.** The study area encompasses the entire Connecticut River watershed. The total study area is about 11,260 square miles. The Connecticut River Watershed has experienced considerable development resulting in significant loss of floodplain, fish spawning habitat (e.g. Atlantic salmon, striped Bass), wetlands, waterfowl nesting areas and other valuable fish and aquatic habitat. Existing aquatic habitat resources have also been impacted by deposition of eroded stream bank material. The Connecticut River and its tributaries depend on a naturally variable flow to support all the different parts of the ecosystem. The construction of hydroelectric, flood control and other dams in the watershed along with municipal and commercial water withdrawals has altered the watershed's natural hydrologic regime and has blocked the passage of anadromous fish. The primary purpose of the study is to determine how management of various dams and water systems can be modified for environmental benefits while maintaining human uses such as water supply, flood control and hydropower generation. Secondary study purposes include identifying and evaluating measures to reduce stream bank erosion, restore anadromous fisheries migratory corridors and spawning habitat, restore degraded wetlands and riverine habitat and improve the overall fish and wildlife habitat of the Connecticut River.
- c. Factors Affecting the Scope and Level of Review.** The Corps and The Nature Conservancy (the non-Federal sponsor) went into this study with the idea that we needed to create a watershed wide hydrologic tool that allows all the stakeholders to evaluate the impact of various flow manipulations on fish and wildlife habitat. Several stakeholders (primarily hydropower) have developed localized computer models over the years that address their concerns, but nothing has been developed that addressed the entire Connecticut River basin all at once. The basin wide model that we envisioned, and the recommendations coming from it, has to be robust enough in its scope and complexity to meet the demands of all of the stakeholders and reviewers.

As mentioned before, the study will result in a watershed management plan that at its heart is based on a set of hydrologic computer models: an operational model (HEC-ResSim), an optimization model (LINGO, developed by the University of Massachusetts), and an ecosystem flow model (HEC-EFM). Supporting models include HEC-RAS and a regression equation based flow tool developed by the USGS. This tool will calculate unregulated flow for all of the sub-basins, thus eliminating the need for expensive run-off models.

The challenges in developing the models are numerous: the basin is over 11,000 square miles in size, there are 44 major tributaries in the basin, there are 70 large dams (14 of which are Corps operated dams) controlling at least 10% of the mean annual flow in the their respective sub basins, varying purposes amongst the largest dam owners (1/3 hydropower, 1/3 flood control, and 1/3 water supply/recreation), the basin is located in 4 different states each with its own agency/regulatory structure, hundreds of different stakeholders, the lack of unregulated flow data, the lack of natural resource data from state to state, the lack of operational data at the dams or unwillingness of certain dam owners to supply the operational

data, and the lack of interest by some dam owners in assisting with the study (FERC process is dam by dam and once licensed there is no incentive to alter flows).

The biggest risks that we face are that the basin wide model cannot perform as advertised or is flawed in its design. As a result, stakeholders may not agree with the results and not utilize the model in the future for water management decisions.

The study is not expected to have significant economic, environmental, or social effects. Hopefully, the model will result in slight operational changes that positively impact the environment while not compromising current uses.

The study does not involve a significant threat to human life or safety. However, the study may result in some controversy as operational changes might be suggested that dam owners may not be interested in or necessarily required to follow.

d. In-Kind Contributions. Products and analyses provided by non-Federal sponsors as in-kind services are subject to DQC, ATR, and IEPR (not applicable in this case). The non-Federal sponsor for this study, The Nature Conservancy, is providing a substantial amount (at least 25% of the total study cost) in in-kind services. The in-kind products and analysis to be provided by the non-Federal sponsor include:

