REVIEW PLAN
28 January 2020

Project Name: Three Forks of Beargrass Creek Ecosystem Restoration, Jefferson County, Kentucky

P2 Number: 465081

Decision Document Type: Feasibility Report with Integrated Environmental Assessment

Project Type: Single-Purpose Ecosystem Restoration (ER)

District: Louisville (LRL)
District Contact: Planner/Project Manager, 502.315.6867

Major Subordinate Command (MSC): Lakes & Rivers Division (CELRD)
MSC Contact: District Support Team Lead, 502.315.6825

Review Management Organization (RMO): Ecosystem Restoration Planning Center of Expertise (ECO-PCX)
RMO Contact: LRD ECO-PCX Account Manager, 218.788.6419

Key Review Plan Dates

Date of RMO Endorsement of Review Plan:	Pending
Date of MSC Approval of Review Plan:	Pending
Date of IEPR Exclusion Approval:	N/A
Has the Review Plan changed since PCX Endorsement?	N/A
Date of Last Review Plan Revision:	Pending
Date of Review Plan Web Posting:	Pending
Date of Congressional Notifications:	Pending

Milestone Schedule

	Scheduled	Actual	Complete
Alternatives Milestone:	**12 March 2020**	*(enter date)*	No
Tentatively Selected Plan:	**5 November 2020**	*(enter date)*	No
Release Draft Report to Public:	**4 January 2021**	*(enter date)*	No
Agency Decision Milestone:	**15 May 2021**	*(enter date)*	No
Final Report Transmittal:	**15 June 2022**	*(enter date)*	No
Senior Leaders Briefing:	**15 July 2022**	*(enter date)*	No
Chief's Report:	**5 August 2022**	*(enter date)*	No

Project Fact Sheet
22 January 2020

Project Name: Three Forks of Beargrass Creek Ecosystem Restoration

Location: Commonwealth of Kentucky, Jefferson County, City of Louisville

Authority: Authority for Three Forks of Beargrass Creek, Kentucky, is contained in a resolution adopted on 5 May 1987 by the Committee on Environment and Public Works of the United States Senate. This resolution provides the Corps broad authority - through the "allied purposes" statement - to review water resources issues throughout the metropolitan Louisville region. The resolution reads:

"RESOLVED BY THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS OF THE UNITED STATES SENATE, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the Rivers and Harbors Act, approved June 12, 1902, be, and is hereby requested to review the report of the Chief of Engineers of the comprehensive flood control plan for the Ohio and lower Mississippi Rivers, published as Flood Control Committee Document Numbered 1, 75th Congress, and other pertinent reports, with a view to determining the advisability of providing additional improvements for flood control and allied purposes in the Metropolitan region of Louisville, Kentucky, with particular reference to existing and potential flooding problems in the Pond Creek, Mill Creek, Beargrass Creek, and Floyds Fork drainage basins."

Sponsor: The sponsor is the Louisville/Jefferson County Metropolitan Sewer District (MSD).

Type of Study: Ecosystem Restoration (ER) Feasibility Study

SMART Planning Status: This study will be SMART Planning (3x3x3) compliant.

Project Area: Jefferson County, Kentucky. The Beargrass Creek system contains three major sub-watersheds the South Fork, Middle Fork, and Muddy Fork with watershed areas of 27, 25, and 7 square miles, respectively. The three forks converge just east of downtown Louisville before discharging into the Ohio River (see Figures 1 & 2). The South Fork, a watershed of 27 square miles, has its headwaters above Bardstown Road and the Buechel area. It runs generally north through the Audubon Park and Germantown neighborhoods to its convergence with the Middle Fork near the Butchertown and Irish Hill neighborhoods. The Middle Fork, a watershed of 25 square miles, begins in the Middletown area. It runs through St. Matthews and Seneca and Cherokee Parks to its convergence with the South Fork. The combined South & Middle Forks flow northward from this convergence through the Butchertown neighborhood. The Muddy Fork, a watershed of 7 square miles, begins near Windy Hills in eastern Louisville. It flows along I-71 until it converges with the combined South and Middle Forks just before discharging into the Ohio River. Interesting natural features include Ohio River floodplain, karstic springs and caves, forest, woodland, and prairie.

Problem Statement: The three creeks once meandered broadly across their floodplains before reaching their confluence with the Ohio River between 3rd and 4th streets in downtown Louisville. Beargrass Creek influenced early settlement patterns of Louisville allowing easy access to shallow, clean water for daily routines. As development progressed and the trade grew, the creek became an obstacle and likely a health issue. In the 1850s, the creek was re-routed to today's channelized alignment with its confluence with the Ohio River now two miles east near Towhead Island.

