Review Plan
MAY 2025

1. Project Summary

Project Name: Southeast Michigan Flood Risk Management Study
Location: Macomb County, Oakland County, Wayne County, Michigan
P2 Number: 510603

Decision and Environmental Compliance Document Type: Integrated Feasibility Report and National Environmental Policy Act (NEPA) Document

Congressional Authorization Required: Yes

Project Purpose(s): Under Section 8201 of Water Resources Development Act of 2022, USACE will study and formulate alternative plans to manage flood risk within the geographic scope of the study.

Non-Federal Sponsor (NFS): Great Lakes Water Authority (GLWA)

Points of Public Contact for Questions/Comments on Review Plan: Detroit District Public Affairs (313) 500-3251

District: Detroit District (LRE)
District Contact: Project Planner, Project Manager

Major Subordinate Command (MSC): Great Lakes and Ohio River Division (LRD)
MSC Contact: Planning Division Chief

Review Management Organization (RMO): Flood Risk Management Planning Center of Expertise (FRM-PCX)
RMO Contact: FRM-PCX LRD Regional Manager

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 RMO Endorsement?	N/A
Date of Last Review Plan Revision	MAY 2025
Date of Review Plan Web Posting	Pending

Milestone Schedule and Other Dates

	Scheduled	**Actual**
FCSA Execution		10 Jul 2024
Alternatives Milestone	10 Jan 2025	10 Jan 2025
Tentatively Selected Plan	11 Jan 2030	TBD
Release Draft Report to Public	13 Mar 2030	TBD
Command Validation Milestone	25 Oct 2030	TBD

Final Report Transmittal	23 Mar 2032	TBD
State & Agency Briefing	6 Apr 2032	TBD
Chief's Report	23 Jun 2032	TBD

2. References

Engineer Regulation 1165-2-217 – Water Resources Policies and Authorities – Civil Works Review Policy, 2 September 2024

Engineer Circular 1105-2-412 – Planning – Assuring Quality of Planning Models, 31 March 2011.

Planning Bulletin 2013-02, Subject: Assuring Quality of Planning Models (EC 1105-2-412), 31 March 2013

Office of Management and Budget, Final Information Quality Bulletin for Peer Review, Federal Register Vol. 70, No. 10, January 14, 2005, pp 2664-267

Secretary of the Army for Civil Works (SACW) Memorandum dated 26 February 2024, Subject: Implementation Guidance for Section 8106(a) of the Water Resources Development Act of 2022, Scope of Feasibility Studies

Planning Bulletin 2019-04 – Incorporating Life Safety into Flood and Coastal Storm Risk Management Studies

The online USACE Planning Community Toolbox provides more review reference information at: https://planning.erdc.dren.mil/toolbox/current.cfm?Title=Peer%20Review&ThisPage=Peer&Side=No.

3. Review Execution Plan

The general plan for executing all required independent reviews is outlined in the following two tables.

Table 1 lists each study product to be reviewed. The table provides the schedules and costs for the anticipated reviews. Teams also determine whether a site visit will be needed to support each review. The decisions about site visits are documented in the table. As the review plan is updated the team will note each review that has been completed.

Table 2 identifies the specific expertise and role required for the members of each review team. The table identifies the technical disciplines and expertise required for members of review teams. In most cases the team members will be senior professionals in their respective fields. In general, the technical disciplines identified for a District Quality Control (DQC) team will be needed for an Agency Technical Review (ATR) team. Each ATR team member will be certified to conduct ATR by their community of practice. If Independent External Peer Review (IEPR) is warranted, panel membership will reflect disciplines representing the areas of expertise applicable to the review being conducted. The table is set up to concisely identify common types of expertise that may be applicable to one or more of the reviews needed for a study.

Table 1: Schedule and Costs of Reviews[1]

Product to undergo Review	Review Level	Site Visit	Start Date	End Date	Cost	Complete
Draft H&H Future Without Project (FWOP) Models	Targeted District Quality Control (DQC)	No	3-Sep-26	24-Sep-26	$10,000	No
Draft H&H FWOP Models	Targeted Agency Technical Review (ATR) Review	No	25-Sep-26	6-Nov-26	$15,000	No
Draft Economics FWOP Models	Targeted District Quality Control (DQC)	No	18-Nov-26	9-Dec-26	$10,000	No
Draft Economics FWOP Models	Targeted ATR Review	No	10-Dec-26	12-Feb-27	$15,000	No
Draft H&H Future with Project (FWP) Models	Targeted DQC	No	24-May-28	14-Jun-28	$10,000	No
Draft H&H FWP Models	Targeted ATR Review	No	15-Jun-28	28-Jul-28	$15,000	No
Draft Economics FWP Models	Targeted DQC	No	4-May-29	24-May-29	$10,000	No
Draft Economics FWP Models	Targeted ATR Review	No	25-May-29	30-Jul-29	$15,000	No
Draft Integrated Feasibility Report (IFR)/Environmental Assessment (EA)	DQC	No	29-Jan-30	26-Feb-30	$40,000	No
Draft IFR/EA	Public Comment under NEPA	No	13-Mar-30	03-May-30	N/A	No
Draft IFR/EA	ATR	No	13-Mar-30	08-May-30	$60,000	No
Draft IFR/EA	Policy and Legal Compliance Review	No	13-Mar-30	17-May-30	N/A	No
Draft IFR/EA	Independent External Peer Review (IEPR)	No	13-Mar-30	16-Jul-2030	$200,000	No
Final IFR/EA	DQC	No	17-Nov-31	23-Dec-31	$40,000	No
Final IFR/EA	ATR	No	23-Dec-31	23-Feb-32	$60,000	No

Final IFR/EA	Policy and Legal Compliance Review	No	23-Mar-32	27-May-32	N/A	No
Review Management Organization (RMO) – Coordination and Participation	An RMO will participate in most key meetings including In-Progress Reviews, Issue Resolution Meetings and SMART Milestone Meetings	No	N/A	N/A	$15,000	No

[1] Additional information on Table 1 can be found in Appendix D.

