DESIGN MEMORANDUM

ON

IMPROVEMENT DREDGING

WEYMOUTH-FORE AND TOWN RIVERS

BOSTON HARBOR

MASSACHUSETTS

NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

26 November 1969

7

ENGCW-EZ (NEDED-T, 26 Nov 69) 3rd Ind
SUBJECT: Design Memorandum on Improvement Dredging Weymouth-Fore and Town Rivers, Boston Harbor, Massachusetts

DA, Office of the Chief of Engineers, Washington, D.C. 20314 29 July 1970

TO: Division Engineer, New England ATTN: NEDED-T

The information furnished in the inclosures to the 2nd indorsement is satisfactory.

FOR THE CHIEF OF ENGINEERS:

wd all incls

WENDELL E. JOHNSON
Chief, Engineering Division
Civil Works

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO:

NEDED-T

26 November 1969

SUBJECT: Design Memorandum on Improvement Dredging Weymouth-Fore and Town Rivers, Boston Harbor, Massachusetts

Chief of Engineers
ATTN: ENGCW-E

Submitted herewith in accordance with ER 1110-2-1150 are ten (10) copies of Design Memorandum for review and approval.

FOR THE DIVISION ENGINEER:

1 Incl (10 cys)
as

JOHN WM. LESLIE
Chief, Engineering Division

ENGCW-EZ (NEDED-T, 26 Nov 69) 1st Ind
SUBJECT: Design Memorandum on Improvement Dredging Weymouth-Fore and Town Rivers, Boston Harbor, Massachusetts

DA, Office of the Chief of Engineers, Washington, D.C. 20314 15 April 1970

TO: Division Engineer, New England

1. Approved, subject to the following comments.

2. Pursuant to the results of a conference held in OCE on 3 April 1970, between OCE personnel and Mr. Reardon of NED, the project economics should be revised in accordance with the following:

a. Benefits credited to new power plants should be deleted, since the latest information indicates that additional power units will not be constructed in this area.

b. The general growth benefits should be revised to allow for a five year accelerated adjustment period for the existing traffic using the waterway in lieu of using a straight line over the project life.

3. Paragraph 21. A discussion covering the results of coordination with the U. S. Fish and Wildlife Service on method and location of disposal of waste should be included in the design memorandum.

FOR THE CHIEF OF ENGINEERS:

Homer B. Willis
for WENDELL E. JOHNSON
Chief, Engineering Division
Civil Works

1 Incl
wd

NEDED-T (26 Nov 69) 2d Ind
SUBJECT: Design Memorandum on Improvement Dredging Weymouth-Fore and Town Rivers, Boston Harbor, Massachusetts

Div Engr, NED, CE, 424 Trapelo Road, Waltham, Mass. 02154 17 June 1970

TO: Chief of Engineers, ATTN: ENGCW-EZ, Washington, D. C. 20314

1. Submitted herewith are pages iii, 10, 11, 18, 19, and 21 of the Weymouth-Fore and Town Rivers Design Memorandum revised in accordance with instructions in your 1st Indorsement, dated 15 April 1970.

2. There are also submitted back-up data sheets for your files showing the derivation of revised benefits in accordance with conference noted in your indorsement.

FOR THE DIVISION ENGINEER:

2 Incl (dupe)
as

JOHN WM. LESLIE
Chief, Engineering Division

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

IN REPLY REFER TO:

NEDED-T

26 November 1969

DESIGN MEMORANDUM ON IMPROVEMENT DREDGING WEYMOUTH-FORE AND TOWN RIVERS BOSTON HARBOR MASSACHUSETTS

PERTINENT DATA

1. Purpose: To review the authorized project modification, arrive at a final plan of improvement, and to prepare an up-to-date estimate of project cost based on more recent detailed field surveys.

2. Location: Weymouth-Fore River originates in Braintree, Massachusetts, flows northerly for about 7.5 miles and flows into Hingham Bay, an arm of Boston Harbor, Massachusetts. It is tidal for about 6 miles of its length. Tidewater terminates at a small dam in East Braintree, Massachusetts. About 3 miles of the river has been Federally improved. Town River is a small tidal stream about 2 miles long, lying entirely within the City limits of Quincy, Massachusetts. It is located about 2 miles above the mouth of Weymouth-Fore River, joining it at that point. The river flows generally eastward and is Federally improved for about 1.6 miles.

3. Project Authorization: River and Harbor Act of 27 October 1965.

4. Project Document: House Document No. 247, 88th Congress, 2nd Session.

5. Recommended Project Plan:

The Weymouth-Fore and Town Rivers were combined into a single project and the existing projects were modified to provide for:

a. A channel 35 feet deep, 37 feet in rock and 500 feet wide from deep water in Nantasket Roads, and along the southerly half of the Boston Harbor "Narrows" channel,

through Nantasket Gut, then 35 feet deep and 400 feet wide to the mouth of Weymouth-Fore River, then 35 feet deep, generally within the limits of the existing project, to the Weymouth-Fore River Bridge, and then 35 feet deep and generally 400 feet wide to the upper limit of the existing project;

b. A channel 35 feet deep and 300 feet wide, increased from 400 to 550 feet at the bends, from the mouth of Town River to the existing turning basin in Town River;

c. A 35-foot deep turning and maneuvering basin at the confluence of the two rivers in King Cove;

d. Enlarging and deepening to 35 feet the existing turning basin in Town River;

e. Adding six acres of 8-foot anchorage to compensate for that part of an existing local small boat anchorage that would be usurped by widening of the 35-foot commercial channel.

All of the above features are generally in accordance with the plan of the Division Engineer as shown on the map accompanying his report and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable.