Currently, the three forks of Beargrass Creek are completely contained within the urbanized Jefferson County, Kentucky. Significant portions of the creeks have been channelized to obtain faster flow and increased capacity during floods. Loss of riparian buffers and wetlands have resulted in high water temperatures, lower dissolved oxygen levels, and reduced energy inputs. Concrete channels further elevate water temperatures, becoming too warm for most aquatic life in the summer. About one-third of rainfall in the Beargrass Creek watershed will land on impervious surfaces collecting toxins, pollutants, and sediments. Accordingly, riparian, wetland, and stream ecosystems have been severely impacted with reduced abundance, diversity, and health of aquatic and riparian organisms. Specific preliminary problems include but are not limited to: 1) Loss of Fluviogeomorphic Processes (Riverine Habitat), 2)Degradation of Hydrologic Regime, 3) Loss of Riparian Zone, and 4) Loss of Species Richness (riverine and riparian native species).

Federal Interest: Wetland, riparian, and riverine ecosystems are threatened nationally due to human interference. These diverse areas provide habitat for a wide range of aquatic flora and fauna. Land adjacent to streams and rivers in Kentucky has been converted from native wetland and bottomland hardwood forests over the past century. Through this process of development in and around Louisville, nearly all the wetland habitat along the Beargrass Creek was drained and/or filled to facilitate new industrial, commercial, and residential areas. Channelization of the forks to reduce flooding and increase conveyance of flood waters has reduced availability of riparian and in-stream habitat. These changes in land use have created an urbanized watershed with a severely altered hydrologic regime, degraded geomorphic form, and dysfunctional ecological function. This study provides an opportunity to address the scarcity of healthy urban watersheds in the nation by utilizing the technical expertise of the U.S. Army Corps of Engineers.

Aquatic ecosystem restoration will increase the wetland, riparian, and in-stream habitat for Beargrass Creek, thus increasing plant and animal species diversity overall. This study has potential to restore riparian corridors that provide habitat for three Federally threatened and endangered species of bats: gray bat, Indiana bat, and northern long-eared bat. The in-stream restoration features designed to reduce sedimentation at the confluence with the Ohio River will potentially restore habitat suitable to ten different species of Federally listed freshwater mussels. Each of these species relies on a host fish species to carry their microscopic larvae (glochidia) in the early stages of the mussel's life cycle. Restoration of in-stream channel features will improve aquatic habitat to support a diverse assemblage of host fishes for mussel species. Wetland and bottomland hardwood forest restoration will provide habitat for resident waterfowl and increase stop-over refugia for migratory birds utilizing the Mississippi Flyway.

In addition to improving the ecological integrity of the watershed, this study has the potential to improve multiple historic landmarks. This study will provide an opportunity to reestablish the aesthetic qualities of Beargrass Creek through Cherokee Park. Designed by nationally recognized landscape architect, Fredrick Law Olmsted, this park and several of the surrounding neighborhoods are listed under the National Register of Historic Places (NRHP). Beargrass Creek is the focal point of Cherokee Park and the neighborhoods were established in a way to co-exist with the landscape and topography. Restoring the creek would reinstate the intrinsic value of this natural resource that inspired the original design plans of Fredrick Law Olmsted and preserve the historic significance of this region.

Risk Identification: Typically for Ecosystem Restoration projects, the level of risk to human safety is minimum to negligible. In particular for this study, restoring native plant communities by removing invasive species, naturalizing/resurging hydrology, and planting native species typically supports

limiting risks to humans. Examples of this being accomplished includes removal of noxious weeds, supports reduction in flood effects and inherent water quality improvements. Restoring urbanized streams by naturalizing channel morphology, channel roughness, and floodplain connectivity also adds support to limiting risks of dangerous currents and velocities during floods.