Table 2: Review Teams - Disciplines and Expertise

Discipline / Role	Expertise	DQC	ATR	IEPR
DQC Team Lead	Extensive experience preparing Civil Works decision documents and leading DQC. The lead may serve as a DQC reviewer for a specific discipline (planning, economics, environmental, etc.).	Yes	No	No
ATR Team Lead	Professional with extensive experience preparing Civil Works decision documents and conducting ATR. Skills to manage a virtual team through an ATR. The lead may serve on the ATR team for a specific discipline (such as planning, economics, or environmental work).	No	Yes	No
IEPR Manager	Planner with extensive knowledge of IEPR policy and procedures and contract management and oversight skills.	No	No	Yes
Planning	Skilled water resources planner knowledgeable in complex planning investigations and the application of SMART principle to problem solving.	Yes	Yes	No
Economics/Life Risk Consequence Assessment	Experience with applying theory, methods and tools used in the economic evaluation of water resources projects. Reviewer should be experienced with the FRM business line. Reviewer should be experienced with flood damage analysis, life risk analysis, and transportation impact analysis.	Yes	Yes	Yes
Environmental Resources	Experience with environmental evaluation and compliance requirements, national environmental laws and statutes, applicable Executive Orders, and other planning requirements.	Yes	Yes	Yes
Cultural Resources	Experience with cultural resource survey methods, area of potential effects, National Historic Preservation Act Section 106, and state and federal laws pertaining to American Indian Tribes.	Yes	Yes	No
Hydrology	Engineer with experience applying hydrologic principles and technical tools to project planning, design, construction, and operation.	Yes	Yes	No
Hydraulic Engineering	Engineer with experience applying hydraulic engineering principles and analytic tools to project planning, design, construction, and operation. Engineer is ideally familiar with pipe network modeling and coastal engineering (Great Lakes basin).	Yes	Yes	Yes
Cost Engineering	Experience using cost estimation software; working knowledge of water resource project construction; capable of making professional determinations using experience.	Yes	Yes	No

Discipline / Role	Expertise	DQC	ATR	IEPR
Civil Engineering	Engineer with experience applying civil engineering principles and analytic tools to project planning, design, construction, and operation. Engineer is ideally familiar with pipe networks and storm and wastewater sewer infrastructure.	Yes	Yes	Yes
Real Estate	Experience developing Real Estate Plans and experience in real estate fee/easement acquisition and residential/business relocations for Federal and/or Federally Assisted Programs for implementation of Civil Works projects.	Yes	Yes	No
Geotechnical Engineer	The conventional role for a geotechnical engineer in FRM studies focuses on riverine and coastal flooding alternatives. For this study, alternatives that require a civil engineer are more likely to be the focus (e.g. combined sewer separation, stormwater retention, and combined sewer control facilities). At the feasibility stage, engineering for these measures will be covered by the hydraulic and civil engineers who have more relevant and extensive experience with these measures.	No	No	No
Infrastructure and Installation Resilience (IIR)	A member of the IIR Community of Practice (CoP) knowledgeable of inland hydrology and infrastructure resiliency policy and practice.	Yes	Yes	Yes
Risk Analysis	For decision documents involving hydrologic, hydraulic, and/or coastal related risk management measures, the ATR team will include a reviewer with expertise in multi-discipline flood risk analysis to ensure consistent and appropriate identification, analysis, and written communication of risk and uncertainty.	No	Yes	No

4. Documentation of Reviews

Documentation of DQC. Quality Control will be performed continuously. A specific certification of DQC completion will be prepared at the base conditions (existing and future), draft and final report stages. Documentation of DQC will follow the District Quality Manual and the MSC Quality Management Plan. DrChecks will be used for documentation of DQC comments. An example DQC Certification statement is provided in ER 1165-2-217, Appendix D. Documentation of completed DQC, to include the DQC checklist, will be provided to the MSC, RMO and the ATR Team leader. The ATR team will examine DQC records and comment in the ATR report on the adequacy of the DQC effort.

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. All members of the ATR team will use the four-part comment structure (see ER 1165-2-217, Section 5). If a concern cannot be resolved by the ATR team and Project Delivery Team (PDT), it will be elevated to the vertical team to resolve using the issue resolution process in ER 1165-2-217, Section 5.9. Unresolved concerns will be closed in DrChecks by noting the concern has been elevated. ATR documentation will include an assessment by the ATR team of the effectiveness of DQC. The ATR Lead will prepare a Statement of Technical Review (see ER 1165-2-217, Section 5.11, and Appendix D), for the draft and final reports, certifying that review issues have been resolved or elevated. ATR will be certified when all concerns are resolved or referred to the vertical team and the ATR documentation is complete.

Documentation of Model Review. Planning models require compliance with EC 1105-2-412. Models developed by the Corps of Engineers are certified and models developed by others are approved. Certifications or approvals may be specific to a single study, a regional application or for nationwide application. Completion of a model review is documented in a memorandum from the Director of a Planning Center of Expertise and should accompany reporting packages for study decisions.

5. Supporting Information

Study or Project Background

Southeast Michigan, defined by the Detroit, Rouge, Clinton, and Lake St. Clair watersheds for purposes of this study, has experienced repeated, widespread flooding for decades, and five federal disaster declarations associated with flooding since 2000.

Like many other post-industrial cities, Detroit's infrastructure system was largely built between the late 19th century up to the mid-20th century, when Detroit's population was at its peak of 1.8 million residents. Declining to just under 640,000 residents in 2020, this massive decline in population also came with declining tax and utility revenue, straining the city's ability to service its aging infrastructure system and thus its residents. After municipal bankruptcy, the NFS for the Study, the Great Lakes Water Authority (GLWA), was formed in 2016 to take over operations and maintenance of the Detroit Water and Sewerage Department's (DWSD) wholesale assets such as major water transmission mains, sewage interceptors, treatment plants, and related facilities through a 40-year lease.