6. Estimated First Cost of Construction of Combined Project:

Weymouth-Fore and Town Rivers 35-Foot Main Channels and 35-Foot Turning and Maneuvering Basins

TOTAL CONSTRUCTION COST (Corps of Engineers Funds Only)	$ 19,400,000
(U. S. Coast Guard)	60,000
TOTAL PROJECT COSTS (Federal)	$ 19,460,000
NON-FEDERAL COSTS	
Land Acquisition	50,000
Dredging at 48-inch Sewer Siphon	50,000
TOTAL NON-FEDERAL COSTS	$ 100,000
TOTAL CONSTRUCTION COST (Federal and Required Non-Federal Costs)	$ 19,560,000

7. Benefits:

The benefit analysis is based on a 50-year project life at a 3-1/8% interest rate. The benefits are considered general in nature. The combined improvement of the Weymouth-Fore and Town Rivers 35-foot Channels and Basins will bring about savings in transportation cost by the elimination or reduction of tidal delays, the use of larger and deeper draft vessels, and by the reduction of required annual towboat costs. These savings are as follows:

Transportation Savings	$1,769,700
Reduction in Towboat Hires	90,800
TOTAL BENEFIT	$1,860,500

8. Annual Charges:

The combined improvement of the Weymouth-Fore and Town Rivers 35-foot Channels and Basins have Annual Charges as follows:

Federal Annual Charges	$ 887,500
Non-Federal Annual Charges	4,000
FEDERAL AND NON-FEDERAL ANNUAL CHARGES	$ 891,500

9. Benefit-Cost Ratios:

The combined improvement of the Weymouth-Fore and Town Rivers 35-foot Channels and Basins has the following Benefit-Cost Ratio:

$1,860,500/$891,500 = 2.1 to 1

10. Requirements of Local Cooperation:

a. Provide, without cost to the United States, all lands, easements, and rights-of-way necessary for the construction and subsequent maintenance of the project;

b. Hold and save the United States free from damages due to construction and subsequent maintenance of the project;

c. Make such alterations to sewer lines or other obstructive features as are necessary; and

d. Provide and maintain, without cost to the United States, depths commensurate with channel depth in berthing areas and local access channels serving the terminals, and maintain the enlargement of the small-boat anchorage.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
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26 November 1969

IMPROVEMENT DREDGING
WEYMOUTH-FORE AND TOWN RIVERS
BOSTON HARBOR, MASSACHUSETTS

DESIGN MEMORANDUM

PROJECT AUTHORIZATION

1. The existing project for Weymouth-Fore River was adopted 30 August 1935 and modified by Acts of 17 October 1940, 2 March 1945, and 3 September 1954 (H. Doc. 555, 82nd Cong., 2nd Sess.). The existing project provides for a channel 32 feet deep in rock, 30 feet deep in other material, and 500 feet wide from deep water in Boston Harbor along the southerly half of the Narrows Channel in Nantasket Roads and through Nantasket Gut, then the same depths and generally 300 feet wide across Hingham Bay and into Weymouth-Fore River to Weymouth-Fore River Bridge, and extending through and above the bridge for 2,700 feet to form a maneuvering basin with widths varying from 470 to 650 feet wide; and a channel 27 feet deep, generally 300 feet wide between Nut and Peddocks Islands. The existing Weymouth-Fore River project was completed in 1960 at a cost of $5,225,802. The existing project for Town River was adopted 26 August 1937 and modified 3 September 1954 (H. Doc. 108, 83rd Cong., 1st Sess.). The existing project provides for a channel 27 feet deep and generally 250 feet wide extending from the junction with the Weymouth-Fore River to a point 1.3 miles upstream, with a turning basin 24 feet deep, 550 feet wide and approximately 1,000 feet long at the inner end; a 15-foot channel, 100 feet wide continuing (0.25 miles) from the upstream limit of the 27-foot channel to a point just below the Quincy Electric Light and Power Company substation. The existing Town River project was completed in October 1958 at a cost of $1,286,287.

2. The uncompleted modification for the improvement of Weymouth-Fore and Town Rivers, Boston Harbor was authorized by the River and Harbor Act of 27 October 1965 (H.D. 247, 88th Cong., 2nd Sess.). The project, as authorized, modifies the existing project to provide for:

> A channel 35 feet deep, 37 feet in rock and 500 feet wide from deep water in Nantasket Roads, and along the southerly half of the Boston Harbor "Narrows" channel, through Nantasket Gut, then 35 feet deep and 400 feet wide to the mouth of Weymouth-Fore River, then 35 feet deep, generally within the limits of the existing project, to the Weymouth-Fore River Bridge, and then 35 feet deep and generally 400 feet wide to the upper limit of the existing project;
>
> A channel 35 feet deep and 300 feet wide, increased from 400 to 550 feet at the bends, from the mouth of Town River to the existing turning basin in Town River;
>
> A 35-foot deep turning and maneuvering basin at the confluence of the two rivers in King Cove;
>
> Enlarging and deepening to 35 feet the existing turning basin in Town River;
>
> Adding six acres of 8-foot anchorage to compensate for that part of an existing local small boat anchorage that would be usurped by widening of the 35-foot commercial channel;

all generally in accordance with the plan of the Division Engineer as shown on the maps accompanying his report and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable.

REQUIREMENTS OF LOCAL COOPERATION

3. The provision of local cooperation, as required by documents authorizing the existing project and the improvements that preceded it, have been fully complied with, excepting for land acquisition at Germantown Point. The City of Quincy is now in the process of acquiring this property. The improvement considered in this design memorandum is the work authorized by the River and Harbor Act of 1965, as described in Paragraph 2. The project modification was authorized subject to the requirements that, prior to construction, local interests agreed to:

a. Provide, without cost to the United States, all lands, easements, and rights-of-way necessary for the construction and subsequent maintenance of the project;

b. Hold and save the United States free from damages due to construction and subsequent maintenance of the project;

c. Make such alterations to sewer lines or other obstructive features as are necessary; and

d. Provide and maintain, without cost to the United States, depths commensurate with channel depth in berthing areas and local access channels serving the terminals, and maintain the enlargement of the small-boat anchorage.

INVESTIGATIONS

4. Physical investigations carried out in support of the survey report contained in House Document No. 247, 88th Congress, 2nd Session, were made in 1939, 1948, 1957, 1960 and 1961. The investigations consisted of hydrographic, boring and probing surveys. Topography was taken from previous surveys and from U.S.C. & G.S. Chart 246.

