



BOSTON NORTH SHORE STUDY

REVERE, LYNN, SAUGUS, MALDEN & EVERETT, MA

FLOOD & COASTAL STORM MANAGEMENT

AND ECOSYSTEM RESTORATION

FEASIBILITY STUDY

SCOPE OF WORK

By BOB HUNT, Senior Project Manager, Retired
TO BE REVIEWED BY SPONSORS & CORPS OF ENGINEERS

STUDY AREA MAP



BOSTON NORTH SHORE, Revere, Lynn, Saugus, Malden & Everett, MA

FLOOD and COASTAL STORM RISK MANAGEMENT

and ECOSYSTEM RESTORATION FEASIBILITY STUDY

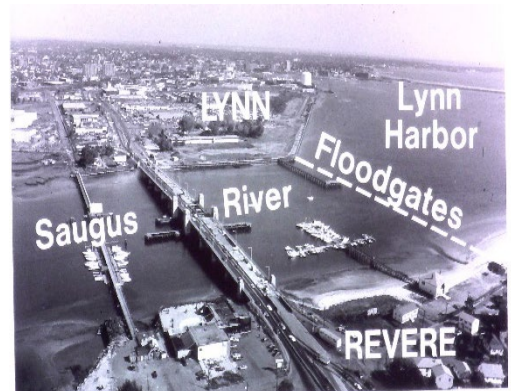
DRAFT SCOPE OF WORK, Revised January 18, 2023

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2. STUDY AUTHORIZATION & PURPOSE:

H.R. 7776 , the National Defense Authorization Act 2023 signed by President Biden on 23 Dec 2022 includes the Water Resources Development Act of 2022 (WRDA 2022), Sec. 8202, “Expedited Completion”, states: “The Secretary shall expedite the completion of a feasibility study for each of the following projects, and if the Secretary determines that the project is justified in a completed report, may proceed directly to preconstruction planning, engineering, and design of the project: ... Project for flood and coastal storm risk management and ecosystem restoration, Boston North Shore, Revere, Saugus, Lynn, Malden, and Everett, Massachusetts...”



The purpose of this scoping document is to help expedite the study and facilitate a scoping meeting between the sponsors and Corps of Engineers. The scope recommends optimizing flood protection for the Regional Saugus River Floodgate Plan, which was selected by communities, approved by the Secretary of Environmental Affairs, sponsored by the Commonwealth in 1990, then, authorized for construction by the President. Several plans will be updated, including the removal of the I-95 embankment, and ecosystem restoration studies are recommended.

3. REFERENCES

The following documents can be found on this web site: saugusriverfloodgates.com

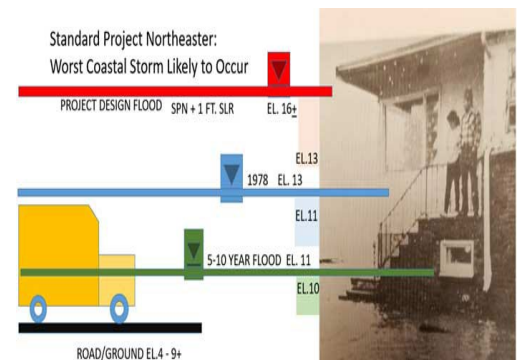
1. April 1990 Saugus River & Trib. Feasibility Report Section #1, Flood Damage Reduction, Main Report;
2. Section #2, December 1989 Environmental Impact Statement/Environmental Impact Report;
3. 1990 Feasibility Report Appendices: A-Plan Formulation, B-Hydrology & Hydraulics; C-Water Quality; D-Design & Costs; E-Geotechnical; F-Real Estate; G-Economics; H-Socioeconomic;

I(1)-Planning Correspondence, Legislative & Agencies; I(2)-Planning Correspondence, Towns & Groups; J(A)- Comments/Responses on Draft Reports; J(B)- Attachments/WLRC/Costs update; J(C)- Comments/Responses on Final Report Review; K-Environmental.

4. Sep. 1993 Saugus River & Tribs., General Design Report (GDR) and Appendices; A-Geotechnical; B- Structural Design-Flood Walls; C- Floodgate Design; D-Cost Estimate; E- Mitigation Plan.
5. Dec. 1993 Saugus River & Tribs., Hydrology & Hydraulics Feature Design Memorandum (FDM) #2 and Appendices: I-Field Data Collection; II-Evaluate Wave Data Saugus River; III- Revere Beach & Point of Pines Shore Front Study; IV-Physical Model Study of Revere Beach; V-Numerical Model Investigation of Saugus River & Tributaries; VI-Physical Model Study of Saugus River & Tributaries; VII- Saugus River Navigation Report; and VIII- Saugus River Floodgate Project Potential Ice Problems Report.
6. February 20, 1990 Certificate of the Secretary of Environmental Affairs.
7. September 1991 Environmental Restoration, Breach I-95 Embankment (East Saugus mitigation features).
8. August 22, 1988 Designation of Rumney Marsh Area of Critical Environmental Concern.
9. March 23, 2021 Environmental Benefits & Mitigation, Regional Saugus River Floodgate Project.
10. Aug. 26, 2020 Letter signed by the Mayors of Revere, Lynn, Malden and Everett, and Town Manager of Saugus requesting the Boston North Shore Study for regional flood protection and environmental enhancement.

The web site also contains the project description, photos, status, history, and milestones. The Corps of Engineers' studies and designs are filed in Records Holding in Waltham under the following names: Flood Damage Reduction Saugus River and Tributaries; Regional Saugus River Floodgate Project; and Southeastern New England Study (SENE). A detailed description of the 1990 selected plan, Regional Saugus River Floodgate Plan, is described in the GDR, with some features updated in the FDM, also described on the web site, and in the 1993 Project Management Plan (PMP).

An aggressive schedule for accomplishing the Boston North Shore Study has been prepared in draft which will require a full time project manager, engineering manager and environmental manager to successfully meet that schedule. Detailed schedules for the design and construction of the project are included in the 1993 Project Management Plan (PMP), currently in possession of the former project manager, with copies stored in Waltham files. Copies will be made available. The PMP also contains cost sharing tables and other information. Network schedules, developed for this study on Microsoft Project software, are available for: (1) the draft schedule for this Boston North Shore Study assuming funding this FY; (2) a summary (mostly critical path tasks) network of the PMP's Design & Construction Schedule updated for a start date when the Study Schedule may be completed; (3) a schedule for the GDR, FDMs, P&S, and summary of construction; and (4) a summary critical path schedule of the PMP design/construction schedule, as compared to, a faster track draft design/construction schedule with the Navigation Miter Gate separated out to progress as a critical task. If approved, this could reduce the project completion schedule up to 1-year & 8-months.

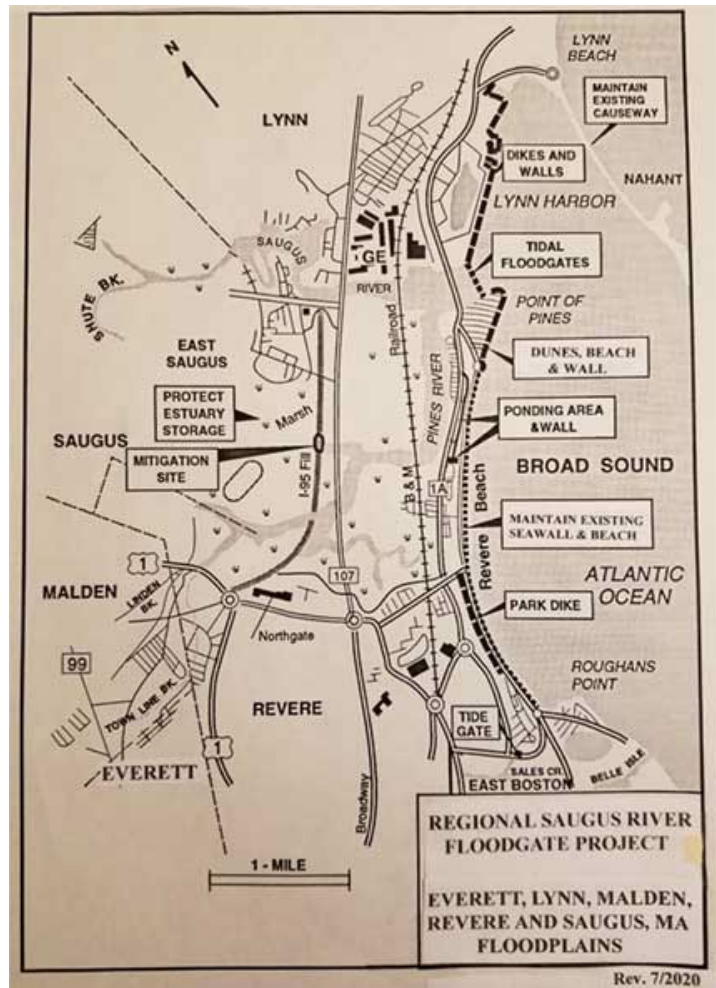


While reviewing all scope and schedules, team members should make every opportunity to reduce the cost, effort and timeframe for accomplishing the feasibility, future design, plans and specifications, and construction schedules. This is important to expedite the overall project and avoid as much loss of life and property damage as possible, since the completion of the project may not be until 2030.