Figure 1: Three Forks of Beargrass Creek Study Area

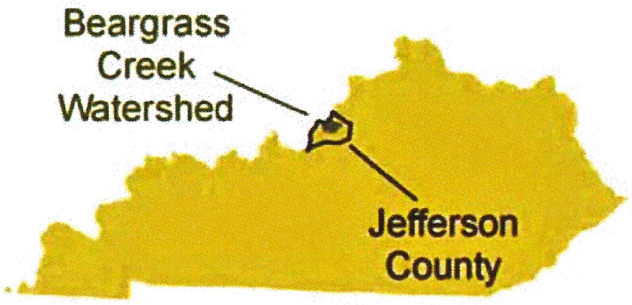
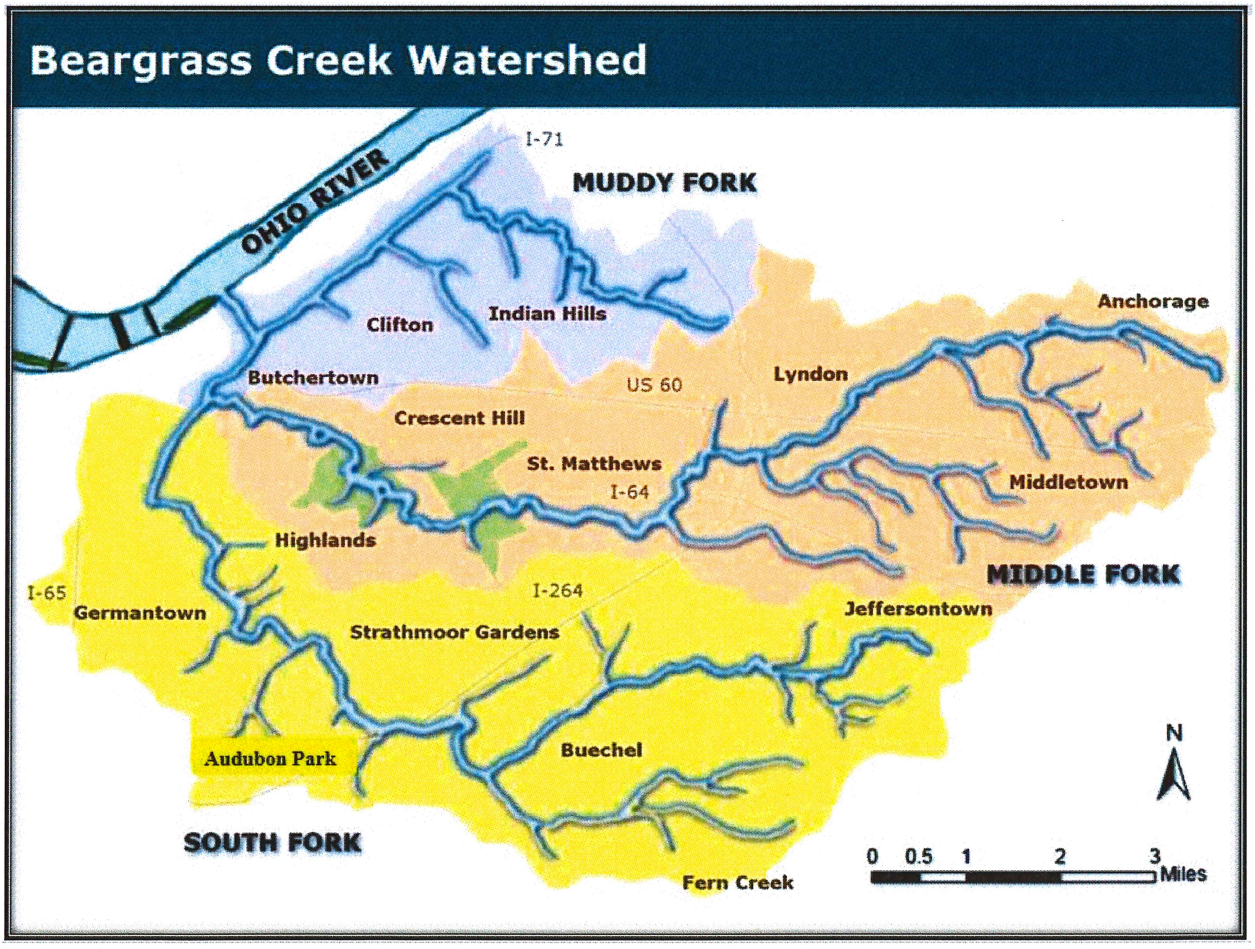