These assets include 183 miles of trunk sewers and interceptors which receive municipal combined and separated sewer flows from 88 member partners across 112 communities. This system is largely designed for the 10-year 1-hr storm and designed to overflow when at capacity, discharging partially treated or untreated wastewater into the Rouge and Detroit Rivers. In 1945, the "Relief Sewer Program" was developed to create a system of major, intermediate, and lateral relief sewers and pump stations to increase the capacity of the sewer system to accommodate a rainfall intensity of 1.9 inches per hour for one hour. This capacity was arrived at after determining an economic breaking point at which there were diminishing returns and unbearable financial burden to upsize anymore. An internal DWSD memo from 1977 acknowledges that:

"To accommodate the occasional downpours of more than 1.9 inches per hour, a choice must be made between flooding basements and flooding streets. In every possible instance, the sewers will be designed and built to cause retention of runoff in the streets and to allow the water to enter the sewers only as fast as the sewers can handle it without flooding basements."

Since the mid-20th century and especially over the last decade, increasingly frequent and extreme rainfall events have hit the region. On August 11th, 2014, the region experienced record-breaking rainfall—more than 6 inches in 4 hours, resulting in a federal disaster declaration. Another federal disaster for the region was declared after more than 6 inches of rain fell within 24 hours on June 26th, 2021. The transportation system includes numerous below grade highways which require pumps to clear its streets during rain events, and during these large events, can be closed for days at a time. Basement backups are increasingly common for portions of the study area during these large storms – where local surcharging (sewer blockages, collapses, overloading of house leads, and sanitary lateral backups) or downstream surcharging (combined sewers and backwater from pump stations and combined sewer overflow outfalls) lead to this recurring household flooding.

According to FEMA, 97% of claims from these federal disaster declarations in Detroit occur *outside* of FEMA's Special Flood Hazard Area, further pointing to a significant inland urban "pluvial" flooding issue. There have been over 260,000 FEMA Individual Assistance claims and inspections within the study area since 2004. FEMA has also reported over 40,000 High Risk Flood Properties (HRFPs) in the study area since 1978. These HRFPs are properties that have experienced one of the following:

1. **Individual Assistance (IA) Repetitive Loss,** where a structure has had at least two IA FEMA inspections showing some level of flood water in the structure, including basements/crawlspaces, or
2. **IA Severe Repetitive Loss,** where a structure has had at least four IA FEMA inspections showing some level of flood water in the structure, including basements/crawlspaces, or
3. **National Flood Insurance Program (NFIP) Repetitive Loss**, where a FEMA NFIP-insured structure has had at least two paid flood losses of more than $1,000 each in any 10-year period since 1978, or
4. **NFIP Severe Repetitive Loss,** where
    a. Four or more $5,000+ claim payments were made, or
    b. Two or more claim payments were made cumulatively exceeding the structure's value (before flood damage).

Riverine and coastal flooding also occur within the study area. Lake St. Clair lies to the east of the study area and the Detroit, Rouge, and Clinton Rivers and their tributaries flow through the study area. Riverine and coastal flooding occur along these waterbodies, increasing in frequency and damage when Great Lakes levels rise and when compounded with urban flooding. In 2019, already high Great Lakes levels and heavy precipitation caused Lake St. Clair's water level to rise higher than some of the coastal, canal front, and riverine shorelines in the region. One example is the City of Detroit deployed temporary flood protection defenses to Jefferson Chalmers, a historic neighborhood on Detroit's lower eastside that sits along the Detroit River and connecting canals and within the FEMA Floodplain.

Study Authority

The Southeast Michigan Flood Risk Study was authorized by Congress in the Water Resources Development Act of 2022, Section 8201. The authority directs the Secretary of the Army, acting through the USACE, to formulate alternatives to manage flood risk within the geographic scope of the study.

The Study Sponsor, GLWA, has also requested a feasibility study that formulates alternatives to maximize the net benefits from the reduction of the comprehensive flood risk within the geographic scope of the study via a letter dated 29 May 2024, prior to FCSA execution per the Implementation Guidance for Section 8106(a). The comprehensive flood risk drivers have been identified by GLWA as the isolated and compound effects of the following, as may be further refined during the development of the specific scope of work for the study:

a) riverine discharge of any magnitude or frequency;
b) flooding associated with seasonal and periodic variations in the water levels of the Great Lakes and connecting corridors;
c) inundation coinciding with storms on Lake St. Clair and the Detroit River;
d) a rainfall event of any magnitude or frequency;
e) flood events where discharges are less than 800 CFS for the 10 percent annual exceedance probability flood event, as may be relevant to consider during development of specific flood resiliency improvement alternatives;
f) seasonal variation in water levels for inland and Great Lakes water bodies within or adjacent to the study area; and
g) other drivers of flood risk including those associated with climate change, especially those drivers that are projected to increase the intensity, duration, and frequency of precipitation and flooding events within the study area.

Study or Project Area

The Study Area has been identified as the watersheds of the Detroit, Rouge, Clinton, and Lake St. Clair Rivers and the boundaries of the GLWA wastewater service area to span a total of 1,435 square miles. The Detroit River Watershed forms a critical hydrological connection between Lake St. Clair and the Detroit River, though it functions primarily as a "sewershed" as no open channels or tributaries run through the watershed. However, overland stormwater runoff in coastal areas drain to the Detroit River and combined waste and storm sewers overflow into the Detroit River in this watershed when the combined sewer system is at capacity. The Rouge River Watershed, approximately 470 square miles, flows through highly urbanized areas in the Metro-Detroit region, where it is subject to significant urban stormwater runoff challenges. The Clinton River Watershed extends over 760

square miles, transitioning from the rural landscapes of northern Oakland County to more developed areas near Lake St. Clair. The Lake St. Clair Watershed includes the lake itself and its tributaries, serving as a vital link in the Great Lakes system.