- Develop a basin-scale planning tool that examines risk of hydrologic alteration and river fragmentation of all 44 major tributaries in the Connecticut River watershed.
- Develop a hydrologic characterization of two tributaries in the watershed, the West and Ashuelot Rivers, using daily gaged flows (reservoir outflows) and calculated time series (daily reservoir inflows) statistically analyzed for a range of flow frequency, magnitude, duration and other parameters.
- Conduct an integrated floodplain assessment and create a tool that will analyze and support conservation decision-making as it relates to the restoration of floodplain and riparian areas in the Connecticut River watershed.
- Using the results of the hydrologic characterization and the literature review as a guide, TNC will develop an Integrated Summary Report (ISR) to inform ecological flow recommendations.
- Working with the Corps and other partners, develop a demonstration project designed to evaluate alternative water management scenarios for 2-3 subbasins (tributaries) and a stretch of the mainstem Connecticut River (incorporating one hydropower dam).
- Define and map the number and spatial resolution of nodes of conservation interest and threat magnitude (due to flood control and/or water withdrawals) in the basin to inform development of a basin-wide hydrologic model.

- Develop quantitative and qualitative relationships between flow alteration and ecological response.
- Working collaboratively with the Corps and others, develop an optimization model designed to maximize ecological functions (expressed as flows, obtained from the ecologic/flow response functions), given economic, flood-inundation, and other operations constraints.
- Working with the PDT, convene a multi-day workshop to develop draft, numeric flow recommendations that include quantified values for each Conservation Target. TNC will prepare a draft report summarizing the results of the multi-day flow workshop, circulate this report for review and approval by participants, and then produce a Final Ecological Flow Prescription Report for the Connecticut River watershed.
- Arrange for the facilities for meetings not held at the Corps District Office in Concord, Massachusetts.

4. DISTRICT QUALITY CONTROL (DQC).

All decision documents (including supporting data, analyses, environmental compliance documents, etc.) shall undergo 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). The home district shall manage DQC. Documentation of DQC activities is required and should be in accordance with the Quality Manual of the District and the home MSC.

This watershed study presents interesting challenges for DQC. The Project Study Team consists of team members from the Corps (New England District and HEC), TNC, USGS, and the University of Massachusetts (UMass). As individual study products are developed, each group responsible for the development of that product has first line responsibility for reviewing their work.

The Corps is responsible for the development of the ResSim model that simulates current and future flow scenarios. This model requires certain physical and operational data of the dams that are being simulated. In order to keep track of the data collected, as well as that which is still missing, the Corps developed a tracking spreadsheet that each modeler fills out prior to submitting a subbasin for incorporation into the overall watershed model. The master watershed model is kept by HEC. They check each of the subbasin models as well as the master data list for that piece of the model prior to incorporation. Each sub-basin's simulation model is run with existing flows to determine if the model will run and, if it does, is it simulating "real world" conditions. The modelers have downstream gage data that is being used to verify the simulation results. The Corps team is also writing a short report that documents the model's development.

UMass is responsible for the development of the optimization model (LINGO, commercially available software). They have a team of staff and students who work on this model. They

have their own internal review process. UMass used STELLA software (commercially available) early in the development of the optimization model to simulate flows. STELLA is not as robust as ResSim but the Corps and UMass periodically checked outputs from each just to make sure that simulations from either party were producing similar results. Where discrepancies were found, discussion followed and adjustments made, where necessary.

TNC products are typically reviewed internally first and then by NAE. USGS work on their run-off tool goes through a very rigorous internal review process before being released to the team.

Each group is responsible for documenting their review results, which can be made available to the ATR team, if requested.

5. AGENCY TECHNICAL REVIEW (ATR)

ATR is mandatory for all decision documents (including supporting data, analyses, environmental compliance documents, etc.). 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.

- a. Products to Undergo ATR.** The study is primarily a hydrologic simulation effort. As mentioned above, several different types of hydrologic/hydraulic models are being used to conduct the study. They include: ResSim, LINGO, HEC-RAS, and HEC-EFM. Climate change forecasting modeling will also be utilized. The basin-wide models developed, as well as any reach specific modeling efforts, including their data input files, will need to be reviewed for completeness and accuracy. Interim documentation of the model development and the proposed flow alternatives analysis will also need to be reviewed. Much of the flow prescription work done by TNC and the unregulated flow information developed by USGS has already been peer reviewed and will not need to be formally reviewed at this time though these products can be provided for information.
- b. Required ATR Team Expertise.** The Connecticut River study will result in a flow management plan for the watershed. Therefore, the PDT has determined that the ATR team will need to be comprised of hydrologists, climate specialists, and ecologists familiar with large watershed modeling. The ATR team will include a mix of of academic and outside agency personnel. Plan formulators and engineers may also be required if the study begins to look at alternatives that require structural changes to dams. For now, the team will be limited to the personnel mentioned. If the study develops into a decision document then other disciplines will need to be added (e.g. plan formulation, cultural resources, structural engineering, cost estimating etc...).