5. Additional probings, supplemented by borings and sounding surveys, were accomplished in 1967 and 1968. Detailed probings were made on 100- and 50-foot spacings and also random spacings in 1968. A total of 49 core and drive borings were made in the probed areas in 1968.

STATUS OF LOCAL COOPERATION

6. The requirements of local cooperation, as specified by the authorizing document, are stated in Paragraph 3 above. The Commonwealth of Massachusetts has executed the necessary assurance that the requirements of local cooperation will be met. The assurance was accepted by the Division Engineer on 24 December 1968. It is currently estimated that the cost to local interests for land acquisition will amount to $50,000 and the cost to the Metropolitan District Commission for dredging in the vicinity of their 48-inch sewer siphon will amount to $50,000.

7. Coordination with State and local interest have been and are still in progress with respect to the project. In order to determine the specific needs of navigational improvement in Weymouth-Fore and Town Rivers, a public hearing was held at Quincy, Massachusetts on

5 May 1960. Among those in attendance were representatives of State and local governments, shipping interests, terminal interests, local yacht clubs and interested citizens. Their requests that the two waterways be treated as a single project with a minimum depth of 35 feet, including widening of channels and adding and enlarging turning and maneuvering areas, has been incorporated in this design memorandum. However, no consideration was given to deepening the existing 27-foot channel in West Gut, as was requested by local interests at this public hearing, because it was not considered justifiable.

8. A meeting was held on 7 December 1967 in the Quincy City Hall to discuss the requirements of local cooperation for the subject project. At this meeting, representatives of the Corps of Engineers and The Commonwealth of Massachusetts Department of Public Works, and officials of the City of Quincy and Town of Weymouth were present; and the latter two officials indicated they would vote on their portion of the local assurances. On 18 March 1968, the Quincy City Council endorsed the proposed project as described in Paragraph 2. Town meetings were held in Hull on 6 November 1968, and in Weymouth on 18 November 1968, wherein the Town Warrants had articles which provided for holding and saving the United States free from damages due to construction and subsequent maintenance of the project. The articles passed by favorable vote in both Towns.

9. The Quincy-South Shore Chamber of Commerce is on record for the subject project. This organization called this project mandatory for the continued expansion of the South Shore waterborne commerce which they estimate represents $44,500,000 annually.

LOCATION AND TRIBUTARY AREA

10. Weymouth-Fore River originates in Braintree, Massachusetts, flows northerly for about 7.5 miles and flows into Hingham Bay, an arm of Boston Harbor, Massachusetts. It is tidal for about 6 miles of its length. Tidewater terminates at a small dam in East Braintree. About 3 miles of the river has been Federally improved. The Town River is a small tidal stream about 2 miles long, lying entirely within the city limits of Quincy, Massachusetts. It is located 2 miles above the mouth of Weymouth-Fore River, joining it at that point. The river flows generally eastward and is Federally improved for about 1.6 miles. The mean range of tide is 9.5 feet. The immediate tributary area of Weymouth-Fore River consists of the City of Quincy, and the Town of Braintree on the left bank and the Towns of Weymouth, Hingham, and Hull on the right bank. Town River lies wholly within the City of Quincy. The mean range of tide is 9.5 feet.

11. The City of Quincy is highly industrialized while the remainder of the Towns are chiefly residential. All of these communities are suburbs of Boston. Therefore, in a broad sense, the entire area of metropolitan Boston plus its adjacent communities may be considered as part of the general tributary area.

12. Quincy is a highly industrialized city with a population of 87,158 in 1965. Among its diversified products are classed such items of manufacture as electronic components, machine parts, tools, steel fabrications, motors, and soap products. In addition, there is a major shipbuilding industry located on Weymouth-Fore River. This shipyard, in addition to building large commercial freighters and tankers ranging in size to 106,000 deadweight tons, has constructed for the U. S. Navy, aircraft carriers, battleships, cruisers, nuclear cruisers, and various smaller types of fighting ships. There are also 3 large oil terminals and 1 large soap products company, Procter and Gamble Co. The City together with the tributary area has enjoyed a favorable growth rate in recent years.

13. Weymouth is semi-industrialized with a population of 50,468 in 1965. Its chief products are fertilizers, shoes and machine products. Hingham, Hull, and Braintree are chiefly residential, although some small industries are located in the Towns. Their combined population was 60,366 in 1965.

14. The locality is served by one railroad, the New Haven RR, with stations at Quincy and Braintree, each about 2 miles from the waterway. A branch line from this railroad extends to the vicinity of the Weymouth-Fore River Bridge. The area is also served by a system of State and limited access highways connecting to all inland points. Logan Airport, operated by the Commonwealth of Massachusetts, lies about 15 miles north of the locality. Regularly scheduled commercial passenger flights, both overseas and domestic, may be obtained at this facility. Extensive airfreight flights are also available.

15. There is one bridge in the area considered in this report. This facility locally known as the "Weymouth-Fore River Bridge" is a State-owned highway bridge. It is a drawbridge of the double leaf bascule type, constructed under plans approved by the War Department. It was completed in 1936. The drawspan has a horizontal clearance of 175 feet between fenders. The least vertical clearance when closed is 33.7 feet at mean high water. It has a closed vertical clearance of 40 feet for about a 100-foot width in the center of the span. Plans for increasing the width of the drawspan and realigning the fender system are now underway.

16. There are several underwater utilities crossing the waterway in the area proposed for improvement. Detailed descriptions of the utilities are contained in the following subparagraphs:

a. The United States Coast Guard owns 2 cables crossing the waterway from Hull to Boston Light. One of these is a power cable, the other a telephone cable. Both of these cables lie on the bottom and will have to be removed and replaced after dredging.

b. The Metropolitan District Commission, a state agency engaged in construction of public works in Boston and surrounding municipalities, owns a 48-inch sewer siphon crossing the channel in the vicinity of Germantown Point. The top elevation of this facility is 37 feet below mean low water. The proposed channel dredging will not require lowering of this facility.

c. The Metropolitan District Commission has a water pipe and cable crossing from Windmill Point to Georges Island. These utilities are in deep water and would not be affected by the proposed deepening.

d. The New England Telephone and Telegraph Company owns cables crossing the waterway at the drawspan of the Fore River Bridge. These cables are laid in a trench 45 feet below mean low water and would not be affected by the proposed improvement.

e. The Department of Public Works, Commonwealth of Massachusetts, owns cables which cross the drawspan of the Fore River Bridge. These cables are laid in a trench 40 feet below mean low water. The proposed improvement would not affect these cables.

f. The Boston Edison Company has a steam tunnel crossing the channel north of the drawspan. This facility has a least depth of 50 feet below mean low water and would not be affected by the proposed improvement.