Figure 2: Three Forks of Beargrass Creek Project Area



1. FACTORS AFFECTING THE LEVELS OF REVIEW

Scope of Review

Factor	Assessment
Will the study likely be challenging?	No. The study not anticipated to be challenging. Based on review of the historic and existing conditions, although major natural resources degradation has occurred within the watershed, assessment and implementation methods anticipated to be utilized have been implemented with success before via USACE planning processes and authorities (30+ studies of this nature have been approved and implemented).
Provide a preliminary assessment of where the project risks are likely to occur and assess the magnitude of those risks.	*Study Risks*: Currently, study risks are considered to be minimal and of low magnitude. Study constraints do not limit the planning process to a point where a National Ecosystem Restoration (NER) plan could not be identified. Data availability is a risk that is currently being mitigated by a thorough investigation of previous studies. If data does not exist that is crucial for the planning process, it will be collected by a USACE team member. Model selection for the riparian zone will need to be finalized. Currently, two planning models have been identified that will require approval prior to use. Inherent uncertainty and risk with measuring ecological benefits and predicting ecological response in a changing climate are present. Another study risk is not achieving an acceptable level of support to gain nation-wide significance levels to acquire approval and funding for design and implementation. To reduce this risk, the study team has already engaged the non-Federal sponsor and stakeholders in building concepts of significance as identified by the P&G. Examples include the creation of habitat for multiple Federally listed species of bats and freshwater mussels, improvements to historic parks and neighborhoods listed under the NRHP, addressing the national scarcity of healthy urban watersheds, and propagating a high degree of local investment in the Beargrass Creek watershed. *Implementation Risks*: Currently, there are no anticipated risks for riparian zone ecosystem restoration since plant communities and native plant species selection would be based on a site's existing

	or geomorphically manipulated hydrogeomorphic setting. Selecting native plant species that have naturally adapted to a site's given hydrologic conditions highly reduces the risk of poor native plant coverage, re-infestation by invasive species, and intensive O&M. Aquatic ecosystem restoration at Eugene Field Park and Horner Park in the Chicago District are two such examples of projects that have successfully reintroduced native vegetation selected based on the site's hydrologic conditions. The minor risks associated with riverine restoration of small to medium sized creeks primarily lies in the availability of space and the effect of hydraulic forces on the restoration features. Those reaches in which it would be "risky" to modify channel configurations and habitat placement are those with little to no floodplain/riparian zone space and function as a confined channel. These risks would be reduced by screening and implementation of methods/features successfully applied in the past for confined channels.
Is the project likely to be justified by life safety or is the study or project likely to involve significant life safety issues?	The selection of an NER Plan would **not** be justified on life safety nor would it increases life safety risks.
Has the Governor of an affected state requested a peer review by independent experts?	No.
Will the project/study likely involve significant public dispute as to the project's size, nature, or effects?	No. The public is not expected to have significant points of dispute about the project. There seems to be resounding support for the study and an ER project as evident through local news articles, past meetings and forums, etc.
Is the project/study likely to involve significant public dispute as to the economic or environmental cost or benefit of the project?	No. It is anticipated the public would not have significant points of dispute in terms of economic or environmental costs.
Is the information in the decision document or anticipated project design likely to be based on novel methods, involve innovative materials or techniques, present complex challenges for interpretation, contain precedent-setting methods or models, or present conclusions that are likely to change prevailing practices?	No. All assessment methods for plan formulation purposes have been utilized with success on other USACE studies, and in particular follow the P&G for ER. Habitat assessment models recommended for use include an ECO-PCX approved model for riverine habitat (the QHEI); and riparian models specific to Kentucky floodplain and wetlands that could be easily approved during the study. Techniques and materials used for ecosystem restoration would be in tune with natural

	processes/system constrains, of natural materials. There are no anticipated precedent-setting topics.
Does the project design require redundancy, resiliency, and/or robustness, unique construction sequencing, or a reduced or overlapping design/construction schedule?	No, designs for naturalizing systems for ER purposes are straightforward. Natural resiliency and sustainability with low levels of O&M occur when the ecosystem design is in concert with system parameters of hydrology, hydraulics, and other hydrogeomorphic parameters. Such is the intent of this study and any resulting plan. Typically, a 5-year construction contract is sufficient to establish hydrogeomorphic parameters, native plant community richness and abundances, and allow time to implement adaptive management measures.
Is the estimated total cost of the project greater than $200 million?	No. It is not anticipated based on potential project sites/reaches and probable restoration techniques that the NER plan would exceed $200 million.
Will an Environmental Impact Statement be prepared as part of the study?	No. An Environmental Assessment will be prepared with subsequent FONSI.
Is the project expected to have more than negligible adverse impacts on scarce or unique tribal, cultural, or historic resources?	No. Due to the nature of the watershed, and the type of potential restoration techniques, it is not anticipated these resources would be adversely affected.
Is the project expected to have substantial adverse impacts on fish and wildlife species and their habitat prior to the implementation of mitigation measures?	No. Resulting projects of the NER plan would have beneficial effects on fish & wildlife species via restoring stream, wetland, and riparian habitats and native plant communities.
Is the project expected to have, before mitigation measures, more than a negligible adverse impact on an endangered or threatened species or their designated critical habitat?	No. Both the absence of Federally designated critical habitats or Federal T&E species within the study area, and the nature of ecosystem restoration result in negligible to positive effects.