ATR Team Members/Disciplines	Expertise Required
ATR Lead	The ATR lead should be a senior professional with extensive experience in conducting ATR. The lead should also have the necessary skills and experience to lead a virtual team through the ATR process. In this case a lead person, who has experience in developing watershed management plans, especially as they relate to flow and ecosystems and knowledge of hydropower, flood risk management, and water supply, will be necessary. The ATR lead will be assigned by the PCX.
Hydrology & Hydraulics	Several team members will be needed for this discipline as there are several different modeling efforts occurring that require fairly specific expertise in order to conduct a proper review. These reviewers will need to be conversant in the Corps suite of hydrology models including HEC-ResSim and HEC-RAS. Knowledge of non-Corps hydrology models such as LINGO will also be needed. A team member with knowledge of climate change modeling and its relationship to the other hydrology models will also be needed.
Plan Formulation	The plan formulator shall have experience in reviewing alternative plans that are based on new flow prescriptions for hydropower, flood control, and water supply dams. A familiarity with river flow and aquatic habitat needs is essential. This reviewer or the reviewing ecologist shall have a familiarity with Corps HEC-EFM software.
Environmental Resources	This team member has to have detailed knowledge of the relationship between flow prescriptions and ecological outputs in a New England riverine setting.

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 Statement of Technical Review should be completed, based on work reviewed to date, for the AFB, draft report, and final report. A sample Statement of Technical Review is included in Attachment 2.

6. 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 1165-2-209, 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 1165-2-209.
 - 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 IEPR.** At this time, the study will result in a flow management plan for the watershed. A flow management plan is not a decision document and does not meet the criteria for an IEPR. For now the PDT has determined that an ATR, comprised of team members from within and outside the Corps, is the appropriate means of reviewing this study and its findings. In addition:
- A flow management plan does not meet any of the mandatory triggers for Type I IEPR described in Paragraph 11.d.(1) and Appendix D of EC 1165-2-209 **nor** will:
 - the consequences of non-performance have significant adverse impact on the environment and social well-being;
 - the flow plan likely contain influential scientific information or be highly influential scientific assessment;
 - it include an EIS;
 - it be controversial;
 - it have more than negligible impact on scarce or unique tribal, cultural, or historic resources; and
 - No one Federal or state agency is specifically charged with reviewing a resulting flow management plan, so therefore, no IEPR will be forthcoming from such an agency; and
 - A flow management plan does not meet the criteria for conducting Type II IEPR described in EC 1165-2-209.
- b. Products to Undergo Type I IEPR.** Not applicable at this time.
- c. Required Type I IEPR Panel Expertise.** Not applicable at this time.

d. Documentation of Type I IEPR. Not applicable at this time.

7. POLICY AND LEGAL COMPLIANCE REVIEW

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.

8. 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 team (if required) 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. This study will not result in recommended projects that will require cost estimates. Therefore, coordination with the DX will not be necessary at this time.

9. MODEL CERTIFICATION AND APPROVAL

EC 1105-2-412 mandates the use of certified or approved models for all planning activities to ensure the models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions. Planning models, for the purposes of the EC, are defined as any models and analytical tools that planners use to define water 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).