17. In Weymouth-Fore River, all of the terminal facilities are concentrated in the vicinity of the Fore River Bridge. The Town River facilities are more widely separated. The facilities and their use are included in the following subparagraphs:

Weymouth-Fore River

a. Immediately north of the Weymouth-Fore River Bridge on the right bank of the waterway, the Boston Edison Company owns a wharf used for the receipt of bituminous coal and oil. Depths in the berth alongside the 600-foot dimension range from 30 to 28 feet.

There is an 85,000-ton standby coal storage area at the rear of the wharf. Storage tanks upstream of the bridge have a capacity of 230,000 barrels. The wharf has no railroad connections, but is served by first-class highways.

b. The Boston Edison Company owns another wharf about 800 feet upstream of the bridge and on the right bank. Total length of the berth is 100 feet, with a depth of 20 feet. The wharf was formerly used for receipts of oil by barge. In addition there is also available a 20-foot deep berthing space at a 230-foot long wharf, immediately upstream.

c. The Cities Service Oil Company operates a deep draft terminal at the head of the 30-foot project and on the left bank. A 600-foot long, by 35- to 29-foot deep berth is available at this facility. Twenty-one steel storage tanks have a total storage capacity of 779,000 barrels. A 215- by 20-foot barge wharf is also available at this facility. Railroad connections as well as excellent highways service this facility.

d. General Dynamics, Quincy Division shipbuilding plant is situated on the left bank of the river immediately above the Fore River Bridge. It has 4 piers used for outfitting, repair, and conversion of ships. Depths at the piers range from 30 to 40 feet. In addition to the piers, there are shipways and graving docks capable of handling tankers of 106,000 deadweight tons and the largest Naval ships. The shipyard is connected to the New York, New Haven and Hartford Railroad by a branch line, the Fore River Railroad.

e. Immediately below the Weymouth-Fore River Bridge, the Procter and Gamble Company, a large soap products company, operates a wharf on the left bank of the river. It is 150 feet long and 51 feet wide with a usable berthing space of 435 feet, 30 feet deep. There are storage tanks in the rear. This wharf has railroad connections. It is not open to public use.

Town River

a. The Mobil Oil Corporation operates a terminal on the right bank of Town River immediately above its mouth. The wharf itself is 90 feet by 30 feet with a usable berthing space, 800 feet long and 35 feet deep. Eleven steel storage tanks have a total capacity of 539,127 barrels. Railroad connections are available at this wharf.

b. The Harbor View Marina, Inc. operates a marina and repair shop on the right bank about 2,500 feet from the mouth of the river. The wharf is about 250 feet long on its shore-connected leg and 280 feet long on its outer leg. Additional L-shape mooring floats are at rear of face and on southeast side. The berth depth is 15 feet along the outer face, and ranges from 5 to 15 feet on its inner sides. The facilities are adequate for the repair, storage and construction of small commercial craft, large yachts and smaller recreational craft. Also located here, is a tank barge owned and operated by the Quincy Oil Company. There are no railroad connectionc to this wharf.

c. The Town River Yacht Club is located on the right bank of the river about 0.8 miles above the mouth. Facilities include a pier with ramp to floats, a marine railway, a boat repair shop and an open air storage lot.

d. The next wharf upstream, now or formerly owned by the Lincoln Oil Company along with its 120-foot long by 10-foot deep berth, has been vacated. Two 6-inch pipelines extend to 5 steel storage tanks with a total capacity of 46,000 barrels which are no longer in use.

e. The John J. Duane Company, a building and wrecking contractor operates two wharves on the waterways. Both are on the right bank. The first terminal is about 1.1 miles above the mouth. The berth is 240 feet long and 6 feet deep. This facility is used for the receipt and storage of scrap metal and for the scrapping of small decommissioned vessels. The second Duane wharf is situated on the 15-foot channel. It has a 100-foot long berth with depths ranging from 5 to 8 feet. It is used for occasional mooring of barges.

f. The Quincy Oil Company Plant No. 4 is located on the right bank of the river about 1.2 miles above the mouth. It has an off-shore wharf 77 feet long by 20 feet wide. The berth is 600 feet long and 32 feet deep. There are 13 steel storage tanks with a total capacity of 740,420 barrels. There are no railroad connections to this wharf.

g. The Quincy Lumber Company, also on the right bank, is 1.4 miles above the mouth. The wharf parallels the shore for a length of 400 feet. Depths at this wharf range from 0 to 6 feet. Various types of small vessels use this wharf occasionally. The terminal is used principally for storage of lumber.

h. The Quincy Electric Company, a subsidiary of the New England System, is located on the right bank of the river about 200 feet above the head of the improved channel. The company has acquired a large tract of land on the left bank and plans to erect a modern wharf and generating plant, requiring the use of deep draft traffic for receipt of fuel. Ultimate capacity of the plant will be 1,000,000 kilowatts.

i. The Quincy Adams Marine Basin, Inc. Pier, located on the left bank about 1 mile from the mouth, has two parallel marine railways and a boat transfer system. Two pile and timber piers extend from the shore with lengths of approximately 500 and 300 feet.

j. It is not necessary that all of the above Weymouth-Fore and Town River facilities be improved to assure full use of a deeper channel. It is expected that the more important berths will be dredged immediately, making these berth depths commensurate with the proposed 35-foot channel. Competition will result in improvement to the other berths over the life of the project as larger vessels come into use.