4. FEASIBILITY STUDY, April 1990

Between 1982 (primarily 1984) and 1993 the communities' and technical groups assisted the Corps of Engineers in an \$8 million (\$16.5 million at today's prices) feasibility study to evaluate alternative flood protection plans and design for the selected project. The Regional Saugus River Floodgate Project provides the highest level of protection possible to 5,100 buildings and infrastructure against storm surges and sea level rise, purchases and protects the 1,650 acre estuary, and provides opportunities for marsh restoration. The regionally supported project received a favorable Certificate from the Secretary of Environmental Affairs (see web site), and was then supported and sponsored by the Commonwealth with Congress and the President authorizing it for construction. In 1993 the design was placed on hold when a new MA Secretary of Environmental Affairs, an environmental activist from Rhode Island, was opposed to construction along the Massachusetts coast, and refused to renew support.

Since the project was inactive for more than 7 years Congress de-authorized it. Now the area requires this updated feasibility study. Efforts to inform the communities that the Regional Floodgate Project would still be a viable solution to protect them against continued coastal floods and sea level rise was started by the retired USACE project manager in March 2019. With the interest restored by the communities, Senator Edward Markey and Representative Katherine Clark sponsored legislation to authorize this study in the Water Resources Development Act of 2022.



OPTION #3-REGIONAL SAUGUS RIVER FLOODGATE PLAN

The 1990 Feasibility Report findings were: (2019 price level, updated with a construction cost index)

Option #1-Local Projection Plans- Five LPPs were justified to protect 86% of buildings using 9.8 miles of shorefront structures which adversely affect views with 4 to 12 foot high structures, impacting real estate properties and 34 acres of wetlands. The \$183 million plan was partially effective since it required 80 gated drainage closures. Existing ones traditionally have significant maintenance and leakage problems. Five major North Shore transportation arteries serving 400,000 commuters would continue to be inundated. See web site.

Option #2-Nonstructural Plan- Only 7% of buildings were economically justified for raising or flood proofing with a warning system. The \$19 million plan had a very high degree of uncertainty in evacuating 4,000 to 10,000 people during high levels of rapid flooding of all roads and buildings from nor'easters, some with heavy snow over several days. Major transportation arteries and local roads would remain inundated.

Option #3-The \$220 million Regional Saugus River Floodgate Plan: protects nearly 100% of the 5,100 buildings (except Crescent Beach/ Garfield School area) against the worst coastal storm likely to occur, the

Standard Project Northeaster (SPN), with sea level rise, but with minimal impact on real estate and views; protect five (5) major transportation arteries serving Boston and local roads; project would purchase, protect and manage the 1,650 acre estuary for runoff storage and environmental education; provides the opportunity to restore flushing to 500 acres of the upper marsh; and mitigates 3 acres of wetland impacts. With 500 feet of gated openings at the mouth of the Saugus River, the Floodgates: provide safe passage for navigation; the natural flushing and tide levels in the estuary, are easily modified for higher rates of sea level rise; and close in 20 minutes to prevent regional damages. Floodgates would tie into 3.1 miles of new structures along the Lynn and Revere shorefronts with passive recreation. This was the only effective, complete and acceptable plan at that time, which produced the highest level of protection and highest net economic benefits. A very detailed description is in the General Design Report with the Feature Design Memorandum recommendation for a total dune system at Point of Pine, and removal of stone and a lower elevation for the Park Dike.

5. ECOSYSTEMS RESTORATION

The authorization legislation for the Study includes Ecosystem Restoration. The Estuary, better known as the Rumney Marsh, is adorned with opportunities to restore 14 ecosystems (156 acres) because of restricted channels where invasive species have flourished and 12 areas of fill (67 acres) which could be removed. Several websites list the restoration areas of interest to the state, including EPA's reference documents, which this study will evaluate.



RUMNEY MARSH-- 1,650 ACRE ESTUARY

The EPA's web site [epa.gov/ma/rumney-marsh-wetland](https://www.epa.gov/ma/rumney-marsh-wetland) contains EPA's Ed Reiner's report on tidal impacts above the I-95 embankment to show that widening the formerly restrictive bridges now, after reconstruction would no longer impede the tide levels, as opposed to the USACE finding during the 1990 study. The following three page pdf includes the EPA Rumney Marsh Restoration Areas Map dated 1-19-22 with a list of all potential restoration sites in the Rumney Marsh with a map showing their locations, and condition of tidegates.

<https://www.epa.gov/system/files/documents/2022-01/rumney-marsh-restoration-areas-2022.pdf>

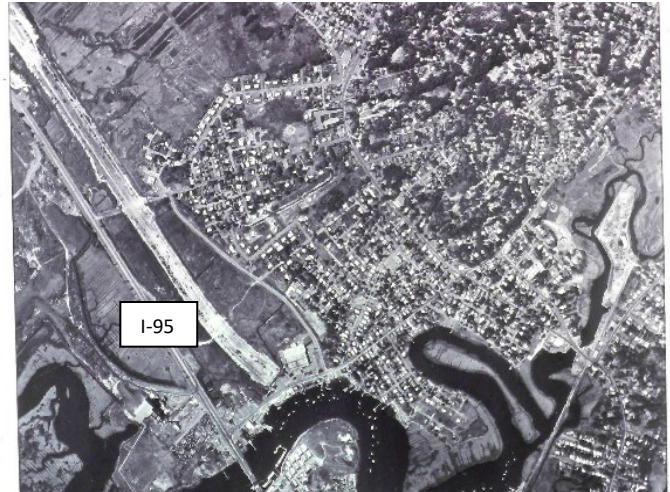
The list of sites on page 3 of the pdf includes potential projects in yellow and red. The red ones are 14 sites (156 acres) dominated with invasive species; and yellow are 12 sites (67 acres) of potential upland fill removal locations totaling on the order of 400,000 cy of sand. The sand when screened was used in the past to restore Revere Beach, and is suitable for dune restoration with the grain size called for by the Corps' Waterways Experiment Station for Point of Pines. It is very resistant to wave erosion. There are 6-non-functioning Self Regulating Tidegates (SRT), and 5-other non-functioning tidegates shown on the map.

An Area of Critical Environmental Concern (ACEC) is the highest level of protection that the Commonwealth can give to a resource area. The Rumney Marsh received the designation during the 1990 Feasibility Study as a result of the environmental investigations on the estuary. In the designation, provided on the web site, the Regional Saugus River Floodgate Project is specifically exempted.

The 2002 published Rumney Marshes ACEC salt marsh restoration plan, web site follows, containing descriptions of most but not all of the sites listed in the EPA Rumney Marsh Restoration Areas Map. Some of the descriptions may be outdated for instance the Ballard Street Salt Marsh Restoration Project did not proceed to permitting and construction and the Town of Saugus replaced the broken tide gate at Ballard Street with a combination gate to provide leakage consistent with the prior broken condition.

<https://www.mass.gov/doc/rumney-marshes-acec-salt-marsh-restoration-plan/download>

Mr. Ed Reiner, EPA Wetland Scientist (Reiner.ed@epa.gov) has worked to restore the marsh for four decades and provided these references. He understands there are studies going on or proposed relative to tide gate repairs and potential ecosystem restoration at Town Line Brook, however, he does not know details of grants or progress. EPA suggests the most important restoration effort would be to remove additional portions of the abandoned I-95 embankment as this is specifically listed as a goal in the Rumney Marshes Area of Critical Environmental Concern (ACEC) designation document.