Study or Project Area Map

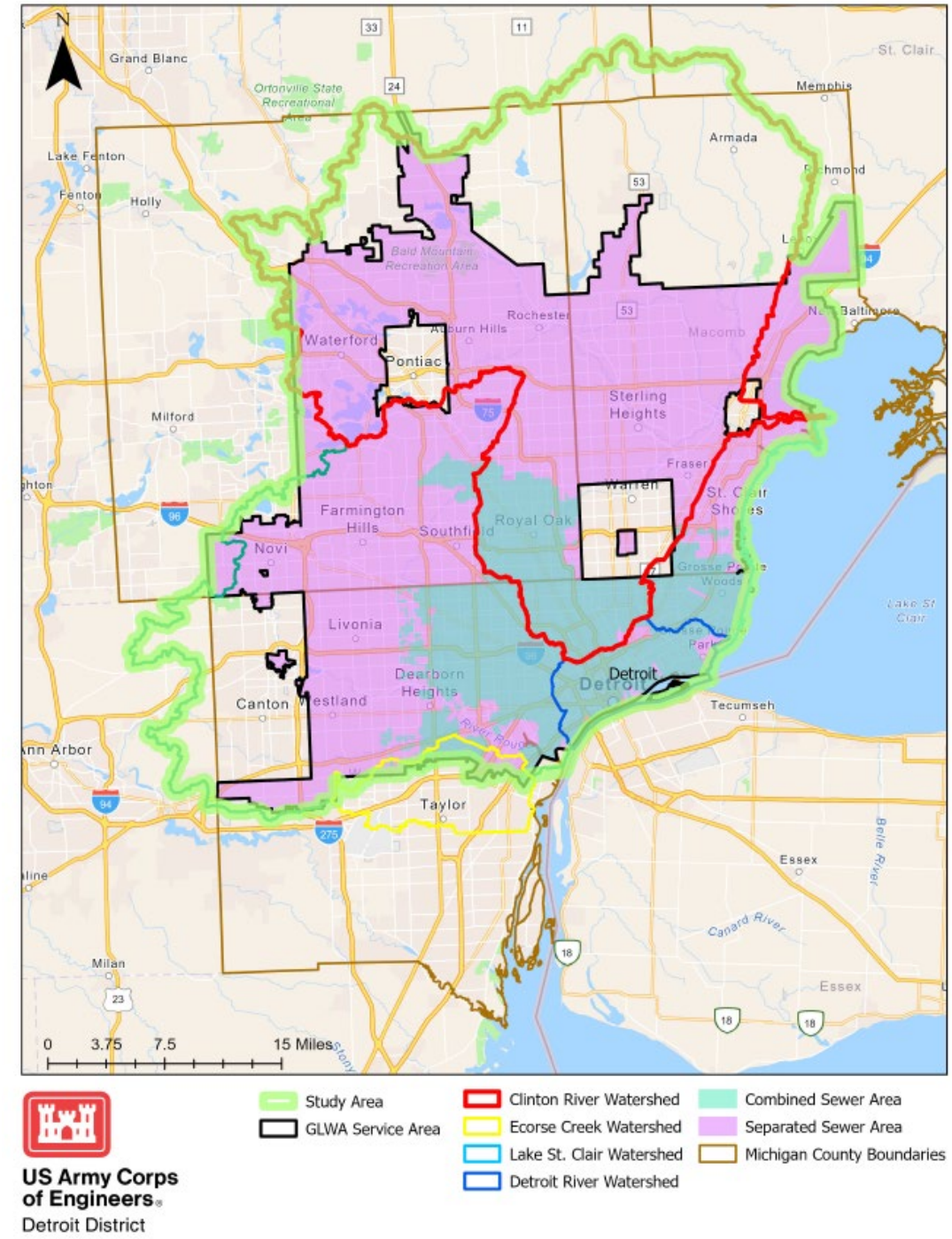

Figure 1 – Study Area Map.

Problem Statement

The following problems and sub-problems were initially developed by stakeholders and agencies at the study's planning charrette, and further refined by a second charrette with the Vertical Team.

1. During heavy precipitation events, local surcharging (e.g. sewer blockages, collapses, overloading of house leads, and sanitary lateral backups) or downstream surcharging (e.g. combined sewers and backwater from pump stations and combined sewer overflow outfalls) has led to recurring pluvial flooding. Pluvial flooding has caused significant economic damage and social hardship throughout the study area as described by the following:
    - 1.1 *Damage to residential structures.* Pluvial flooding has led to recurring flood damages to residential structures and associated contents.
    - 1.2 *Impacts to commerce and industry*. Pluvial flooding has impacted important sectors of the economy (e.g. automotive manufacturing) through direct (e.g. inundation) and indirect (e.g. decreased access, user delays, lost revenue) damages.
    - 1.3 *Damage to infrastructure.* Pluvial flooding in the study area has caused significant damage to infrastructure throughout the study area, including wastewater and water utilities, power, and pumping stations.
    - 1.4 *Traffic user delays.* Economic impacts of pluvial flooding and associated damage extend to user delays and associated costs from interstate and road closures.
2. Pluvial flood inundation or damage to structures and infrastructure increases life safety risk throughout the study area as described by the following:
    - *2.1* *Loss of life due to inundated occupied vehicles.* Flooding-related injuries and fatalities in the study area have occurred due to the inundation of occupied vehicles.
    - *2.2* *Elevated life safety risk to inundated structures.* Elevated life safety risk is associated with direct inundation of structures within the study area and may put the population living in or utilizing said structures at risk of losing their life.
    - *2.3* *Inundation of or damage to critical infrastructure and structures.* Inundation of or damage to critical infrastructure within the study area, including infrastructure associated with emergency services, first responders, critical utilities (e.g. power, roads, combined sewer systems), can also result in increased life safety risk.
    - *2.4* *Social Hardship.* Inundation of and damage to residential structures and roadways reduces access to critical facilities and services and leads to isolated individuals and communities during and following flood events. This leads to increased life safety risk, including the potential for indirect life loss.

3. During periods of high Great Lakes water levels elevating riverine levels and/or during heavy precipitation events, rivers and streams within the study area overflow their banks, resulting in elevated flood risk for affected communities. Recurring riverine flooding has caused economic damage, social hardship, and isolation of communities throughout the study area as described by the following:
    - *3.1* *Damage to residential and commercial structures.* During periods of elevated Great Lakes water levels, riverine flooding causes damage to residential and commercial structures.