PROJECT PLAN

18. The project plan includes the removal and disposal of ledge rock and ordinary materials to provide for:

a. A channel 35 feet deep, 37 feet in rock and 500 feet wide from deep water in Nantasket Roads, and along the southerly half of the Boston Harbor "Narrows" channel, through Nantasket Gut, then 35 feet deep and 400 feet wide to the mouth of Weymouth-Fore River, then 35 feet deep, generally within the limits of the existing project, to the Weymouth-Fore River Bridge, and then 35 feet deep and generally 400 feet wide to the upper limit of the existing project;

b. A channel 35 feet deep and 300 feet wide, increased from 400 to 550 feet at the bends, from the mouth of Town River to the existing turning basin in Town River;

c. A 35-foot deep turning and maneuvering basin at the confluence of the two rivers in King Cove;

d. Enlarging and deepening to 35 feet the existing turning basin in Town River;

e. Adding six acres of 8-foot anchorage to compensate for that part of an existing local small boat anchorage that would be usurped by widening of the 35-foot commercial channel.

19. In order to provide a clear channel depth of 35 feet in the main channel, the project plan involves the drilling, blasting and removal of about 130,000 cubic yards of ledge rock to a required depth of 37 feet plus 2 feet of allowable overdepth, and the dredging of about 6,700,000 cubic yards of ordinary material to a depth of 35 feet plus 2 feet allowable overdepth. The required 37-foot depth in rock areas is in accordance with standard design criteria for removal of underlying rock to enable future project maintenance to a clear depth of 35 feet. The two-foot allowable overdepth provides for inaccuracies in dredging process at the specified depth and insures attainment of project depth.

20. An evaluation of the materials to be excavated from the Weymouth-Fore and Town Rivers was made based on the results of the boring and probing survey made in 1968, supplemented by probings from surveys of 1939, 1948, and 1961, and by borings from survey of 1957. To generalize, the materials to be excavated by dredging will require 8% hard digging (silty, clayey sands and gravels - largely glacial till); 19% moderately compact (silty sands, and inorganic clays and silts) but with a substantial amount of silty sand. The boring logs indicate that while these silty sands were scattered throughout the project areas, the only area considered feasible for hydraulic dredging lies in and about the area between Germantown Point and the Fore River Bridge. About 73% of this portion would lend itself to easy pumping and has granular material. Shore placement of the above type of materials would involve expensive retention structures and spoil areas unofficially recommended by local interests were too small and not well located. The materials to be dredged, except as noted above, are generally unsuitable for fill purposes and would result in an offensive nuisance. It is presently considered impractical and uneconomical, therefore, to use the hydraulic landfill method.

21. In addition, in view of the largely developed areas along the project route, the recreational aspects of the surrounding areas, the conservation principles of other Federal and State agencies for the preservation to marshlands (e.g. Rock Island Cove) for fish and wildlife resources, and elimination or minimization of pollution, it is considered highly improbable that sufficient land areas, along the margin of Town River Bay, for disposal of the volume of materials to be excavated, could be made available. Accordingly, it is considered that the most practical and economical manner of accomplishing the work will be by means of a bucket dredge with disposal in a dumping ground at sea in the vicinity of Boston Light. Disposal at sea, as proposed, is being coordinated with the U. S. Fish and Wildlife Service and the Federal Water Pollution Control Administration in accordance with regulations. It is proposed to dump the spoil material at sea in an area located 3,500 yards east of a north-south line through Boston Light, south of a line bearing west by north (magnetic) to Graves Light and north of a line bearing west-northwest (magnetic) to Boston Light. The U. S. Fish and Wildlife Service in its report of April 16, 1969 approved the use of the proposed spoil area provided that the spoil be placed so as to leave a depth of not less than

25 fathoms at mean low water and that the spoil material be deposited over as much of the dumping area as practicable to avoid creating mounds of 30 feet or more in height. The Federal Water Pollution Control Administration reviewed the U. S. Fish and Wildlife Service report. They had no comments on the report.

22. A critical location where widening of the channel is authorized lies at Germantown Point, at the confluence of the two rivers. To achieve this widening, it will be necessary to carry the side slope excavation to the top of the existing ground surface. The maximum elevation is 14 feet above mean low water. In order to prevent wave action from eroding the slope material left in place at this point of land, a revetment consisting of a 1.0-foot thick blanket of well-graded quarried stone ranging in size from 0 to 6 inches and a 2.5-foot thick layer of cover stone ranging in size from 50 to 1,000 pounds would be placed on the dredged slope. The bottom of the revetment would commence at a depth of 10 feet below mean low water and extend to the top of the dredged slope. Information on the size of stone and size of waves acting is shown in the appendix.

DEPARTURES FROM PROJECT DOCUMENT PLAN

23. The present project plan is the same as that recommended in the authorizing document and authorized by Congress, with the exception of a minor realignment of channel lines at the confluence of the Fore and Town Rivers. Project cost estimates have been refined based on detailed soundings, borings and probing investigations completed during 1967 and 1968. The rock removal quantities have changes significantly. Dredging costs are based on recent experience in similar areas and reflect prices current in October 1969, resulting in cost changes to the document project costs. Overdepth allowance presently contemplated are the same as those used in the authorizing document.

24. Subsequent to the authorizing document, the Metropolitan District Commission revised its estimate to lower the 48-inch sewer siphon. The latest revised estimate is $2,000,000. Because of this high estimate of cost the Commissioner prefers to leave the sewer siphon in its present location if at all possible. A discussion was held on 25 March 1969 between representatives of the Metropolitan District Commission and the Corps of Engineers and it was pointed out that project grade could be obtained over the sewer siphon without lowering the siphon. However, because of the high risk operation while dredging in the vicinity of the sewer siphon which could easily be damaged by either puncture from the spuds of the dredge or from operation of the bucket or could be damaged by blasting operations in lowering the rock to project grade, it was emphasized that the Government would not be responsible for damage to the siphon. It was further pointed out at the discussion that there would be no objection by the Corps of Engineers in leaving the sewer siphon in its present location, provided the Metropolitan District assumes all responsibility and costs in dredging the area over the pipe, and extending 50 feet on either side of the centerline of the pipe for full

channel width of 350 feet measured along centerline of pipe. On 21 August 1969, the Director of Sewerage Division and Chief Sewerage Engineer submitted the following to the Metropolitan District Commission:

> "It is recommended that the Metropolitan District Commission assume all responsibility and costs for dredging all materials in the vicinity of the 48-inch siphon across Weymouth-Fore River in an area 50 feet on either side of the centerline of the pipeline and approximately 350 feet measured along the centerline of the pipe and so notify the Department of the Army in writing."