<https://www.mass.gov/files/documents/2016/08/pf/rmdes.pdf>

EAST SAUGUS, MARSH & I-95 FILL

Because of the large number and complexity of potential restoration sites, the breaching and removal of the I-95 embankment is the priority and should be evaluated first with this Regional study. The remaining restoration sites, so as not to delay regional protection, should be accomplished as a separate Ecosystem Restoration Feasibility Study, which could take about 18 months to accomplish.

6. RUMNEY MARSH ACEC AREA

Area of Critical Environmental Concern--The ACEC Designation states: "The Saugus River Flood Damage Reduction Project is the first project to be exempted from the designation.. this project will be exempted as it is approved by the Office of Coastal Zone Management through its Federal Consistency review. I feel that the ongoing interagency review process, directed by the Corps of Engineers, will allow the project to be closely scrutinized as to its environmental impacts and provide for appropriate mitigation. This process will meet or exceed the intent of the designation with regard to the proposed project."

The ACEC Designation states the goal of the Executive Office of Energy and Environmental Affairs (EEA) is to remove the I-95 Embankment: "The second exemption is the removal of sand from the so-called "I -95 Embankment". While the removal of this material may not present a problem even under the designation, in the interest of clarity and facilitation of an important beach nourishment project, this activity Rumney Marshes ACEC Designation 22 August, 1988 Page 5 is also exempt. It is presumed that this excavation will be consistent with the existing Secretarial Certificate for the project. In general, I am, and have been, very concerned with the ultimate fate of this fill. To restate my position, our ultimate goal is to remove the fill and restore the marsh. Any activity which does not further this goal will be deemed inconsistent with the designation."

Taken from the ACEC Restoration Plan: "The Rumney Marshes Area of Critical Environmental Concern (ACEC) has been characterized by the U.S. Fish and Wildlife Service as one of the most biologically significant estuaries in Massachusetts north of Boston. The ACEC is 2,634 acres in size and is located in the municipalities of Boston, Revere, Winthrop, Lynn and Saugus. The ACEC is comprised of two marsh systems, Rumney Marsh and Belle Isle Marsh. These two areas are now disconnected, but were formally portions of a much larger salt marsh complex."

"The Rumney Marshes ACEC includes two highly productive estuarine systems The ACEC boundary for Rumney Marsh is primarily the 100-year floodplain to the north, west, and south, and follows roads and rights-of-way to the east. The ACEC boundary for Belle Isle Marsh includes the 100-year floodplain, wetlands edge, wetlands plus 100-foot buffer, and roads, encompassing the marsh and the tributary of Sales Creek. The Rumney Marshes ACEC is ecologically diverse with salt marsh, tidal flats, subtidal channels and abutting upland.

An extraordinary variety of birds use the area, including five state-listed endangered, threatened, or species of special concern according to the Massachusetts Natural Heritage and Endangered Species Program. The marshes also provide habitat for commercial fish and shellfish; a filtering system for improved water quality; and recreational, educational, and scenic resources. The extensive holdings of the (formerly) Metropolitan District Commission (MDC) in both Rumney Marsh and Belle Isle Marsh offer public access to the marshes and uplands for hiking, nature study, boating, and fishing for area residents and visitors. The recent opening of the Bear Creek Wildlife Sanctuary in Saugus further enhances public access to the ACEC and its salt marshes. The salt marshes are vitally important to the surrounding human population in their capacity to prevent flood damage by providing floodwater storage.”

The ACEC Designation reported: “Nearly 70 percent of all commercial fish and shellfish resources are dependent on estuaries for spawning and nursery grounds. Winter flounder, alewife, smelt, blueback herring, and American eel are a few of the more common finfish that occur within the nominated estuarine ecosystems...Intertidal habitats...support a wide variety of invertebrate resources. These include soft shelled and razor clams, mussels, snails, marine worms, and other invertebrates that are integral components of the marine food chain. Although many of the shellfish beds are too contaminated for human consumption, they represent an important food source for wildlife, attracting large numbers of wintering waterfowl to the area annually”. The list of bird species, migratory or indigenous, is extraordinary.” Because of the extreme value of this important resource, a separate Feasibility study is recommended to restore up to 223 acres of wetlands.

7. DAMAGE SURVEYS

There were 5,000 buildings identified in the 1990 Feasibility Report, plus 100 in Everett recently identified, in the Standard Project Northeast (SPN) floodplain of which only about 3,700 were damage surveyed. Currently, about 2,100 buildings need to be damage surveyed as explained below, including 1,200 in the Town Line and Linden Brook floodplain, and 900 in the remaining SPN floodplains of Revere, Lynn and Saugus. First, in Revere, Lynn and Saugus, there are: (1) about 350 buildings in the floodplain two feet above the 1990 SPN level, which is the additional area vulnerable to flooding by 2070, over the next 50 years; (2) there is an additional roughly a 4% increase in new development in the floodplain previously surveyed, or about 150 buildings. This is based on Revere’s growth in new construction reported in Dec. 2022. Revere’s floodplain was previously surveyed with 1,750 buildings in 1982, now there is 71 new buildings, or 4%: 66 new structures with 5,565 new housing units, and five (5) large city or commercial buildings. Details are included in the Economics section of this report and a list with the City; and (3) The Upper Saugus River and Shute Brook areas in Saugus were not evaluated for damages because of the cost of extending surveys. There are about 300 building in the original SPN floodplain, many flooded in the Blizzard of 78 and other storms. Surveys should be conducted for these 300 buildings plus an estimated 100 buildings 2.5 feet above the original SPN level. All together, these 900 buildings should be surveyed in order to develop benefits necessary to optimize the level of protection for the Regional project.

(4) The Town Line and Linden Brook areas in the floodplain of Revere, Malden and Everett were not evaluated for damages in the 1990 Feasibility Report since the Metropolitan District Commission, since dissolved, had planned to address the problem, however, no action was eventually taken. In the Blizzard of 1978, 100 year tide, and the 1979-10 year tide event with heavy rain, both events produced depths of water from 3 to 4 feet deep in the area flooding to El. 7 to 8 ft. NGVD. Several neighborhoods are located between the 5 and 10 foot NGVD contours. In addition to the estimated 1100 buildings in the original SPN floodplain, also to be damage surveyed there are about 200 buildings at 2.5 feet above the original SPN floodplain. This will account for the half foot of sea level rise since the damage survey, plus 2 feet of sea level rise to be evaluated in the SPN+1 and SPN+2ft sea level rise plans. H&H will establish these elevations. During coordination with Revere on the scope of this study it became apparent that the Town Line Brook floodplain extended into the **City of Everett**, which would benefit from regional protection. Past and potential future flood levels will need to be determined followed by the damage surveys.

Due to the fact that the Regional Saugus River Floodgate Project was initially optimized without the benefits of this area, and due to the amount of effort to determine benefits, it is recommended that the analysis of benefits for this floodplain proceed after all other damage and benefit analyses have been completed. This area will benefit from a regional project that prevents coastal flood waters from overtopping their shore front, and from entering any malfunctioning tide gates. Also the Regional Floodgate project will facilitate their drainage during gate closures, while operating their pumping station. Efforts should be started as soon as possible on this area but should not delay completion of the regional feasibility report.

“The Department of Conservation and Recreation (DCR) is developing a Master Plan for their land holdings in Rumney Marsh, however, not much progress has been made so far to Mr. Reiner’s knowledge other than a few meetings. Their limited resources have been working with Woods Hole Group on studies for resilience planning at Belle Isle Marsh.”

8. RECON STUDIES

Two other areas in Revere warrant further investigation which are largely independent of the regional protection area. Roughans Point at the south end of Revere Beach, and Crescent Beach/Garfield Scholl area behind the south end of Revere Beach. These investigations should not delay completion of the regional study which must remain on a fast track. However, they should be accomplished concurrently, if at all possible, due to the pending danger of sea level rise. Recon studies are included in this scope of work to determine if further action is warranted. If so, interim reports to Congress may be required the following two areas.

9. ROUGHANS POINT: The Roughans Point Flood Protection Project was built by the Corps about 1987 and included an armour stone revetment fronting the existing seawall with a cap on the wall. At that time it would provide 500 year protection at a stillwater El. 11.2 Ft. NGVD to 300 structures in the floodplain. With seas ½ foot higher today and facing a sea level rise of one more foot by 2050, and two feet by 2070, the stillwater levels for the 500 year event would then become 12.7 and 13.7 resp., and for the SPN+1 at 13.5 and SPN+2 at 14.5ft.NGVD. An evaluation of risk should be conducted independent of the regional study. See CERC-86-8 technical report on the overtopping model for Roughans Point.