4. Recurring riverine flooding increases life safety risk throughout the study area as described by the following:

4.1 *Social Hardship.* Inundation of and damage to residential structures and roadways reduces access to critical facilities and services and leads to isolated individuals and communities during and following flood events. This leads to increased life safety risk, including the potential for indirect life loss.

Goals and Objectives

Benefits associated riverine and pluvial flooding will be evaluated separately or jointly as needed to determine federal interest per current flood risk management policy.

1. Reduce damages and associated economic and social impacts to residential structures/communities resulting from the individual and/or combined effects of riverine and pluvial flooding:
    1.1. Inundation of and damage to residential structures.
    1.2. Inundation of and damage to infrastructure for which residential communities rely (e.g., roads, water and wastewater utilities, power and pumping stations).

2. Reduce direct and indirect economic damages to industries and commerce resulting from the individual and/or combined effects of riverine and pluvial flooding:
    2.1. Direct impacts through inundation of and damage to commercial and industrial facilities.
    2.2. Indirect economic impacts through road closures and user delays.

3. Reduce direct and indirect life safety risks resulting from the individual and/or combined effects of riverine and pluvial flooding:
    1. Inundation of occupied structures and vehicles.
    3.2. Individual and community isolation due to inundated or damaged transportation infrastructure resulting in loss of emergency services and/or access to critical facilities.
    3.3. Damage to critical infrastructure and loss of associated services.

At least three deaths have been attributed to or associated with flooding in the region since 2014. These deaths have included individuals who have suffered medical emergencies while trapped in their car on a flooded highway, and an elderly individual who fell in their basement which had some amount of floodwater. Flooding events have caused major expressways and highways to shut down, hindering access to emergency services, which could have an impact on life safety risk. Improvement to life safety risk could be measured by life loss modeling, reduction of flood depths on roadways and in structures, and emergency response and warning times. Flood-induced basement backups bring combined sewage into homes, presenting risks to public health as flood victims are exposed to pathogens and mold, and additional cleanup cost burden.

Future Without Project Conditions

Under the Future Without Project Condition (FWOP) scenario, Southeast Michigan will face increasing flood risks due to more frequent and intense rainfall, development will lead to further changes in floodplain hydrology, and fluctuating Great Lakes water levels. Aging and undersized infrastructure will further degrade, leading to higher and more frequent flood damages, economic losses, and potential displacement of residents and businesses. Seasonal riverine, coastal, and compound flooding will persist, with continued impacts on transportation infrastructure, increasing life safety risks, delays, and costs. A number of local infrastructure projects will be implemented prior

to any USACE investment in the region from this study's recommended plan and will be incorporated into the FWOP scenario for modeling.

Types of Measures/Alternatives Being Considered
This Study will evaluate a wide range of structural, non-structural, and nature-based measures aimed at reducing flood and storm damage risks and improving infrastructure resilience. Potential flood risk reduction measures include optimizing existing flood control structures, improving in-system storage devices, and implementing floodproofing techniques for residential and critical infrastructure. Structural solutions such as levees, floodwalls, pump stations, and backflow preventers may be considered to mitigate urban and riverine flooding. The study will also explore structural improvements like sewer separation, rerouting, and upsizing, pump station and communication systems improvements. Other structural options may involve enhancing sewer system performance by resolving bottlenecks, building new or larger sewers, and incorporating catch basin maintenance and private sewer lateral repairs. Engineering With Nature (EWN) measures will also be considered and may include green infrastructure/bioretention, living shorelines to improve stormwater management and reduce erosion, and habitat creation to attenuate wave energy. Non-structural strategies emergency evacuation plans, flood warning systems, floodproofing or elevating key infrastructure components (e.g. pump stations, etc.)

Estimated Cost/Range of Costs
Costs of alternatives are unknown at this time but given the size of the area and problem complexity, costs are expected to be well over $200 million for implementation of a comprehensive plan.

6. Models to be Used in the Study

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 following planning models may be used to develop the decision document:

Table 3: Planning Models.

Model Name and Version	Brief Model Description and How It Will Be Used in the Study	Certification / Approval
HEC-FDA 2.0	To estimate damages, HEC-FDA 2.0 uses a point-based structure inventory. Hydraulic stage data are used to determine the flood depths at each structure, and structure depth-damage curves are used to estimate damages. The program integrates hydrologic engineering and economic analysis to formulate and evaluate plans using risk-based analysis methods. It will be used to evaluate /compare plans to aid in selecting a recommended plan.	Certified

Regional Economic System (RECONS)	RECONS is a regional economic impact modeling tool that estimates jobs supported, income, sales and value added associated with Corps Civil Works spending and additional economic activities. The model will be used to estimate the regional economic impacts of project implementation.	Certified
RMC-LifeSim 2.0	RMC-LifeSim is an agent-based simulation system for estimating life loss with the fundamental intent to simulate population redistribution during an evacuation. Life loss is then determined by the hazard (e.g. flooding).	Certified for Life Safety Analysis
TotalRisk 1.0	TotalRisk is a flexible, and scalable, risk analysis program that connects the components of flood risk analysis: hazard, response and consequences. TotalRisk natively interacts with LifeSim to estimate life risk. It will be used in combination with LifeSim to estimate life risk.	Certification Pending
IWR Planning Suite II	The IWR-Plan was developed by the Institute of Water Resources as accounting software to compare habitat benefits among alternatives. Since this is a flood risk reduction study this model may be used for any potential mitigation to determine best buy alternatives and incremental cost analysis of alternatives. It may also be used to combine justified flood risk reduction measures across the study area into alternatives.	Certified

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. For example, HH&C models need to comply with the requirements of HH&C CoP Enterprise Standard 08101.

These engineering models may be used to develop the decision document:

Table 4: Engineering Models.