On 28 August 1969, the Commission at its regular meeting voted: Approved as recommended. The above recommendation was confirmed in writing by letter dated 29 August 1969 from the Director of Sewerage Division and Chief Sewerage Engineer inclosed with this Design Memorandum.

COST ESTIMATE

25. The estimate of project cost determined in the authorizing document was based on probing, boring, and hydrographic surveys made in 1939, 1948, 1957, 1960, and 1961. It was estimated that 2,700,000 cubic yards of ordinary material and 75,000 cubic yards of rock would be required to be removed from within the project limits from the Weymouth-Fore River 35-foot (Rock 37-ft.) Channel and Basin and 1,960,000 cubic yards of ordinary material and 92,000 cubic yards of rock would be required to be removed from within project limits from the Town River 35-foot (Rock 37-ft.) Channel and Basin. In addition, the alteration to the sewer, described in the preceding paragraph, was included at a cost of $1,500,000 in the authorizing document. Land acquisition costs at Germantown Point were also included.

26. The current estimate of cost is based on quantities determined mostly from the more recent sounding, detailed probing and boring surveys of 1967 and 1968 and partly supplemented by probings from surveys of 1939, 1948, and 1961, and by borings from a survey of 1957. A small part of the project channel area at Nantasket Roads, where dredging quantities were not expected due to the 40- to 60-foot depths, was last sounded in 1961.

Dredging quantities are in terms of in-place measurement with a 2-foot overdepth allowance. The materials to be encountered include both rock and ordinary material, and the required grade for rock was taken as two feet below project depth. For the current estimate, 100 percent of all material was assumed to be removed by bucket dredge, placed in a scow and towed to a dumping ground in the ocean in the vicinity of the Boston Lightship. It is possible that 10 percent of the total material could be feasibly removed by hydraulic dredge provided large enough spoil areas are made available adjacent or near to the channel areas having the suitable material and which are already described in Paragraph 20. Side slopes were assumed to be 1 vertical on 1 horizontal in rock and 1 vertical on 3 horizontal in ordinary material. Since the work will be accomplished under a continuing contract over a period of an estimated 3 years, an allowance for channel shoaling has been included in the quantity estimates. Estimates of first cost are based on prices prevailing in October 1969, and are tabulated below for the proposed 35-foot improvement. The work contemplated will require the removal of 4,000,000 cubic yards of ordinary material and 68,000 cubic yards of rock from within the project limits from the Weymouth-Fore River 35-foot (Rock 37-ft.) Channel and Basin, and 2,700,000 cubic yards of ordinary material and 62,000 cubic yards of rock would be required to be removed from within the Town River 35-foot (Rock 37-ft.) Channel and Basin. In the current estimate, the $1,500,000 cost of alteration to the Metropolitan District Commission sewer described in Paragraph 24 was not included because it has not been deemed necessary to alter the sewer. An allowance of $50,000 non-Federal cost has been included in the current estimate to cover costs of the dredging over the sewer siphon to be undertaken by the Metropolitan District Commission.

27. CURRENT ESTIMATE OF COSTS (October 1969)

Combined Weymouth-Fore & Town River 35-foot Channels and Basins (Rock 37-foot)

Dredging Ordinary Material 6,500,000 cy @ $1.85	$12,025,000 (1)
Rock Removal 130,000 cy @ $30.00	3,900,000 (2)
Slope Revetment 6,000 tons @ $29.00	174,000
	$16,099,000
Contingencies 12% (Ordinary Material)	1,475,000
Contingencies 15% (Rock)	600,000
Contingencies 15% (Slope Revetment)	26,000
TOTAL CONTRACT COSTS	$18,200,000
Engineering & Design	400,000
Supervision & Administration	800,000
TOTAL CONSTRUCTION COST (Corps of Engineers Funds Only)	$19,400,000
Aids to Navigation & Lowering Cables (U.S.C.G.)	60,000
TOTAL PROJECT COSTS (Federal)	$19,460,000
Non-Federal Costs	
Land Acquisition	50,000
Dredging at 48-inch Sewer Siphon	50,000
TOTAL NON-FEDERAL COSTS	$ 100,000
TOTAL (Federal and Required Non-Federal Costs)	19,560,000

(1) Includes 1,600,000 cubic yards 2 feet allowable overdepth and 700,000 cubic yards expected shoaling prior to dredging. Excludes 200,000 cubic yards of maintenance dredging to be paid for with O&M funds.

(2) Includes 60,000 cubic yards 2 feet allowable overdepth.

28. COMPARISON OF COMBINED COSTS

35-Foot Weymouth-Fore and Town River Channels and Basins

	Document Estimate (Aug 1962)	Latest Approved Estimate (Jul 1969)	Current Estimate (Oct 1969)
Channels Dredging Ordinary Materials	4,660,000 cy @ $1.30 $ 6,060,000	6,700,000 cy @ $1.85 $12,395,000	6,500,000 cy @ $1.85 $12,025,000
Rock Removal	167,000 cy @ $25.00 $ 4,175,000	130,000 cy @ $30.00 $ 3,900,000	130,000 cy @ $30.00 $ 3,900,000
Slope Revetment	-	-	6,000 tons @ $29.00 $ 174,000
Contingencies	$ 1,516,000(15%)	$ 2,205,000(14%)	$ 2,101,000
Ordinary Material (12%)	-	-	($ 1,475,000)
Rock Removal (15%)	-	-	($ 600,000)
Slope Revetment (15%)	-	-	($ 26,000)
TOTAL CONTRACT	$11,751,000	$18,500,000	$18,200,000
Engineering & Design	149,000	400,000	400,000
Supervision & Administration	600,000	900,000	800,000
TOTAL COSTS (C of E Funds Only)	$12,500,000	$19,800,000	$19,400,000
Aids to Navigation & Lowering Cables (U.S.C.G.)	10,000	50,000	60,000
TOTAL COST FEDERAL	$12,510,000	$19,850,000	$19,460,000
Non-Federal Costs			
Land Acquisition	$ 40,000	$ 50,000	$ 50,000
Lower Utilities	1,500,000	50,000(1)	50,000
TOTAL NON-FEDERAL COSTS	$ 1,540,000	$ 100,000	$ 100,000
TOTAL (Federal and Required Non-Federal Costs	$14,050,000	$19,950,000	$19,560,000

(1) Dredging at 48-inch Sewer Siphon.