2. REVIEW EXECUTION PLAN

This section describes each level of review to be conducted. Based upon the factors discussed in Section 1, this study will undergo the following types of reviews:

District Quality Control. All decision documents (including data, analyses, environmental compliance documents, etc.) undergo DQC. This internal review process covers basic science and engineering work products. It fulfils the project quality requirements of the Project Management Plan.

Agency Technical Review. ATR is performed by a qualified team from outside the home district that is not involved in the day-to-day production of the project/product. These teams will be comprised of certified USACE personnel. The ATR team lead will be from outside the home MSC. If significant life safety issues are involved in a study or project a safety assurance review should be conducted during ATR.

Cost Engineering Review. All decision documents shall be coordinated with the Cost Engineering Mandatory of Expertise (MCX). The MCX will assist in determining the expertise needed on the ATR and IEPR teams. The MCX will provide the Cost Engineering certification. The RMO is responsible for coordinating with the MCX for the reviews. These reviews typically occur as part of ATR.

Model Review and Approval/Certification. EC 1105-2-412 mandates the use of certified or approved models for all planning work to ensure the models are technically and theoretically sound, compliant with USACE policy, computationally accurate, and based on reasonable assumptions.

Policy and Legal Review. All decision documents will be reviewed for compliance with law and policy. ER 1105-2-100, Appendix H provides guidance on policy and legal compliance reviews. These reviews culminate in determinations that report recommendations 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. These reviews are further detailed in section 2.e.

Review Schedules and Costs. Table 1 provides the schedules and costs for reviews. The specific expertise required for the teams are identified in later subsections covering each review. These subsections also identify requirements, special reporting provisions, and sources of more information.

Table 1: Levels of Review

Product(s) to undergo Review	Review Level	Start Date	End Date	Cost	Complete
Planning Model Review	Model Review	1/6/20	2/10/20	$10K	No
Draft Feasibility Report and EA	District Quality Control	10/5/20	11/2/20	$25K	No
Draft Feasibility Report and EA	Agency Technical Review	11/9/20	2/1/21	$50K	No
Draft Feasibility Report and EA	Policy and Legal Review	11/9/20	12/18/20	$10K	No
Final Feasibility Report and EA	District Quality Control	3/21/22	4/18/22	$10K	No
Final Feasibility Report and EA	Agency Technical Review	4/25/22	5/30/22	$25K	No
Final Feasibility Report and EA	Policy and Legal Review	4/25/22	5/30/22	$10K	No

a. DISTRICT QUALITY CONTROL

The home district shall manage DQC and will appoint a DQC Lead to manage the local review (see EC 1165-2-217, section 8.a.1). The DQC Lead should prepare a DQC Plan and provide it to the RMO and MSC prior to starting DQC reviews. Table 2 identifies the required expertise for the DQC team. Some reviewers may serve in multiple disciplines such as team lead and a technical discipline, or planning and environmental resources, or environmental resources and planning or NEPA, or NEPA and planning or environmental resources.

Table 2: Required DQC Expertise

DQC Team Disciplines	Expertise Required
DQC Lead	A senior professional with extensive experience preparing Civil Works decision documents and conducting DQC. The lead may also serve as a reviewer for a specific discipline (such as planning or other environmental resources, etc).

Planning	A senior water resources planner with experience in USACE ER plan formulation, implementing habitat indices to achieve AAHU, performing CE/ICA analyses, utilizing natural processes, system parameters, natural materials and native plant species.
Environmental Resources	Knowledge in describing and assessing the affected environment, habitat model/indices application, etc.
NEPA Resources	Knowledge in NEPA process and assessing environmental affects/effects associated with FWP conditions. Would include all NEPA aspects of Earth, Water, Air, Cultural, etc resources.
Hydrology	Knowledge in characterizing highly urbanized watersheds, sewer systems, karstic hydrogeology, floodplain interactions, characterizing manipulating hydrologic parameters for ER purposes, use of hydrologic models identified in this review plan.
Hydraulic Engineering	Knowledge of highly urbanized watersheds, confined channels, piped streams, applying channel modifications, in-stream structures, in-channel velocities, computer modeling such as HEC-RAS, HEC-HMS, HEC-SSP, and InfoWorks Integrated Catchment Model.
Geotechnical	Knowledge in designing in-stream structures with natural alluvial materials and expertise in naturalistic bank restoration. Bank slope stability analyses. Requires expertise in sources and analyses of stone materials for riverine restoration.
Cost Engineering	Knowledge in marine and land demolition of structures and features, demolition/recycling/disposal of concrete and other materials, earthmoving, site grading and excavation, relocation of infrastructure, temporary erosion control features, invasive plant species removal, and native plantings. Knowledge of minor recreational features such as paths and signage is helpful.
Real Estate	Expertise in gross appraisals and LERRD crediting for ER projects; potential needs include In Fee, Permanent Ecosystem Easements, Temp Easements, and Channel Improvements.