Model Name and Version	**Brief Model Description and How It Will Be Used in the Study**	**Approval Status**
HEC-RAS 6.7	Developed and maintained by the USACE Hydrologic Engineering Center (HEC). Project will require 2-dimensional flow capabilities. The latest version 6.7 allows projects to create a stormwater pipe network and integrate the network with 2D surface elements. HEC-RAS 2-D is commonly used for: Calculating depths and velocities over very low relief areas, the application of gridded rainfall	CoP Preferred

	over large areas; and (with version 6.7) the interplay of pluvial flood risk in urban settings. HEC-RAS 6.7 may be used to model local scale alternatives.	
HEC-RAS2025	RAS2025 is currently under development by the USACE HEC. The 2-dimensional unstructured mesh fevelopment tools are currently available and are an improvement over the mesh creation tools in HEC-RAS 6.6. Meshes created in RAS2025 are backwards compatible with HEC-RAS 6.6. RAS 2025 may be used to model local alternatives.	Single-Use Approval, coordinating with HH&C CoP and FRM-PCX
PC Stormwater Management Model (PC-SWMM) version 7.7	The NFS GLWA has an existing EPA SWMM model to be utilized during the study. EPA-SWMM is a free software that is used to analyze and design pipe networks (storm, sanitary and combined sewers) but it is limited in its ability to model overland flow in low-relief areas. This model will be converted to the more user-friendly, proprietary software PC-SWMM. PC-SWMM can model the combination of overland flow and the connect with the underground storm sewer system. PC-SWMM uses the EPA-SWMM modeling engine but provides an easier to use graphical interface for both data input and to review results. PC SWMM is an approved model. PC-SWMM will be used to model regional alternatives.	HH&C CoP Allowed for Use – Single-use approval pending by HH&C CoP
Tier 2 Infrastructure and Installation Resilience (IIR) Analysis	The IIR Community of Practice is scoping a Tier 2 Climate Analysis per Engineer Circular (EC) 1100-1-113. The analysis may utilize dynamically downscaled Global Climate Models (GCMs). It will be used for potential increased levels of protection for alternatives which will leverage comprehensive benefits or locally preferred plan justification.	Single-use approval pending by IIR CoP
Microcomputer Aided Cost Engineering System (MCACES), MII (Cost Engineer)	MCACES is the cost estimating software program tools used by cost engineering to develop and prepare Class 3 CW cost estimates.	CW Cost Engineering and ATR MCX mandatory
Abbreviated Risk Analysis / Cost Schedule Risk Analysis (Cost Engineer)	Cost risk analyses identify the amount of contingency that must be added to a project cost estimate and define the high-risk drivers. The analyses will include a narrative identifying the risks or uncertainties. During the alternatives evaluation, the PDT will assist the cost engineer in defining confidence/risk levels associated with the project features within the abbreviated risk analysis. For the Class 3 estimate, an evaluation of risks will be performed using Crystal Ball Cost Schedule Risk Analysis for construction costs over $40 million or the Abbreviated Risk Analysis for projects under $40 million. PDT anticipates project to cost over $40 million.	CW Cost Engineering and ATR MCX mandatory

Total Project Cost Summary (TPCS) (Cost Engineer)	The TPCS is the required cost estimate document that will be submitted for either division or Headquarters USACE (HQUSACE) approval. The Total Project Cost for each CW project includes all Federal and authorized non-Federal costs represented by the CW Work Breakdown Structure features and respective estimates and schedules, including the lands and damages, relocations, project construction costs, construction schedules, construction contingencies, planning and engineering costs, design contingencies, construction management costs, and management contingencies.	CW Cost Engineering and ATR MCX mandatory

7. Factors Affecting Level and Scope of Review

All planning products are subject to the conduct and completion of District Quality Control. Most planning products are subject to Agency Technical Review and a smaller sub-set of products may be subject to Independent External Peer Review and/or Safety Assurance Review. Information in this section helps in the scoping of reviews through the considerations of various potential risks.

Assessing the Need for IEPR

Mandatory IEPR Triggers

- Has the Chief of Engineers determined the project is controversial? ***No. The PDT has held 5 public scoping workshops, numerous municipal engagements, and intra-agency coordination thus far and has not identified significant controversy on the study.***
- Has the Governor of an affected state requested an IEPR? ***No***
- Is the cost of the project more than $200 million? ***Yes***

Discretionary IEPR

- Has the head of another Federal agency requested an IEPR? ***No***

Potential IEPR Exclusion

- Is the project cost greater than $200 million? ***Yes***
- Does the project have an Environmental Impact Statement (EIS)? ***At this time, it is not expected that an EIS will be required.***

Per ER 1165-2-217, exclusions to the IEPR process can be considered even when the project cost is more than $200 million and when the project will not undergo an EIS, if the following four exclusion criteria are met:

1) Not controversial,
2) Negligible impacts on scarce or unique cultural, historic, or tribal resources,
3) No substantial adverse impacts on fish and wildlife species and habitat; and
4) Negligible adverse impact on listed or endangered species or critical habitat.

It is uncertain at this time if all four exclusion criteria will be met. Additionally, this is one of the first studies to leverage Section 8106(a) of the Water Resources Development Act (WRDA) of 2022 to

investigate pluvial flooding adding potential complexity. As such, an IEPR has been scoped for inclusion in the study.

Assessing Other Risk Considerations

Risk-informed decisions for this study must account for various constraints and considerations to minimize adverse impacts and comply with legal and policy requirements. Key risk considerations include avoiding adverse impacts to water quality as mandated by the Clean Water Act, including adherence to National Pollution Discharge Elimination System (NPDES) permits. Currently GLWA is undergoing negotiations for a new NPDES permit with the State of Michigan Department of Environment, Great Lakes and Energy (EGLE), and changes to this permit during the study's duration may lead to NEPA compliance challenges during the study. Additionally, there is currently high uncertainty around the scope of environmental sampling required for NEPA compliance given the conceptual level and large scale of the initial array of alternatives. Other risks include having numerous implementation sponsors on the Tentatively Selected Plan (TSP) or multiple Consulting Parties under Section 106 of the National Historic Preservation Act, which could potentially increase complexity on the real estate and cultural resources reviews, respectively.