29. Reasons for variations from authorizing document.

a. The increase in cost of removal of ordinary material is based on increased quantities and reflects an increase in dredging cost, based on current unit prices. Also, dumping inspection is now included in this cost.

b. The significant decrease in cost of rock removal is based on decreased quantities as determined from detailed probing and boring surveys made in 1968, during preconstruction planning.

c. The increase in Engineering and Design cost is based on accomplishment of probing and boring surveys by contract in 1968; actual costs incurred; and detailed development of rock areas found during the field investigation. Federal pay increases were also considered.

d. The increase in Supervision and Administration reflects costs due to increase in contract amount and re-estimate of Government costs based on present schedule of construction. Federal pay increases were also considered.

e. The $1,500,000 cost of lowering the 48-inch Braintree-Weymouth sewer siphon across Weymouth-Fore River was eliminated because the Massachusetts Metropolitan District Commission felt that its siphon should remain in its present location, if at all possible. Present engineering studies revealed that, although altering the sewer would make a better project, it was feasible not to lower the sewer siphon. An allowance of $50,000 non-Federal costs has been included to cover costs of the dredging over the sewer siphon to be undertaken by the Metropolitan District Commission.

SCHEDULE FOR DESIGN AND CONSTRUCTION

30. The improvement of Weymouth-Fore and Town Rivers will be accomplished under two separate contracts. It is proposed to contract for work to remove all material except rock from the entire project and the construction of the slope revetment at Germantown Point under an initial contract. The removal and disposal of rock is proposed to be accomplished under a second contract.

31. Improvement of the project channels and basins involves the removal and disposal of about 5,700,000 cubic yards of ordinary materials (principally mud, clay and some silty sand), and 130,000 cubic yards of rock. The time required for completion of dredging ordinary material under the initial contract is 3 years subject to

availability of funds. Midway during the second year of the initial contract, after the removal of overlying materials from the rock areas is nearly completed, plans and specification for the second contract for rock removal will be issued as soon as practicable, when the volume of the rock to be removed is determined from specification rock surveys. The time required for the completion of the rock removal operations, based on the present estimated quantity, is one year. The dredged slope at Germantown Point will be covered with riprap as soon as practicable after completion of the dredging in that area. The present project schedule, contingent on funding and fulfillment of the requirements of local cooperation, is as follows:

	Ordinary Material & Slope Revetment Contract		Rock Removal Contract	
Issue Advance Notice	February	1970	September	1972
Issue Plans & Specifications	March	1970	October	1972
Open Bids	April	1970	November	1972
Award Contract	May	1970	December	1972
Start Construction	June	1970	January	1973
Complete Construction	June	1973	December	1973

32. The time required for the completion of the entire project is 42 months subject to availability of funds. The current fund requirements of October 1969 for the above schedule are as follows:

Combined Weymouth-Fore and Town Rivers

35-Foot (37-Ft. Rock) Channels and Turning & Maneuvering Basins

	Required Funds
Allotted to 30 June 1969	$ 840,000
Fiscal Year 1970	35,000
Fiscal Year 1971	3,600,000
Fiscal Year 1972	5,300,000
Fiscal Year 1973	6,700,000
Fiscal Year 1974	2,925,000
TOTAL COST (C of E Funds Only)	$ 19,400,000

OPERATION AND MAINTENANCE

33. Maintenance of the project is the responsibility of the United States and will consist of periodic dredging to restore project depths within the limits of the authorized Federal project modification. The estimated additional annual maintenance quantities are based primarily on shoaling experienced in the existing channels and adjusted to allow for the wider channels. Allowances were made also for the enlarged existing basin in Town River and the new basin in Fore River. The additional annual maintenance cost is estimated at $70,000 based on an average of 30,000 cubic yards.

BENEFITS

34. The benefit analysis is based on a 50-year project life at 3-1/8% interest rate. The benefits are considered general in nature and are expected to accrue from the same sources as those stated in the authorizing document. Current benefits are based on reanalysis of those in the authorizing document to reflect current price levels and refined commerce projections based on latest available statistics.

35. Improvement of the waterway will enable realization of considerable benefits for the locality. The benefits will result from more economical transportation of petroleum and petroleum products that will comprise future waterborne commerce. Transportation savings will be realized in three general areas, namely - the elimination or reduction of tidal delays; the use of larger and deeper draft vessels; and the reduction of required annual towboat costs.

36. The basic assumptions and methodology employed in the survey report have been retained for derivation of the current benefits. The following departures resulting from updating of benefits are as follows:

a. Assumptions on future power have been deleted. Recent information indicates that power units previously planned will not be constructed.

b. The unit savings in shipping ($/ton) and towboat charges have been escalated to current price levels (+25%).

c. Population projections in project area are based on estimates by Arthur D. Little Inc. done for their report entitled "Projective Economic Studies of New England" (140% increase in population from period 1960 to 2020).

d. Increase use factor of 25% was applied to general petroleum and petroleum products to reflect new and more varied uses of petroleum products.

e. Larger tankers (32,000 and 64,000 d.w.t.) will be carrying the waterway commerce within 5 years after project completion. An average annual equivalent factor based on 5-year growth period was used to compute benefits on existing commerce.