Documentation of DQC. Quality Control should be performed continuously throughout the study. A specific certification of DQC completion is required at the draft and final report stages. Documentation of DQC will be conducted in DrChecks and follow the Louisville District Quality Control Procedures for Civil Works Planning Projects and the MSC Quality Management Plan. An example DQC Certification statement is provided in EC 1165-2-217, on page 19 (see Figure F).

Documentation of completed DQC will be provided to the MSC, RMO and ATR Team leader prior to initiating an ATR. The ATR team will examine DQC records and comment in the ATR report on the adequacy of the DQC effort. Missing or inadequate DQC documentation can result in delays to the start of other reviews (see EC 1165-2-217, section 9).

b. AGENCY TECHNICAL REVIEW

The ATR will assess whether the analyses are technically correct and comply with guidance, and that documents explain the analyses and results in a clear manner. ATR will be managed by the ECO-PCX. The review is conducted by an ATR Team whose members are certified to perform reviews. Lists of

certified reviewers are maintained by the various technical Communities of Practice (see EC 1165-2-217, section 9(h)(1)). Table 3 identifies the disciplines and required expertise for this ATR Team. Some reviewers may serve in multiple disciplines such as team lead and a technical discipline, or planning and environmental resources, or environmental resources and planning or NEPA, or NEPA and planning or environmental resources.

Table 3: Required ATR Team Expertise

ATR Team Disciplines	Expertise Required
ATR Lead	A senior professional with extensive experience preparing Civil Works decision documents and conducting DQC. The lead may serve as a reviewer for a specific discipline.
Planning	A senior water resources planner with experience in ER plan formulation, implementing habitat indices to achieve AAHU, performing CE/ICA analyses, utilizing natural processes, system parameters, natural materials and native plant species.
Environmental Resources	Expertise in describing and assessing the affected environment, habitat model/indices application, etc.
NEPA Resources	Expertise in the NEPA process and assessing environmental affects/effects associated with FWP conditions. Would include all NEPA aspects of Earth, Water, Air, Cultural, etc resources.
Hydrology	Expertise in characterizing highly urbanized watersheds, sewer systems, karstic hydrogeology, floodplain interactions, characterizing manipulating hydrologic parameters for ER purposes, use of hydrologic models identified in this review plan.
Hydraulic Engineering	Expertise of highly urbanized watersheds, confined channels, piped streams, applying channel modifications, in-stream structures, in-channel velocities, computer modeling such as HEC-RAS, HEC-HMS, HEC-SSP, and InfoWorks Integrated Catchment Model.
Geotechnical	Expertise in designing in-stream structures with natural alluvial materials and expertise in naturalistic bank restoration. Bank slope stability analyses. Requires expertise in sources and analyses of stone materials for riverine restoration.
Cost Engineering	Expertise in marine and land demolition of structures and features, demolition/recycling/disposal of concrete and other materials, earthmoving, site grading and excavation, relocation of infrastructure, temporary erosion control features, invasive plant species removal, and native plantings. Knowledge of minor recreational features such as paths and signage helpful.
Real Estate	Expertise in gross appraisals and LERRD crediting for ER projects; potential needs include In Fee, Permanent Ecosystem Easements, Temp Easements, Channel Improvements.
Climate Preparedness and Resilience	An ATR certified member of the Climate Preparedness and Resiliency Community of Practice (CoP) will participate in the ATR review. This reviewer will have previous experience relevant to climate resilience for ecosystem restoration planning.