- a. Planning Models.** The only planning model being used is an ecosystem flow model (HEC-EFM). This modeling software is currently under review. The operational and optimization models described below only provide a flow for a specified ecological point of interest in the watershed. EFM, working hand-in-hand with HEC-RAS, will take that flow and show spatially and statistically how the altered flow actually effects the target species. This will help refine the flow prescriptions and maximize ecological improvements.
- b. Engineering Models.** The following engineering models will be used in the development of the watershed management plant: an operational model (HEC-ResSim) and an optimization model (LINGO software, CT model developed by the University of Massachusetts). HEC-RAS will also be used to evaluate flood inundation at certain ecological locations. Each of these engineering models is industry accepted.

Model Name and Version	Brief Description of the Model and How It Will Be Applied in the Study	Approval Status
HEC-ResSim 3.1	HEC's Reservoir Simulation software is a reservoir simulation model that uses rules (e.g., minimum and maximum flow requirements, seasonal pool elevation targets) to simulate the effects of water management policies. Rules can be altered, removed, or added to test the effects of different policies. Each new set of rules results in different time series of flows at reservoir and downstream locations. In this study, existing conditions at selected projects will be simulated using the current operating rules and then conditions will be altered to test the effects of alternative management policies in the basin.	Corps Preferred Model
LINGO	Based upon current conditions and streamflow forecasts (climate induced change), this optimization modeling software will compute daily releases from the study dams that address all of the operational concerns in the basin, including power production, flood control, water supply, and replication of naturalized streamflows when possible. The optimization model will have several uses. The model will be used to examine the changes in basin-wide hydropower production and determine the possible environmental benefits of coordinating release decisions. Also, requiring that current hydropower production rates be maintained and incorporating current flood risk reduction levels, the reproduction of unimpaired flows can be optimized. This would show the improvement in environmental flows that could be obtained without any loss in flood risk reduction or in hydropower production. In addressing the three needs of hydropower production, flood risk reduction and reproduction of unimpaired flows, the model can be used as a negotiation tool to examine the value in changes of operation. Finally, environmental monitoring and streamflow forecast information can be incorporated into the optimization tool to provide real time operational guidance and	Industry Accepted Model

	outline “best decisions” to achieve specific streamflow objectives over a week, month or season.	
Unregulated Flow Modeling Tool	This flow tool, developed by USGS, is a tool that estimates unaltered flows from a set of regression equations that relate basin characteristics and flow-duration curves of gaged sites. From this synthesized flow-duration curve streamflows at the ungaged site are determined for a given day by the percent exceedence of flow on that day at an index gage(s) for the period-of-record (POR) or the period-of-interest (POI). This process, known as the QPPQ-transform method (Fennessey, 1994), assumes that the flow on a given day is at the same percent exceedence at the ungaged site as the index site(s) and which produces a daily estimate of unaltered flow from the synthesized flow-duration curve.	Peer Reviewed Accepted Model
HEC-EFM	The Ecosystem Functions Model software is a planning tool that aids in analyzing ecosystem response to changes in flow regime. It enables project teams to visualize existing ecologic conditions, highlight promising restoration sites, and assess and rank alternatives according to the relative change in ecosystem aspects. Central to HEC-EFM analyses are “functional relationships.” These relationships link characteristics of hydrologic and hydraulic time series (flow and stage) to elements of the ecosystem through combination of four basic criteria: 1) season, 2) flow frequency, 3) duration, and 4) rate of change. After relationships are developed, a statistic computations package (also managed by the interface) analyzes flow and stage time series for the specified criteria and produces a single flow value for each relationship. This process is repeated to assess a modified flow regime and resulting values for without and with project conditions are compared to indicate the direction of change of ecosystem health.	Corps Preferred Model – under review
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 will be used for steady flow analysis to evaluate the effect of alternative flow regimes on site specific ecological target areas.	Corps Preferred Model

10. REVIEW SCHEDULES AND COSTS

- a. ATR Schedule and Cost.** The study is currently advanced enough that the ATR team could be engaged to review the set-up of the various models. This review could begin as early as the winter of 2011/2012. This would coincide with the completion of all the base models for the study (Res-Sim, Lingo, and the USGS flow model) including some alternative runs from the optimization model (Lingo). The results of the ecoflow workshop that was held in the spring of 2011 are available now for review. A more definitive review schedule will develop as these products become available. The study budget includes \$100,000 for ATR reviews.