10. CRESCENT BEACH/GARFIELD SCHOOL: To repeat the description in the 1990 Feasibility Report pg. 55: “This section is nearly hydrologically separate from the study area. Located behind the south end of Revere Beach, high ground cuts it off from the rest of the study area floodplain (except for MBTA tracks and a culvert which pass under the local sections of Beach and Revere Streets). The areas behind the Park Dike were optimized at the SPN level of protection with provisions for a temporary closure at Beach Street. However, south of Beach Street tidal flooding in the Garfield area is also caused by high tides in the Belle Isle Inlet which overtop at Bennington Street into Sales Creek. Construction of the Roughans Point flood damage reduction project would prevent 100 year (1978) flooding from entering the area by way of the Eliot Circle intersection. In addition, construction of a tide gate on Sales Creek is also needed to provide 100 year protection for the Garfield School area. The gate is justified, based on damages prevented in the area.”

“A 500 year flood with a tide level one foot higher than 1978 would flood Suffolk Downs to about El. 11 feet NGVD and would overtop the Revere Beach Parkway, the MBTA tracks under the Parkway, and the Eliot Circle intersection. However, preventing flooding from a 500 year event in the Garfield School area would require 1,200 feet of walls, dikes and road raising. The cost significantly exceeds the additional economic benefits that could be gained. The Garfield School area can only be justified for protection to the 100 year level, for which the highest net benefits are produced by use of a tidegate on Sales Creek.” This needs to be reviewed, especially in light of new Corps policy to protect adjacent areas even when the increment is not economically justified.

11. SEA LEVEL RISE

The NASA Sea Level Change Team confirmed, Fall 2022, that sea level rise would cause near term catastrophic and nuisance flooding, and evidence indicates the rise is accelerating, and findings confirm the higher rates developed by Federal agencies in a Feb 2022 report by NASA, NOAA, and the U.S. Geological Survey that over the next **30 years, by 2050, sea levels on the East Coast will rise 10 to 14 inches**, a rise historically seen in 100 years. This rise closely aligns with the USACE High Curve projection under which the project will be evaluated to protect against, and may be evaluated for even one foot higher, forecasted to be reached in 2070. As previously determined, the project would be designed to be easily modified for about a five foot rise, possibly achieved in 2100. Of like concern, “**..by the mid-2030s every U.S. coast will experience more intense high-tide floods** due to a wobble in the Moon’s orbit that occurs every 18.6 years.” **THIS WILL HAPPEN ONLY ABOUT 10 YEARS AFTER DESIGN IS STARTED, SO TIME IS OF THE ESSENCE!** Further, “..this lunar cycle, in conjunction with rising sea level, is projected to worsen the impacts of high-tide flooding during the 2030s and 2040s.”

12. PROPOSED OBJECTIVES

The Regional Project has recently received renewed support by letters from the five communities wishing to expedite the project and avoid repeated and future coastal catastrophic flooding, while facing another foot of rise by 2050 (NASA). Extensive work was accomplished by 1993: on the project, its alternatives, the environment, real estate, physical and numerical modeling, land & river surveys, borings, coordination, damage surveys, structural design and estimates, hydrology and hydraulics, layouts, cost estimates, and documentation. The floodplain and shorefront has had negligible change except some new buildings; however sea level has risen about one-half foot since the 1990 Feasibility, GDR and H&H FDM reports which largely relied on 1978 tide levels. It is therefore only prudent and in the best interest of the region and American taxpayer to limit investigations to: update the hydrology and benefits for the half foot growth of sea level rise since 1978; optimize the design for two foot higher rates of rise; use existing designs to incrementally update cross-sections and costs; survey damages for 900 buildings in the SPN+2 foot floodplain; analyze any alternative methods or practices required for re-evaluating non-structural plans; and coordinate extensively with Federal, state and local agencies, organizations and the public. Therefore, the objectives for the feasibility study should be to: make maximum use of existing information; provide addendums to existing reports; review and update alternatives benefits, costs and impacts; optimize the selected plan; evaluate removal of the I-95 embankment for ecosystem restoration and sand dune development; evaluate other flood prone areas (Town Line Brook, Roughans Point, and Crescent Beach/Garfield School area), and other potential ecosystems restoration sites without delaying the initial Feasibility Report and possibly including their reporting in interim reports; determine state and Federal support for a Regional Project; and accelerate the study for flood protection to accomplish it in about a year, if at all possible.

13. SPONSORS

The sponsors will have significant input into the planning process since the formulation and support of any recommended plan will be for their benefit and they will be cost sharing 50-50 in this study. They will be credited with in-kind services or contributions. For now it is envisioned that the effort by the Revere Planners, who have the lead for the public, will be credited toward their share, as well as a consultant. The consultant would assist in the public involvement process and coordination with resource agencies. In addition managing the project’s web site by Revere for the benefit of both the public and Corps is critical to keep updated information and status available to all concerned. The sponsors should also obtain available reports, high water marks and photos of flooding, as well as topographic mapping or surveys in areas lacking topo especially in the Town Line and Linden Brook areas.

The sponsor should also provide a list of all new buildings and demolished buildings since the original damage surveys were accomplished. In Revere surveys were accomplished in 1982, and in Lynn and Saugus in 1986. Revere has elevations around Town Line Brook associated with their hydraulic study. There should also be elevations in North Revere associated with their northern strand bike path, recently constructed. There should also be elevations behind Northgate and the DPW facility and BJs. Malden may have elevations as well.

14. GENERAL DIRECTION FOR TEAM

Weekly team meetings should be held to facilitate coordination among the team and sponsor during this busy and urgent regional study. To facilitate the brief meeting, it could also be conducted on zoom for the benefit of the sponsor and team members with minor efforts.

Option 1, Local Protection Plans: Since there is assumed to be very little change in the layout and design of the LPPs, the initial evaluation of these plans should include only an update of each LPP total cost and benefits with the appropriate cost index. This will then be compared to the same cursory update of the other two options, although Options 2 & 3 may both undergo more detail to optimize their formulation at the request of communities and agencies, taking into account sea level rise and damage surveys of new buildings. Although Option #1 is not included in the study cost estimate and schedule, if it is decided that LPP plans must be updated with revised cross sections, estimates, and impacts, then incremental adjustments should be made. These include raising of walls and dikes on the existing cross sections drawn to compute only the incremental increase in quantities with updated unit costs.

Option 2, Non-structural Plans: Although the initial findings showed minimal protection and lacked acceptability, the formulation of non-structural plans may have changed over the past 30 years and may require additional formulation, analysis and consideration. For this reason, and past concerns, early coordination with the public and agencies is important to determine if it is necessary to perform any additional studies. Effort is included in the study cost and schedule for this plan.

Option3, Regional Saugus River Floodgate Plan: Since this plan is known to be the strong preference for the communities, as well as the plan initially approved by both the Federal and State Governments, which produced the highest net economic benefits, highest level of protection, and met other criteria, it will undergo optimization at various sea level rise conditions. Early coordination is required to assure environmental concerns can again be mitigated due to likely updated regulations. There would be five plans evaluated to optimize the regional project: 100 year plan based on current tidal frequencies; 500 year plan with current tidal frequencies; the Standard Project Northeaster (SPN) with current frequencies; the SPN+1 plan with an SPN with one foot sea level rise reflecting 2050 sea level conditions; and SPN+2, for an SPN with two feet of sea level rise reflecting 2070 sea level conditions.

To expedite the formulation, evaluation and support of plans, immediate coordination with communities and resource agencies must be started and maintained. It remains critical to expedite this study as authorized by Congress due to the pending and repeated flooding from coastal storms and sea level rise. Until updated information is available, the descriptions of the three basic plans in the 1990 Feasibility Report and web site should be used to coordinate with the public and promote the education, understanding, explanations and any re-formulation of these three alternatives. This will obtain immediate feedback of other potential plans, issues or recommendations, especially non-structural which is of particular concern to some resource agencies and private interest groups, to consider if there are any viable alternatives to protect the public and restore the environment. The Certificate of EEA is included in the project web site and explains the Secretary's findings for each of the major environmental issues, and should be reviewed by the sponsors, agencies, and team.