Documentation of ATR. DrChecks will be used to document all ATR comments, responses and resolutions. Comments should be limited to those needed to ensure product adequacy. If a concern cannot be resolved by the ATR team and PDT, it will be elevated to the vertical team for resolution using the EC 1165-2-217 issue resolution process. Concerns can be closed in DrChecks by noting the concern has been elevated for resolution. The ATR Lead will prepare a Statement of Technical Review (see EC 1165-2-217, Section 9), for the draft and final reports, certifying that review issues have been resolved or elevated. ATR may be certified when all concerns are resolved or referred to the vertical team and the ATR documentation is complete.

c. INDEPENDENT EXTERNAL PEER REVIEW

This project does not meet any of the three conditions to require an IEPR provided in the Interim Guidance on Streamlining Independent External Peer Review (IEPR) for Improved Civil Works Product Delivery memo, dated 5 April 2019. These conditions can be found in Section 4 (a-c):

1. "The requirement for a Type I IEPR is based upon Section 2034 of WRDA 2007 and Section 1044 of the Water Resources Reform and Development Act of 2014, Section 1141 of WRDA 2018, the Office of Management and Budget Peer Review Bulletin, and other USACE policy considerations. The current guidance in EC 1165-2-217 regarding mandatory triggers for Type I IEPR includes conditions beyond the statutory requirements." The April 2019 memorandum streamlines the mandatory triggers to reflect only the statutory requirements for Type I IEPR. Effective immediately, the three mandatory conditions determining whether Type I IEPR is undertaken are as follows:
   a. The total cost of the project, including mitigation, is greater than $200 million.
   b. The Governor of an affected state requests a peer review by independent experts.
   c. The Chief of Engineers determines the project study is controversial due to significant public dispute over the size, nature, or effects of the project or the economic or environmental costs or benefits of the project (including but not limited to projects requiring an environmental impact statement (EIS)).

d. MODEL CERTIFICATION OR 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 are any models and analytical tools used 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 a planning product. The selection and application of the model and the input and output data is the responsibility of the users and is subject to DQC, ATR, and IEPR.

Table 5: Planning Models. The following models may be used to develop the decision document:

Model Name and Version	Brief Model Description and How It Will Be Used in the Study	Certification / Approval
Institute of Water	IWR Planning Suite II assists with plan formulation by combining user-defined solutions to planning problems and	Certified

Resources (IWR) Planning Suite II (Version 2.0.9)	calculating the effects of each combination, or "plan." The program can assist with plan comparison by conducting cost effectiveness and incremental cost analyses, identifying the plans which are best financial investments and displaying the effects of each on a range of decision variables.	
Qualitative Habitat Evaluation Index (QHEI)	Developed by the Ohio EPA. An index of macro-habitat quality of streams in Ohio and associated ecoregions. It provides a measure of habitat that generally corresponds physical habitat with the presence and abundance of stream fishes, and which are generally important to other aquatic life (e.g., invertebrates). The author described the goal of the QHEI as "filling a gap between completely subjective habitat descriptions and more labor intensive Habitat Suitability Indices developed for each species in a fish community." More specifically, this is an index-based, community-focused, ecological assessment. Calculation of the index is based on field observations and scoring of reach-scale habitat metrics organized under substrate quality, riffle-pool quality, bank and riparian quality, channel morphology development, and in-stream cover. Local stream gradient is scored using topographic maps. Each metric contains submetrics – for instance, the "channel morphology" metric is scored based on sinuosity, development, channelization, and stability. The metrics are individually scored and then summed to provide the total QHEI site score, with a maximum possible score of 100. The QHEI is extensively used within Ohio and adjacent ecoregions, generally for the purposes of biological monitoring or determining stream impairment.	Approval
TBD Riparian / Plants	Coordination with Regulatory Division led to the development of a tentative plan to select a riparian planning model. Use of the Floristic Quality Assessment (FQA) would require an approved plant list for the bluegrass region of Kentucky. The EPA Rapid Bioassessment Protocol (RBP) is used extensively by the Regulatory Division. The Hydrogeomorphic (HGM) Wetland Classification System is used within the RBP to assess wetland and riparian structure. The FQA and HGM models have their strengths and weaknesses in characterizing habitat unit benefits for aquatic ER.	TBD - ECO-PCX coordination required to select the model best fit for the study and facilitate the approval process.

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. The professional practice of documenting the application of the software and modeling results will be followed. The USACE Scientific and Engineering Technology Initiative has identified many engineering models as preferred or acceptable for use in studies. These models should be used when 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.