- b. Type I IEPR Schedule and Cost.** Not applicable at this time.
- c. Model Certification/Approval Schedule and Cost.** The HEC-EFM planning model is currently under review. Certification is not expected until 2012. The ATR team will review the model for single use on this study.

11. PUBLIC PARTICIPATION

As discussed previously, the study will result in a flow management plan for the Connecticut River. The public at large has not been engaged formally to date though opportunities to engage the study process have been included in the schedule in the form of some regionally focused public meetings. These meetings will take place once there are results to disseminate. In the mean time, the study has conducted a fairly wide ranging stakeholder outreach effort. Over 150 different stakeholders throughout the basin were contacted to determine their interest in participating in the watershed plan development, their perception of the needs of the watershed as it pertains to flow, and the usefulness of a basin wide model in their work. An eco-flow workshop was held in the spring of 2011 with resource agencies and academia. The workshop resulted in seasonal flow prescriptions for the study’s target species. The results of all the public participation efforts will be made available to the ATR team.

Again, if this study eventually includes a Corps decision document then a more formal public review process will need to be conducted.

12. REVIEW PLAN APPROVAL AND UPDATES

The North Atlantic Division 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.

13. REVIEW PLAN POINTS OF CONTACT

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

Home District POC	Christopher Hatfield, PM	978-318-8520
Division POC	Larry Cocchieri	347-370-4571
RMO POC	Sue Ferguson	615-736-7192

ATTACHMENT 1: TEAM ROSTERS

**TABLE 1.
PROJECT DELIVERY TEAM (PDT)**

<u>Discipline</u>	<u>Name</u>	<u>Office/Agency</u>
Study Manager (Corps)	Christopher Hatfield	Corps (NAE) - Planning
Study Manager (TNC)	Kim Luz	TNC
Ecologist	Colin Apse	TNC
Research Hydrologist	Stacey Archfield	USGS
Hydrologic Modeler	Rick Palmer	UMass Amherst
Hydrologic Modeler	Austin Polebitski	UMass Amherst
Hydrologic Modeler	David Ahlfeld	UMass Amherst
Hydrologic Modeler	Casey Brown	UMass Amherst
Hydrologic Modeler	Townsend Barker	Corps (NAE) - WM
Hydrologic Modeler	John Hickey	HEC Davis
Hydrologic Modeler	Woodrow Fields	HEC Davis
Hydrologic Modeler	David Julian	HEC Davis
Hydrologic Modeler	Leila Ostadrahimi	HEC Davis
Modeling Documentation	Marilyn Hurst	HEC Davis

**TABLE 2.
AGENCY TECHNICAL REVIEW (ATR) TEAM**

<u>Discipline</u>	<u>Name</u>	<u>Office/Agency</u>
ATR Team Leader	TBD	Corps
Hydrologic Modeler	Rich Vogel	Tufts University
Hydrologic Modeler	Pete Loucks	Cornell University
Hydrologic Modeler	Neil Fennessey	UMass Dartmouth
Hydrologic Modeler	David Williams	Corps (Tulsa) – WM
Plan Formulator	TBD	Corps
Ecologist	TBD	Corps
Climate Change	Anji Seth	University of Connecticut
Aquatic Ecologist	LeRoy Poff	Colorado State University

**ATTACHMENT 2: SAMPLE STATEMENT OF TECHNICAL REVIEW FOR
DECISION DOCUMENTS**

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 1165-2-209. 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 DrCheckssm.

SIGNATURE

Name

ATR Team Leader

Office Symbol/Company

Date

SIGNATURE

Name

Project Manager

Office Symbol

Date

SIGNATURE

Name

Architect Engineer Project Manager¹

Company, location

Date

SIGNATURE

Name

Review Management Office Representative

Office Symbol

Date

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

Name
Chief, Engineering Division
Office Symbol

Date

SIGNATURE

Name
Chief, Planning Division
Office Symbol

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

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