- Will the study likely be challenging? If so, describe how?

Yes, this is a highly urbanized study area with a complex interaction between the surface flooding and subsurface combined sewer system involving combined flow storage, pump stations, and other flow regulators. The PDT will be generating storm events accounting for a range of climate scenarios and modeling a regional combined sewer system including 183 miles of trunk sewers and interceptors, retention facilities, pump stations, and dozens of outfalls, which receive municipal combined and separated sewer flows across 945 square miles. This system also interacts with the riverine/coastal systems in the study areas—high water levels on Lake St. Clair, the Detroit River, and the Rouge River can cause coastal/riverine and compound flooding with the regional system surcharging during heavy rainfall. The study will be leveraging expanded FRM authority under Section 8106(a) of WRDA 2022.

- Provide a preliminary assessment of where the project risks are likely to occur and assess the magnitude of those risks.

There is medium risk and uncertainty involving assumptions made regarding 1) the FWOP condition including existing, proposed and authorized U.S. Army Corps of Engineers (USACE), State, and Municipal projects in the Study Area 2) riverine flood modeling, 3) the accuracy of the existing model information given the age of the system and then model updates made over the 30-year time frame of model development, and 4) accuracy of structure- information used for economic analysis (National Inventory and other local level structure data will be updated and used.).

- Is the project likely to be justified by life safety or is the study or project likely to involve significant life safety issues? Briefly describe the life risk, including the District Chief of Engineering's assessment as to whether there is a significant threat to human life associated with aspects of the study or failure of the project or proposed projects.

Based on historical life safety risk associated with flooding and an assessment of the life safety risk associated with failure of alternatives considered on the study, it is highly unlikely, with concurrence

from LRE's Chief of Engineering & Construction. This FRM study will evaluate alternatives that can reduce damages to structures and alleviate rainfall and storm-related flood risks in the Study Area therefore reducing life safety concerns. This study does not have major high-risk structures under consideration for modification/creation, nor is there high velocity flooding that would impact life safety. The flooding is primarily basement backups in structures, riverine/coastal flooding, and street/highway flooding at low/no velocity. Additionally, the PDT will use LifeSim which should identify any high-risk life safety concerns from the alternatives – this decision will be reevaluated if any LifeSim results indicate high risk life safety issues.

The project will incorporate life safety into the planning study in accordance with Planning Bulletin 2019-04 to determine the potential life safety risks and consequences. Life safety risk will be qualitatively evaluated during measure and alternative development to better ensure that a full range of alternatives are identified to address risk drivers, incremental risk of existing structures (including overtopping) and the residual risk that might remain after we put alternatives in place. Potential risk drivers identified to date include, combination of coastal storm, riverine and rainfall flooding in some areas, incremental risk associated with existing flood risk reduction structures, short warning time, limited availability of stream gauge data that inform warning systems and evacuations, and vulnerable populations. An IEPR that includes a safety review may be determined to be required if alternatives with significant life safety issues and are selected, but currently it is not expected.

- 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? If so, how?

Related to H&H modeling and the study, potentially—see first question, "will the study likely be challenging?" above. Related to design and implementation of the project, no—this project will likely not utilize novel design and engineering practices.

- Does the project design require redundancy, resiliency, and/or robustness, unique construction sequencing, or a reduced or overlapping design/construction schedule? If so, how?

No.

- Is the project expected to have more than negligible adverse impacts on scarce or unique tribal, cultural, or historic resources? If so, what are the anticipated impacts?

Yes, it is likely to have adverse impacts on historic resources, such as cultural, archaeological, architectural, or tribal resources. One of the high economic damage areas of flooding concern is a historic district registered on the National Register of Historic Places (Jefferson Chalmers, Detroit), as well as other historic districts present throughout the study area where alternatives may be considered. It is unclear at the time what those adverse impacts will be. Observed patterns in human habitation show a preference to settling near or along rivers and other bodies of water due to the essential resources they provided, including fresh water, food, fertile soil for agriculture, and transportation routes. These areas also served as strategic locations for trade, defense, and cultural practices. As such, there is a potential that archeological sites and resources are present in the study area and may be adversely impacted by the project. However, currently the initial array of alternatives

has high uncertainty on these potential impacts. This will be closely monitored as the study progresses.

- Is the project expected to have substantial adverse impacts on fish and wildlife species and their habitat prior to the implementation of mitigation measures? If so, describe the impacts?

  No, it is not expected to have substantial adverse impacts to fish and wildlife species. If the tentatively selected plan has significant adverse effects on fish and wildlife species, then the project would require formal coordination with US Fish and Wildlife Service or possibly an Environmental Impact Statement depending on whether the project also affected the quality of the human environment. Currently, the PDT does not expect this.

- 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? If so, what are the anticipated impacts?

  No, it is not expected to have substantial adverse impacts to threatened or endangered (T&E) species. If the tentatively selected plan has significant adverse effects on T&E species or their critical habitats, then the project would require Section 7 coordination with US Fish and Wildlife Service or possibly an Environmental Impact Statement depending on whether the project also affected the quality of the human environment. While there are T&E species and one species' critical habitat within the full study area, currently, the PDT does not expect alternatives to adversely affect this. The T&E species in the study area include: Indiana bat, northern long-eared bat, piping plover, rufa red knot, eastern massasauga, northern riffleshell (clam), rayed bean (clam), round hickorynut, snuffbox mussel, mitchell's satyr butterfly, Powskiek sipperling, and eastern prairie fringed orchid; the critical habitat is salamander mussel.

8. Risk Informed Decisions on Level and Scope of Review

Targeted ATR.
Will a targeted ATR be conducted for the study? **Yes,** the types of targeted ATRs being conducted and the rationale is provided below.

Targeted ATR – Econ: It is recommended that a targeted ATR be completed by a certified, FRM ATR reviewer following the FWOP conditions analysis as well as the FWP conditions analysis. This will allow the economic and planning team members to address any potential issues or concerns before moving forward with additional analyses. This will help mitigate the risk of completing the study in its entirety and having to address issues or concerns at that time. Also, it will potentially save on time and funding by addressing these things earlier in the process.