Table 6: Engineering Models. These models may be used to develop the decision document:

Model Name and Version	Brief Model Description and How It Will Be Used in the Study	Approval Status
InfoWorks Integrated Catchment Model Version 9.0	A software product from Innovyze. It is used for hydraulic and hydrologic modeling of the Louisville Metro combined sewer network. The local sponsor, Louisville MSD, uses the software in planning, optimizing and sizing combined sewer projects. Because of the complex nature of the combined sewer network and the existence of a calibrated catchment model, InfoWorks may be utilized to complement the HEC-HMS analysis focused on computing discharges throughout Beargrass Creek watershed. InfoWorks was approved for a previous study with the Sponsor. The use of InfoWorks may not be necessary but it is included here in case it is used.	Pending.
HEC-SSP v 2.1	Provides statistical analysis of hydrologic data. Will be used primarily for performing frequency analyses at various gages in the watershed to support calibration of the HEC-HMS hydrologic analysis.	HH&C COP preferred
HEC-HMS v 4.2.1	Software to simulate the hydrologic processes of the Beargrass Creek watershed.	HH&C COP preferred
HEC-RAS v 5.0.7	Software to simulate the hydraulic processes of streams within Beargrass Creek watershed.	HH&C COP preferred

e. POLICY AND LEGAL REVIEW

Policy and legal compliance reviews for draft and final planning decision documents are delegated to the MSC (see Director's Policy Memorandum 2018-05, paragraph 9).

(i) Policy Review.

The policy review team is identified through the collaboration of the MSC Chief of Planning and Policy and the HQUSACE Chief of the Office of Water Project Review. Attachment 1 lists the team. The team will be drawn from Headquarters (HQUSACE), the MSC, the Planning Centers of Expertise, and other review resources as needed.

- The Policy Review Team will be invited to participate in key meetings during the development of decision documents as well as SMART Planning Milestone meetings. These engagements may include In-Progress Reviews, Issue Resolution Conferences or other vertical team meetings plus the milestone events.

- The input from the Policy Review team should be documented in a Memorandum for the Record (MFR) produced for each engagement with the team. The MFR should be distributed to all meeting participants.

- In addition, teams may choose to capture some of the policy review input in a risk register if appropriate. These items should be highlighted at future meetings until the issues are resolved. An MFR may document key decisions on how to address risk or other issues.

(ii) Legal Review.

Office of Counsel representatives will be assigned to participate in reviews. Members may participate from the District, MSC and HQUSACE. The MSC Chief of Planning and Policy will coordinate membership and participation with the office chiefs.

- In some cases legal review input may be captured in a metting or milestone MFR. In other cases, a separate legal memorandum may be used to document Office of Counsel input. Each participating Office of Counsel will determine how to document legal review input.

ATTACHMENT 1: TEAM ROSTERS

PROJECT DELIVERY TEAM			
Name	Office	Position	Phone Number
[redacted]	LRL-PMC-PL	Project Manager / Planner	(502) 315-6867
[redacted]	LRC-PM-PL-E	Planning Mentor	(312) 846-5589
[redacted]	LRL-PMC-PL	Planning Team Lead	(502) 315-6776
[redacted]	LRL-EDT-G	Project Engineer	(502) 315-6454
[redacted]	LRL-EDT-H	H&H Engineer	(502) 315-6832
[redacted]	LRL-PMC-PL	Biologist	(502) 315-6130
[redacted]	LRL-PMC-PL	Archaeologist	(502) 315-7468
[redacted]	LRL-REC	Real Estate Specialist	(502) 315-6956
[redacted]	LRL-OC	Attorney	(502) 315-6648
[redacted]	LRL-EDD-G	Geospatial	(502) 315-2615
[redacted]	LRL-EDM-C	Cost Engineer	(502) 315-6385

DISTRICT QUALITY CONTROL TEAM			
Name	Office	Position	Phone Number
		DQC Lead	
		Ecosystem Restoration Planner	
		Environmental Resources	
		NEPA Resources	
		Hydrologist	
		Hydraulic Engineer	
		Geotechnical	
		Cost Engineer	
		Real Estate	

AGENCY TECHNICAL REVIEW TEAM			
Name	Office	Position	Phone Number
[redacted]	MVP-RPEDN-PD-F	ATR Lead	(651) 290-5259
		Ecosystem Restoration Planner	
		Environmental Resources	
		NEPA Resources	
		Hydraulic Engineer	
		Hydrologist	
		Geotechnical	
		Cost Engineer	
		Real Estate	
		Climate Preparedness and Resilience	

VERTICAL TEAM			
Name	Office	Position	Phone Number

POLICY REVIEW TEAM			
Name	Office	Position	Phone Number
[redacted]	LRL-PMC	Planning, Programs, and Project Management Branch Chief	(502) 315-6880