14A- Floodgate Changes: Of particular important to note are changes in the design of the Regional Floodgate Plan since the Feasibility study. The **Project Description** was modified in November 1993 from the GDR and H&H FDM#2 which should be reviewed. For example, the floodgate structure has revised tainter gate dimensions, number and locations within the structure, as a result of the models, and is a concrete wall across the river. The Miter Gate's circular cofferdam was redesigned and enlarged, and should be reviewed. There are 5 large artist renderings of the floodgate structure to be turned over to the team by the PM. Lynn Harbor includes public access and landscaping along the new dike. Nahant Causeway needs to be maintained, which reduces waves in Lynn Harbor, and reduces the design top elevations.



FLOODGATE PHYSICAL MODEL

14B-Other Project Changes: At Point of Pines, WES modeling recommended that revetments be eliminated along the north half, and that dunes be built with I-95 sand, in lieu of revetments, be considered as a better alternative with higher protection for the south half as explained below. At the Revere Beach Park Dike, the rip rap may not be needed, and the dike top elevation is dependent on beach profiles, possible similar to eroded conditions in 1978 before beach restoration. The Mitigation plan location and design will likely need to be redone for a new location. Also, if the project is recommended with removal of the I-95 embankment as an ecosystem restoration measure with improvements along the west edge of East Saugus, the need for a mitigation site may not be required with the ecosystem benefits from removal of the I-95 embankment. See the features from the Draft Restoration Report in the web site. See the Hydrology and Hydraulics FDM#2, not the GDR, for the design and top elevations for building the: dunes at Point of Pines, Reaches A to E; and Park Dike.

14C- Revere Beach Concerns: Revere's Planner Reported: "One consideration under Hydrology and Hydraulics is the wave runup analysis for the changed profile of Revere Beach. Some (600,000 cy) of sand was placed on Revere Beach in (1990/91) and much of it has been eroded and shifted to the Point of Pines (a major benefit to the POP). The data for the original profile of this engineered beach has now changed and the beach has lost its effectiveness in reducing overtopping along Revere Beach Blvd. as the original profile has been compromised and not maintained by DCR over the years. I'm not sure if the engineered beach was factored into the 1990 feasibility report but it is an essential component to mitigate wave runup and erosion at the base of the Revere Beach seawall structure."

Response: During design the Dec. '93 Hyd and Hyd Feature Design Memorandum #2 (FDM), pages 74 thru 81 and it's Apdx. III and IV on the web site, evaluated the modeling for overtopping Revere Beach seawalls based on both the 1978 (pre-restoration profiles) and 1991 profiles with and without the Park Dike behind Revere Beach in the vicinity of the police station. The design level of protection is the Standard Project Northeaster (SPN) which is the worst storm likely to occur. Modeling the Park Dike top at El. 19.5 ft. NGVD, less than El. 23 ft. NGVD, which it is currently set at, the dike performs well eliminating 92% of the SPN overtopping with the 1978 profile, 96% with the 1991 profile. The El. 23 ft. NGVD dike, plus lowering the seawall, and providing vegetation and walkways on the park surface should further reduce overtopping of the park dike. The El. 23 ft. NGVD Park Dike performs well with the SPN storm +1 foot rise in sea level with the 1991 beach profile, but would see significant overtopping with the beach eroded to 1978 conditions. Maintenance of the beach is critical for reducing overtopping. The project's operating manual would clearly explain the need for maintenance. At the north end of Revere Beach, overtopping would be directed back to the estuary for storage. The FDM addresses several conditions for an eroded beach with sea level rise; however more modeling may be required during the GDR phase. The 1990 Local Cooperation Agreement between the Commonwealth (MDC) and Federal

Government allows for 50 years of cost sharing 65/35 for the periodic maintenance of the beach, estimated to average 3,000 cubic yards per year.

14D- Revere Beach & Point of Pines Surveys: A few representative profile surveys should be done at these beach locations to provide sufficient information, along with information in the CERC studies, for quantity estimates during the feasibility study. Complete profile surveys by either DEP or the Corps and detailed evaluation of both areas should be accomplished during the GDR phase to determine: the total amount of erosion since being restored; the exact amount of sand needed to return profiles to design levels; where the sand has gone or built up, such as at POP; the likely future maintenance required to properly maintain the beach; the impact on estuary storage requirements; and success of the current dune establishment. The timing when the surveys should be accomplished and their analysis should not delay the feasibility study/report. The complete surveys should be accomplished in late summer or early fall, when the sand has returned to the beach before the winter storms begin again to erode it.

14E- Point of Pines' Revetment vs. Full Dune: Based on information in the Hyd & Hyd FDM pages 75 – 77 and Apdx. III by the Corps and their Coastal Engineering Research Center, both the numerical and physical models of erosion and overtopping at Point of Pines beach and seawalls show that the planned revetments fronting the seawalls in Reaches A to D (Carey Circle north to the existing sand dunes) would not provide the level of protection needed as shown in the reports, using conditions represented by the 1945 storm (and other storms): with SPN overtopping between 3,600 Acre-Feet Table B1 (with beach built up to 10.5 ft. MLW) to 7,300 Ac-Ft Table C2 (existing beach). For more frequent storms there'd be less overtopping, eg. 10 year at 148-343 Ac-Ft., 20 yr. at 184-379, 50 yr. at 548-1250, and 100 yr. at 663 -1613. But as sea level rises, significant overtopping would increase for frequent storms to the severe detriment of the area.

However, modeling of sand dunes at Point of Pines in the H&H FDM Apdx. III confirms the very high level of protection which would be afforded by a complete dune system in Table C1 with "0" or no overtopping for all events including the SPN using the coarse I-95 sand. Dunes would be built with a 30 foot wide berm built at a minimum top El. 21 ft. MLW (16.5 ft. NGVD), the same elevation as top of seawalls along the south half of the shorefront, but at Carey Circle built to El. 23 ft. MLW (18.5ft. NGVD). The full dune design with sand fences and walkways across the dunes at the end of each street is strongly recommended, showing no overtopping for the SPN and likely higher storms as sea level rises. As reported Apdx. III page 103: "Analysis of the dune optimization profile response results indicates that the dune designs tested with a coarse-grained beach fill are extremely resistant to erosion in response to the SPN." The General Design Report (GDR) was prepared before these results were available. The total dune system for Point of Pines needs to be documented in the Feasibility Report to replace the revetment plan. This will provide much higher protection, higher project benefits, lower costs than revetments, and much less overtopping. Overtopping would likely cut in half (see FDM Apdx. III) the overtopping estuary storage requirement when the gates are closed, currently at 660 acre-feet (FDM pg.127). The cost estimates, stage-frequency curves and hydrographs would need to be revised. The sand migrating from Revere Beach to nourish the beaches at Point of Pines will continue to help maintain a full dune system. Due to the need for more investigation for the effects of sea level rise on the sand dunes, additional modeling may be required during the GDR phase. For the feasibility investigation a suggested dune top elevation of El.23 ft. NGVD should be considered as an estimate for protection against the SPN + 1 foot rise.

14F-Removal of I-95 Embankment: The amount of sand needed for the full dune system at Point of Pines Reaches A thru D, including Carey Circle to POP's existing dunes, is estimated at 110,000 cy. The available course-grained sand in a few areas of the abandoned I-95 embankment in the estuary is about 209,000 cy. This material is located in the "flood control berm" (see cross-section in website, Reports, Environmental Restoration Report) for areas #18, #23, #29 and the Pines River opening (shown on EPA's Map of Rumney Marsh

Restoration). The full dune system would not likely be built, or I-95 breached, until the floodgates were operational due to the possibility of raising flood levels in East Saugus. The removal of this material would create about 16.7 acres of ecosystem habitat and open up about 4,900 LF of open marsh to facilitate natural flushing and flooding of the 500 acres of upper estuary. The Draft Environmental Restoration Report on the web site evaluates options to mitigate slightly higher tides along the marsh edge of East Saugus, and describes benefits from restoring the upper estuary.

14G- Revere Beach Dune Creation: Besides the over topping at POP, the north half of Revere Beach contributes about half of the 660 acre-feet of SPN overtopping into the estuary during gate closure. There remains about 100,000 cy of I-95 material available in the above four (4) areas plus more in other areas which could be used to create sand dunes along this northern reach, plus restore design levels along the beach. Currently some sand dunes have been created along the north beach which benefit migrating birds. Sand could be used to create a much better protective dune and eliminate the SPN overtopping and make more estuary storage available as sea levels rise. This has not previously been evaluated, but may be considered in the feasibility study with additional modeling delayed until the GDR stage, so as not to delay the Feasibility Report.