The targeted economics ATR will include review of the HEC-FDA model and transportation impacts model (i.e., detour and delays analysis). For the FWOP targeted ATR, model inputs and assumptions will be documented and provided for review. For the FWP targeted ATR, a draft of the economics appendix will be provided for review."

Targeted ATR – H&H: This project will leverage an existing EPA-SWMM model that covers approximately 265 square miles of Detroit and its suburbs. This existing model will be converted to

the proprietary PC-SWMM model and then expanded to more accurately capture the inflows to the system from the surface flooding. The PC-SWMM model will also contain more detailed pipe information obtained from the Infoworks model leveraged from the Detroit Water and Sewerage Department. These sets of models, along with existing terrain LiDAR data, will be used to calculate the existing conditions hydraulic grade lines in the sewer pipes and thus estimate any existing conditions basement flooding. The model will then be updated with the alternatives and the impacts to basement flooding will be analyzed. The PC-SWMM model may also be used to analyze just pluvial flooding that had been experienced in some locations. It is also possible that HEC-RAS 6.7 may be used for some alternatives to provide more detail at specific project locations, and would be included in the ATR reviews.

Due to the size of the existing models, and the complexity of leveraging models built over at least a decade by different entities, it was decided that targeted ATRs of the model will be conducted at the FWOP and FWP stages to address any potential issues or concerns before moving forward or finalizing analyses.

Targeted ATRs of the model will be conducted at the FWOP and FWP stages to address any potential issues or concerns before moving forward or finalizing analyses.

IEPR Decision.
The Detroit District recommends that an Independent External Peer Review (IEPR) be conducted because the anticipated project cost is expected to exceed the mandatory cost trigger of $200M and current uncertainty around meeting the four exclusion criteria; however, if the selected alternatives do not exceed a cost of $200 million or the four exclusion criteria are met as the study progresses, the decision to perform IEPR may be reassessed.

Safety Assurance Review. Safety Assurance Reviews are managed outside of the USACE and are conducted on design and construction products for hurricane, storm and flood risk management projects, or other projects where existing and potential hazards pose a significant threat to human life. In some cases, significant life safety considerations may be relevant to planning decisions. These cases may warrant the development of relevant charge questions for consideration during reviews such as ATR or IEPR. In addition, if the characteristics of the recommended plan warrant a Safety Assurance Review, a panel will be convened to review the design and construction activities on a regular schedule before construction begins and until construction activities are completed.

Decision on Safety Assurance Review. It is the PDT's assessment that a Safety Assurance Review does not need to be performed and a preliminary decision from the District's Chief of Engineering & Construction has been obtained that this review will not need to be conducted. This study does not have major high-risk structures under consideration for modification/creation, nor is there high velocity flooding that would impact life safety. The flooding is primarily basement backups in structures, riverine/coastal flooding, and street/highway flooding at low/no velocity. Additionally, the PDT will use LifeSim which should identify any high-risk life safety concerns from the alternatives – this decision will be reevaluated if any LifeSim results indicate high risk life safety issues.

9. Policy and Legal Compliance Review

Policy and legal compliance review of draft and final planning decision documents is delegated to the MSC (see Director's Policy Memorandum 2019-01).

(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. The makeup of the Policy Review 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.

- 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. Any key decisions on how to address risk or other considerations should be documented in an MFR.

(ii) Legal Review.
Representatives from the Office of Counsel 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 the MFR for the particular meeting or milestone. In other cases, a separate legal memorandum may be used to document the input from the Office of Counsel.

Each participating Office of Counsel will determine how to document legal review input.

10. Public Comment

This Review Plan will be posted on the District's website. Public comments on the scope of reviews, technical disciplines involved, schedules and other considerations may be submitted to the District for consideration. If the comments result in a change to the Review Plan, an updated plan will be posted on the District's website.

11. Documents Distributed Outside the Government

For information distributed for review to non-governmental organizations, the following disclaimer shall be placed on documents:

"This information is distributed solely for the purpose of pre-dissemination review under applicable information quality guidelines. It has not been formally disseminated by USACE. It does not represent and should not be construed to represent any agency determination or policy."

Appendix A - Brief Description of Each Type of Review

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 and accompanying components will undergo DQC. This internal review covers basic science and engineering work products. It fulfils the project quality requirements of the Project Management Plan. The DQC team will read all reports and appendices. The review must evaluate the correct application of methods, validity of assumptions, adequacy of basic data, correctness of calculations (error-free), completeness of documentation, and compliance with guidance and standards. Districts are required to check all computations and graphics by having the reviewer place a highlight (e.g., place a "red dot") on each annotation and/or number indicating concurrence with the correctness of the information shown.

Agency Technical Review (ATR) & Targeted ATR. ATR and all targeted-ATRs will be 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.

Independent External Peer Review. IEPR is required for this decision document. This is the most independent level of review and is applied in cases that meet criteria where the risk and magnitude of the project are such that a critical examination by a qualified team outside of USACE is warranted. Certain criteria dictate mandatory performance of IEPR and other considerations may lead to a discretionary decision to perform IEPR. For this study, a risk-informed decision has been made that IEPR is appropriate. The information in Section 1 – Factors Affecting the Scope of Review – informed the decision to conduct IEPR.

Cost Engineering Review. All decision documents will be coordinated with the Cost Engineering Mandatory Center of Expertise (MCX). The MCX assisted 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 occur as part of ATR.

Model Review and Approval/Certification. The use of certified or approved planning models for all planning work is required to ensure the models are technically and theoretically sound, compliant with policy, computationally accurate, and based on reasonable assumptions. Engineering models must comply with standards set by the appropriate Engineering Community of Practice.

Policy and Legal Compliance Review. 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.

Public Review. The District will post the Review Plan and approval memo on the District's internet site. Public comment on the adequacy of the Review Plans will be accepted and considered. Additional public review will occur when the report and environmental compliance document(s) are released for public and agency comment.