14H- Woods Hole Group Investigation: In discussions with Mr. Conor Ofsthun, Coastal Scientist, with the Woods Hole Group, he has a huge undertaking to work with the five communities in our study area and identify the potential damages to major municipal structures such as fire stations, pumping stations, etc. These facilities would have their start of damage elevation surveyed, then evaluated for damages at several levels of flooding including 10, 100, and 1000 year frequencies. Potential structural and non-structural solutions would then be identified. The resulting product is a planning level report to “identify projects to reduce risk” which is due in June 2023 using \$203k funds from the state’s Municipal Vulnerability Program (MVP) which includes matching funds from the communities.

Conor Ofsthun reported this summary of his investigation, in part: “The City of Revere (Project Lead) with the support of the Saugus River Watershed Council (Project Manager) are coordinating a regional study of coastal vulnerability and adaptation for the Saugus River Watershed (SRW) region. Five cities and towns have come together to initiate this study. Along with the Woods Hole Group, the five municipalities and the Saugus River Watershed Council (SRWC) make up the Project Team...

“The SRW Coastal Vulnerability Assessment and Adaptation Plan (Project) encompasses a detailed vulnerability and risk assessment of municipal infrastructure and natural resources to develop targeted, regional strategies aimed at reducing risks from increased coastal storm intensity, sea level rise and storm surge. In addition to coastal storm and sea level rise vulnerability, the Project will pilot a combined coastal/stormwater 2-dimensional modeling effort in the Town Line Brook of Malden/Everett to address the cumulative effects of ocean-based and meteorological storms. Furthermore, an economic impact analysis will be prepared to quantify the results of the vulnerability assessment in terms which can support future grant efforts, such as the FEAM Building Resilient Infrastructure and Communities (BRIC) program...

“Prioritizing potential areas and projects for adaptations is a key outcome of this vulnerability assessment. Through the process of analyzing marsh migration, prioritizations will look to areas which facilitate natural and nature-based features and green infrastructure, wherever possible and effective. ..The project will result in a number of public benefits by making positive steps towards storm damage protection and flood control for publicly held assets (thereby reducing vulnerability to hazards and storm recovery costs), as well as for nearby private properties (that may benefit from the detailed vulnerability mapping as well as any proposed regional adaptation actions that additionally reduce sea level rise and storm surge vulnerability in the SRW). The assessments will help the region strategically coordinate and allocate resources to preserve and enhance the Saugus River Watershed societal, environmental, and economic vitality in the face of a changing climate.”

Revere's Elle Baker is the point of contact for further information on this investigation.

14I- Contracting Out Study Tasks-Due to the work load of the New England Corps office and simplicity of modifying the existing designs by a foot or two, supervisors should consider the use of contracting out, if necessary. Contracting out could be used for the updating of cross sections, layouts, quantity takeoffs, estimates, damage surveys, data entry and analysis in order to help accelerate the schedule.

15. Project Manager, Plan Formulation Branch: Tasks include but not limited to:

1. A full time project manager is required to oversee the project, public coordination, manage the schedule and budget, and manage the 15% Contingency (about \$200k) suggested for the study;
2. Assist establishing Steering committees in each community and a Technical Group in coordination with the lead community, Revere. A description of those interests used during the initial study are shown in the back of the 1990 Feasibility Report. A field trip to the New Bedford Hurricane Barrier which uses the miter navigation gate, and to Fox Point which uses tainter gates similar to the proposed project flushing gates which proved useful for committees during the initial study, and is recommended;
3. Assist ordering all reports from Records Holding, review all available reports and coordinate the study scope of work and study costs with team members and sponsor;
4. Prepare and coordinate the cost sharing agreement;
5. Prepare the Draft Feasibility Report;
6. Coordinate the Public and Washington level reviews of the Draft Report and EIS/EIR supplement;
7. Prepare the Final Feasibility Report; and
8. Coordinate with the team the preparation of scopes, costs and review schedules for the GDR, FDMs, Plans & Specifications, and Construction phases. The scope should include at least full surveys of Revere Beach and Point of Pines to determine migration, total erosion since restored, restoration quantities, and level of protection afforded to the Wonderland/Park Dike area, North Revere Beach area and Point of Pines during the GDR stages, as well as any required modeling. The 1990 Local Cooperation Agreement between the Federal Government and the Massachusetts Metropolitan District Commission allowed for 50 years of 65/35 cost sharing for the maintenance/restoration for the Revere Beach Erosion Control Project.

16. Hydrology and Hydraulics: Tasks include but not limited to:

1. Review all existing documents and determine the recommended scope and cost of study efforts;
2. Install and record gaging stations, if necessary, in the vicinity of the I-95 embankment. EPA's report indicates that the widening of the Route 107 Bridges removed the flow restriction so that tides are no longer restricted to flow above the embankment. If substantiated this could have an impact on marsh restoration;
3. Evaluate the estuary tides for alternative impacts on the estuary and East Saugus with and without removal of the embankment, and with and without the floodgates installed;
4. Select top elevations for all shorefront structures using SF curves to represent PLANS: for the 100 year, 500 year, SPN, SPN+1, and SPN+2 ft. rise levels of protection.
5. Investigate the flooding in the Upper Saugus River and Shute Brook areas of Saugus and develop existing stage frequency, assume two more curves, but likely similar to the Boston curve;
6. Develop S-F curves for existing conditions for 18 zones, eg. raise the current 1990 curves up about ½ foot;
7. Prepare S-F curves for both a 1-foot sea level rise and 2-foot rise conditions for 20 zones;
8. Develop modified stage-frequency curves for above 5-Plans with the Floodgate Project installed with design heights to protect against tide heights for the 5-plans;
9. Develop overtopping and estuary storage volumes from above plans;

10. Evaluate and prepare for the feasibility phase, plans to reduce flooding along the west side of East Saugus to mitigate for removal of the I-95 embankment, see draft Restoration Report in the web site which describes two mitigation plans;
11. Without delaying efforts to complete the Regional study or Feasibility Report, investigate the flooding in the Town Line and Linden Brook areas and develop existing and modified stage frequency curves so damage surveys can begin. There are descriptions and photos on the web site (at end of Project Description) of the seven causes of tidal flooding in the Town Line Brook area. This effort could be done by a separate engineer to avoid impacts on the rest of the critical path schedule, or that would delay the overall completion of the regional study. The results of the investigation would serve to verify that the optimized level of protection was determined in the Feasibility phase, and report the additional benefits to the project;
12. Without delaying the regional study, update the stage frequency curves for Roughans Point for a +1-foot rise and +2-foot rise in sea level to determine the impact of rising sea levels. Depending on the results of Economics determining the recurring damages, additional investigations may or may not be required;
13. Without delaying the regional study, update the stage frequency curves for the Crescent Beach/Garfield School area for a +1-foot rise and +2-foot rise in sea level to determine the impact of rising sea levels. Depending on the results of Economics determining the recurring damages, additional investigations may or may not be required;
14. Without delaying the regional study, prepare modified SF curves for a plan for Roughans Point; and
15. Without delaying the regional study, prepare modified SF curves for Crescent Beach/Garfield School area.
16. Without delaying the plan for regional protection, formulate, evaluate, and detail selected plans for an assumed thirteen (13) of 26 potential "Other Ecosystem Restoration sites" in coordination with others.

17. Environmental: Tasks include but not limited to:

1. Review all existing documents, final EIS/EIR, Comments and Responses, and determine the recommended scope and cost of study efforts;
2. An Environmental Manager, skilled in all regulations and issues, shall be assigned to work full time and coordinate frequently with the public, agencies and organizations while overseeing the following tasks ;
3. The Environmental Manager will request the input from other team members skilled in, for example, fisheries, birds, animals, cultural resources, benthos, recreation and wetlands, etc. when required;
4. After site visits and coordination, use tidal data from H&H, to determine the best plan for removal and restoration of the I-95 embankment with the requirement for use of the I-95 sand to restore/create sand dunes at Pt. of Pines, and possibly other areas like Revere Beach and Roughans Point;
5. Design the I-95 Restoration plans in coordination with Engineering;
6. Coordinate the layout, quantities, and cost estimate of the I-95 Restoration plan with engineering;
7. Coordinate the preparation of the I-95 Restoration Plans O&M cost;
8. Prepare the I-95 Restoration Plan text for Environmental Apdx. and Supplemental EIS/EIR;
9. Determine environmental impacts from the alternate Floodgate Plans;
10. Design the Mitigation sites assuming about 4 x-sections, if necessary, for alternate five Floodgate plans;
11. Coordinate the layout, quantities, and cost estimates of the Mitigation sites with engineering;
12. Coordinate the Mitigation site O&M cost with operations;
13. Prepare mitigation results for the Supplement to the Environmental Apdx. and for the EIS/EIR Supplement.
14. Update the information for the Main Report.
15. Prepare an amendment to the Environmental Appendix, and an amendment for the combined Supplemental EIS/EIR draft and final, which will require scoping and transcript meetings in advance.
16. Without delaying regional protection, coordinate and evaluate 26 sites for potential ecosystem restoration;
17. Without delaying the plan for regional protection, formulate and detail selected restoration plans for an assumed thirteen (13) of 26 potential "Other Ecosystem Restoration sites", develop layouts, costs, benefits

and economic analysis, and coordinate all efforts with the public, agencies, engineering and operations. Coordinate the preparation and review of an Ecosystem Restoration Feasibility Report;

18. ECONOMICS: Tasks include but not limited to:

1. Review all existing documents and determine the recommended scope and cost of study efforts;
2. An early effort is required to use a cost growth index to update benefits for the three options in the 1990 Feasibility Report. This information will be used for an initial screening, comparison of options, and for early coordination. Due to the impacts of Option #1 Local Protection plans' very high walls, difficulty to raise 9.8 miles of walls as sea level rise and structures which impact views, wetlands and real estate, this option was very unacceptable and does not warrant additional effort. So to eliminate the high cost of re-doing the many layouts, costs and benefits, and thus incurring a much higher study cost with very little to gain that significantly extends the schedule, this cursory update is recommended (see Economics Apdx. in web site);
3. Conduct damage surveys, data entry, and GPS spot elevations for all new construction since the damage surveys were conducted (1982 for Revere, and 1986 for Lynn and East Saugus), assume 4% of the 3,700 buildings original surveyed, or 150 new buildings, plus in the floodplains which are 2.5 feet above the original SPN levels in the Revere, Lynn and Saugus areas estimated at 350 buildings. The growth data provided by Revere includes; Point of Pines at 14 structures, 323 housing units and 1-fire station; Revere Beach and backshore at 37 structures, 4,114 housing units, a new High School proposed at Wonderland; Rumney Marsh Backshore at 9 structures, 13 units, 1-school (Rumney Marsh Academy); at Suffolk Downs Development (Phase 1 under construction) at 6 structures, 1,115 housing units, 500,000 gsf health science bldg., & 45,000 gsf innovation building; and in Town line Brook at 45 structures and 123 housing units;
4. Accomplish damage surveys, data entry, and GPS spot elevations for the 300 buildings plus an additional 100 buildings 2.5 feet above the original SPN level in the Upper Saugus River and Shute Brook areas, and use a GPS to establish an elevation in front of each building.
5. Develop existing and modified damages and benefits for 20 zones in Revere, Lynn and Saugus for five Floodgate plans (100 year, 500 year, SPN, SPN+1, SPN+2);
6. Assume two non-structural plans will be evaluated, including updating the plan in the 1990 Feasibility Report, and a preferred plan by State agencies;
7. Determine the economic benefit for an improved Harbor of Refuge behind the floodgates. Currently vessels use the area during storms. There were about 350 vessels above the General Edwards Bridge and 450 in Lynn Harbor at the time of the 1990 Feasibility Report;
8. Develop the economic analysis for the five Floodgate plans, including but not limited to: the damage survey of buildings and properties; damages for two levels of sea level rise (pg G-52), eg. +1 foot and +2-feet; damage to shorefront structures (pg. G47 Econ Apdx); reduction in FEMA insurance premiums; recreation benefits along the Lynn Harbor dike, for the Revere Beach Park Dike, and for Point of Pines dunes/beach; the impact on infrastructure; and the lost income for nearly a half million vehicles diverted from the five major arteries (US#1, 1A, 107, B&M Commuter line, MBTA Blue Line) for several possible days, and their impact on income and productivity as they overwhelm merging on the Route 128 /I-95 alternate route around Boston during commuting hours. Develop the net benefit vs. five Floodgate plan curve to determine which plan produces the highest net economic benefits;
9. Update only pertinent information in Appendix H, Socioeconomics which is important for decision making;
10. Prepare an amended Economics Appendix;
11. Without delaying the Regional Study, accomplish damage surveys for the 1100 buildings plus 200 additional buildings 2.5 ft. above the original SPN level in the Town Line and Linden Brook areas, and use a GPS to establish an elevation in front of each building followed by data entry and analysis;
12. Without delaying the Regional Study, develop the existing and modified damages and benefits for the Town Line and Linden Brook floodplains, add these benefits to the five plans in item #8, and show the revised optimization curve. If completed on time, revise the final Feasibility Report total benefits;

13. Without delaying the regional study, update the damage survey for Roughans Point from S-F curves provided by H&H, prepare recurring damages to determine the impact of rising sea levels;
14. Without delaying the regional study, update the damage survey for Crescent Beach/Garfield School area from S-F curves provided by H&H, prepare recurring damages to determine the impact of rising sea levels;
15. Without delaying the regional study, develop the recurring damages for Roughans Point from modified SF curves and prepare the economic analysis, and provide input for a Reconnaissance Report.
16. Without delaying the regional study, develop the recurring damages for the Crescent Beach/Garfield School area from modified SF curves and prepare the economic analysis, and provide input for a Reconnaissance Report.

19. Real Estate: Estuary Purchase and Project lands: Tasks include but not limited to:

1. Review all existing documents and determine the recommended scope and cost of study efforts;
2. Update lands required for the Regional Project as shown in the GDR
3. Update the cost to purchase the 1,650 acres of Estuary lands, which the FDM states that the minimum estuary guide taking elevation has been reduced from El. 7 to 6 ft., NGVD;
4. Prepare Update to Real Estate Appendix
5. Without delaying the regional study, prepare the real estate costs for a plan for Roughans Point.
6. Without delaying the regional study, prepare real estate costs for a plan for the Crescent Beach area.

20. ENGINEERING MANAGER; Tasks include but not limited to:

1. An Engineering Manager is required to oversee the management of study costs, schedules, quality of engineering products, and prepare the Design Appendix;
2. Coordinate the review of all team members thorough review of all existing documents and determine the recommended scope and cost of study efforts;
3. An early effort is required to use the construction cost index to update the three options in the 1990 Feasibility which will be used as an initial screening and comparison of options. Due to the impacts of Option #1 Local protection Plans' very high walls, difficulty to raise 9.8 miles of walls which impact views, wetlands and real estate, this option was very unacceptable and does not warrant additional effort. So to eliminate the high cost of totally re-doing the layouts and costs and incurring a much higher study cost with very little to gain that significantly extends the schedule, this cursory update is recommended;
4. Schedule and evaluate surveys for about four beach profiles at each location for feasibility estimates: in the Park Dike area, the north Revere Beach area, and at Point of Pines; and
5. The Engineering Manager is responsible for preparing the Design and Cost Appendix;

21. GEOTECHNICAL ENGINEERING: Tasks include but not limited to:

1. Review all existing documents and determine the recommended scope and cost of study efforts;
2. Evaluate Floodgate borings and piles;
3. Coordinate with structures to revise, after site visits/coordination, the existing Floodgate x-sections for incrementally adjusting designs for Plans: 100 year, 500 yr, SPN, SPN+1 ft and SPN+2ft due to the rise in sea level (eg. raise or lower wall heights by 1-2 feet from those shown in the GDR);
4. Coordinate the GDR layout of the Floodgates to determine if any changes may be required due to adjusting wall heights, since it is designed so the structure can be easily modified for up to five (5) of sea level rise;
5. Coordinate with structures to adjust by 1 to 2 feet the Lynn Harbor x-sections (5 wall sections and 3 dike sections) for the top elevations for 100 year, 500 yr, SPN, SPN+1 ft and SPN+2ft due to the rise in sea level;
6. Coordinate with structures to incrementally adjust the 2- Point of Pines wall sections for 5 top elevations;
7. Coordinate with structures for the GDR layout of the POP wall sections, assume no change;
8. Coordinate with structures to incrementally adjust the 3-Revere Beach Park Dike and wall sections;
9. Coordinate with structures the GDR layout of the Park Dike and wall features, if necessary;

10. Coordinate the design and layout of the Mitigation site cross sections, if required;
11. Coordinate the design and layout of the embankment breaching and removal for the I-95 Restoration Plan, including mitigation features at East Saugus, see Draft Restoration Report in web site;
12. Provide input to the Updated Design and Cost Appendix;
13. Without delaying the regional study, prepare a plan to protect Roughans Point from rising sea levels; and
14. Without delaying the regional study, prepare a plan to protect the Crescent Beach/Garfield School area from rising sea levels.
15. Without delaying the regional study, prepare plans for the “Other ecosystem restoration” sites, say thirteen (13) of the 26 sites.

22. STRUCTURES: Tasks include but not limited to:

1. Review all existing documents and determine the recommended scope and cost of study efforts;
2. Incrementally adjust the height of Floodgate GDR cross-sections one to two feet for the top elevations for Plans: 100 year, 500 yr, SPN, SPN+1 ft and SPN+2ft due to the rise in sea level;
3. Coordinate the GDR layout of the Floodgates, for any changes if necessary;
4. Coordinate with geotechnical to incrementally adjust the GDR Lynn Harbor x-sections (5 wall sections and 3 dike sections) for the top elevations for 100 year, 500 yr, SPN, SPN+1 ft and SPN+2ft due to the rise in sea level;
5. Coordinate the layout of the 5 Floodgate layouts, if necessary;
6. Coordinate with geotechnical to incrementally adjust, after site visits/coordination, the GDR’s 2- Point of Pines wall sections by one to two feet for 5 top elevations;
7. Coordinate with geotechnical for the GDR layout of the POP wall sections;
8. Coordinate with geotechnical and H&H (see model results and recommendations to possibly delete stone under the Park Dike) to incrementally adjust the existing 3-Revere Beach Park Dike and wall sections;
9. Coordinate with geotechnical the GDR layout of the Revere Beach Park Dike and wall features, if any changes are necessary;
10. Coordinate the design and layout of the embankment breaching and removal for the I-95 Restoration Plan, including mitigation features at East Saugus, see Draft Restoration Report in web site;
11. Provide input to the Updated Design and Cost Appendix;
12. Without delaying the regional study, prepare a plan to protect Roughans Point from rising sea levels;
13. Without delaying the regional study, prepare a plan to protect the Crescent Beach/Garfield School area from rising sea levels.

23. LAYOUTS & QUANTITIES: Tasks include but not limited to:

1. Review all existing documents and determine the recommended scope and cost of study efforts;
2. Use the GDR Floodgate layout in computing changes to the quantity of materials from raising the walls a foot or two;
3. Compute the incremental adjustments in the quantities using the GDR Floodgate quantities for the top elevations for Plans: 100 year, 500 yr, SPN, SPN+1 ft and SPN+2ft;
4. Use the GDR layout for the 5 Lynn Harbor plans for computing quantities after any design changes resulting from site visits and coordination with the city and property owners;
5. Compute the incremental adjustments in the quantities from the GDR Lynn Harbor estimates, after any design or layout changes, for the top elevations for 100 year, 500 yr, SPN, SPN+1 ft and SPN+2ft;
6. Revise the existing Point of Pines layout with 5 cross sections, since the revetment is being deleted on the north half, and likely deleted along the south half when changed to all sand dunes;
7. Compute the incremental adjustments in the quantities to the existing Point of Pines 2- wall sections quantities, and compute quantities for new dune only sections for 5 top elevations;

8. Use the GDR layout for the Revere Beach Park Dike and wall section plans for computing quantities;
9. Compute the incremental adjustments in the quantities to the GDR's Revere Beach 1- wall section quantity, and compute quantities for a slightly modified height to the Revere Beach Park Dike section for possibly 5 top elevations, if necessary;
10. Develop the layout for the Mitigation Site, which may include minor changes for each of the five plans evaluated for the Floodgate, if necessary.
11. Compute the quantities for the Mitigation site plans;
12. Develop the layout for the I-95 Restoration plan for removal of the I-95 embankment, including East Saugus features;
13. Compute the quantities for the I-95 Restoration plan;
14. Provide input to the Updated Design and Cost Appendix;
15. Without delaying the regional study, prepare a layout for a plan to protect Roughans Point;
16. Without delaying the regional study, prepare a layout for a plan to protect Crescent Beach/Garfield;
17. Without delaying the regional study, prepare plans for the "Other ecosystem restoration" sites, say thirteen (13) of the 26 sites.

24. COST ESTIMATES: Tasks include but not limited to:

1. Review all existing documents and determine the recommended scope and cost of study efforts;
2. Compute cost estimates for the five Floodgate plans for top elevations for 100 year, 500 yr, SPN, SPN+1 ft and SPN+2ft;
3. Compute cost estimates for five Lynn Harbor plans for the top elevations for the five plans;
4. Compute cost estimates for five Point of Pines plans for 5 top elevations;
5. Compute cost estimates for five Revere Beach plans;
6. Compute cost estimates for five minor changes in a Mitigation site plan, if necessary;
7. Compute the cost estimates for the Restoration plan, including East Saugus features;
8. Provide input to the Updated Design and Cost Appendix.
9. Without delaying the regional study, prepare a cost estimate for a plan to protect Roughans Point from rising sea levels;
10. Without delaying the regional study, prepare a cost estimate for a plan to protect the Crescent Beach/Garfield School area from rising sea levels.
11. Without delaying the regional study, prepare cost estimates for the "Other Ecosystem Restoration" sites, say thirteen (13) of the 26 sites.

25. PLAN FORMULATION BRNCH: Nonstructural plans; Tasks include but not limited to:

1. Review all existing documents and determine the recommended scope and cost of study efforts;
2. Update the cost of Nonstructural plans in the 1990 Feasibility Report for coordination with agencies;
3. Coordinate alternative features to any structural plan which may be requested during meetings and discussions with the public and resource agencies;
4. Develop (assume) one alternative nonstructural plan which may be requested by a resource agency, and update the plan in the 1990 Feasibility Report, in coordination with the economics;
5. Prepare quantities for the alternative nonstructural plans;
6. Prepare cost estimates for the alternative nonstructural plans;
7. Prepare the Nonstructural appendix;
8. Without delaying the Regional Project, develop alternative recon plans for Roughens Point and Crescent Beach in coordination with H&H; and
9. Without delaying the regional study, coordinate the preparation of plans for the "Other Ecosystem Restoration" sites, say thirteen (13) of the 26 sites.

26. CONSTRUCTION: Tasks include but not limited to:

1. Review all existing documents and determine the recommended scope and cost of study efforts;
2. Coordinate with the team during the layout of the floodgate and the sequence of construction developed during modelling;
3. Coordinate with team, relying on procedures developed for the previous design, during layouts of Lynn Harbor, Point of Pines, Revere Beach Park Dike, Mitigation site and the Restoration Plan.
4. Provide documentation required for reporting, or referencing prior descriptions.

27. OPERATIONS: Tasks include but not limited to:

1. Review all existing documents and determine the recommended scope and study cost;
2. Coordinate with the team during the preparation of the floodgate plans, the operation and O&M requirements as largely described in prior documents;
3. Coordinate with team for operation procedures, relying on procedures developed for the previous designs, during preparation of plans for Lynn Harbor, Point of Pines, Revere Beach Park Dike, Mitigation site, the Restoration Plan and protection of the Estuary.
4. Provide documentation required for reporting operations of these features.

28. GLOSSARY OF TERMS

ACEC--Area of Critical Environmental Concern

AF (Ac-Ft)--Acre-Feet

CERC--Corps' Coastal Engineering Research Center

DCR--Dept. of Conservation and Recreation

DPW--Dept. of Public Works

EPA--US Environmental Protection Agency

EEA-MA Executive Office of Energy and Environmental Affairs

EIS/EIR--Environmental Impact Statement/Environmental Impact Report

FDM--Feature Design Memorandum

GDR--General Design Report

GPS--Global Positioning System

H&H--Hydrology & Hydraulics

LPP--Local Protection Project

MVP--Municipal Vulnerability Program

MBTA--Massachusetts Bay Transportation Authority

MDC--Metropolitan District Commission

NGVD--National Geographic Vertical Datum

NASA--National Aeronautics and Space Administration

O&M--Operation and Maintenance

P&S--Plans and Specifications

POP--Point of Pines

PMP--Project Management Plan

SPN--Standard Project Northeast

SRW--Saugus River Watershed

SRWC--Saugus River Watershed Council

WES--Corps' Waterways Experiment Station

WRDA--Water Resources Development Act

WLRC--Washington Level Review Center

USACE--US Army Corps of Engineers