The average annual petroleum commerce for the Weymouth-Fore and Town Rivers waterway for the past 5 years of record totaled 2,375,000 tons. Based on revised population projections and increased use factor petroleum commerce is expected to increase to 5,900,000 tons in projected year 50. The growth was projected on a straight-line basis over the life of the project.

37. Benefits anticipated from the improvement are summarized as follows:

SUMMARY OF AVERAGE ANNUAL BENEFITS

Weymouth-Fore and Town Rivers

Transportation Savings	$1,769,700
Reduction in Towboat Hires	90,800
TOTAL BENEFIT	$1,860,500

38. Annual charges computed in the authorizing document were based on an assumed 100-year project life at an interest rate of 2-7/8 percent of the Federal investment. Current annual charges are computed at an interest rate of 3-1/8 percent over a 50-year project life. Additional annual maintenance costs are based on experienced shoaling in the existing channels and basins and adjusted to reflect the increased dimensions of the recommended channels and basins.

Combined Weymouth-Fore and Town Rivers Project

35-Foot (37-Ft. Rock) Channels and Turning & Maneuvering Basins

Federal Investment

Federal First Cost - Corps of Engineers	$ 19,400,000
Interest During Construction @ 3-1/8% per year for 3½ years	1,060,000
First Cost - U. S. Coast Guard	60,000
TOTAL FEDERAL INVESTMENT	$ 20,520,000

Federal Annual Charges

Project Life	50 years
Interest (3-1/8%)	$ 641,300
Amortization (0.00854)	175,200
Additional Annual Maintenance Channel and Basins	70,000
Additional Annual Maintenance Navigation Aids	1,000
TOTAL FEDERAL ANNUAL CHARGES	$ 887,500

Non-Federal Investment

Land Acquisition	$ 50,000
Dredging at 48-inch Sewer Siphon	50,000
TOTAL NON-FEDERAL INVESTMENT	$ 100,000

Non-Federal Annual Charges

Interest (3-1/8%)	$ 3,100
Amortization (0.00854)	900
TOTAL NON-FEDERAL ANNUAL CHARGES	$ 4,000
TOTAL FEDERAL AND NON-FEDERAL ANNUAL CHARGES	$ 891,500

39. A comparison of annual benefits of $1,860,500 to the estimated annual charges of $891,500 yields a current benefit-cost ratio of 2.1 to 1.

RECOMMENDATIONS

40. The recommended plan of the combined Weymouth-Fore and Town River improvements proposed in this design memorandum consists of:

a. A channel 35 feet deep, 37 feet in rock and 500 feet wide from deep water in Nantasket Roads, and along the southerly half of the Boston Harbor "Narrows" channel, through Nantasket Gut, then 35 feet deep and 400 feet wide to the mouth of Weymouth-Fore River, then 35 feet deep, generally within the limits of the existing project, to the Weymouth-Fore River Bridge, and then 35 feet deep and generally 400 feet wide to the upper limit of the existing project;

b. A channel 35 feet deep and 300 feet wide, increased from 400 to 550 feet at the bends, from the mouth of Town River to the existing turning basin in Town River;

c. A 35-foot deep turning and maneuvering basin at the confluence of the two rivers in King Cove;

d. Enlarging and deepening to 35 feet the existing turning basin in Town River;

e. Adding six acres of 8-foot anchorage to compensate for that part of an existing local small boat anchorage that would be usurped by widening of the 35-foot commercial channel.

This project plan is the same as that recommended in the authorizing document and authorized by Congress. All of the above features are generally in accordance with the plan of the Division Engineer as shown on the map accompanying his report, and with such modifications thereof as, in the discretion of the Chief of Engineers, were advisable. The recommended improvement would also require local acquisition of a parcel of real estate at Germantown Point. The current design memorandum does not require non-Federal construction consisting of lowering a 48-inch sewer siphon crossing Weymouth-Fore River, which was formerly recommended and required by the authorizing Document. However, it is required that the Metropolitan District

Commission assumes all responsibility and costs for dredging all materials in the vicinity of the 48-inch sewer siphon in an area 50 feet on either side of the centerline of the pipe for full channel width. The project plan will serve adequately the present and prospective needs of the harbor and economically is justified. It is recommended that the authorized project be constructed as described herein.

Incl (In 8 sheets)
Maps - File No. 380 Dr. 23

APPENDIX A

The Commonwealth of Massachusetts

Metropolitan District Commission

20 Somerset Street, Boston 02108

SEWERAGE DIVISION

August 29, 1969

Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Attention: John Wm. Leslie
Chief, Engineering Division

Re: NEDED-T

Gentlemen:

Referring to your letter of July 30, 1969, on August 21, 1969 I submitted the following to the Metropolitan District Commission:

"It is recommended that the Metropolitan District Commission assume all responsibility and costs for dredging all materials in the vicinity of the 48 inch siphon across Weymouth Fore River in an area 50 feet on either side of the centerline of the pipeline and approximately 350 feet measured along the centerline of the pipe and so notify the Department of the Army in writing."

On August 28, 1969 the Commission, at its regular meeting voted: Approved as recommended.

It was suggested in your letter of July 30, 1969 that the Commission negotiate with the Government contractor to do the necessary work. This it is unable to do and the work will have to go out for competitive bids. However, I feel that the request for bids by the Commission should be co-ordinated with the work by the Government so that the most advantageous procedures could be followed. We will, therefore, keep in touch with you as to the progress of the work. Our appropriation for the work should be available not later than mid-summer of 1970.

Very truly yours,

A. C. Hayes
Director of Sewerage Division
and Chief Sewerage Engineer

ACH/mm

APPENDIX B

DESIGN ANALYSIS FOR SLOPE PROTECTION AT GERMANTOWN POINT

1. General. - This appendix is a resume of the design methods and techniques used in determining the proposed riprap revetment on the side slope at Germantown Point. The design methods in general follow Beach Erosion Board Technical Report No. 4 "Shore Protection, Planning and Design, (Third Edition June 1966)".

2. Design Tide Elevation. - The maximum elevation of tide occurring with a frequency of approximately once each year is considered an appropriate tide height to base the design of the protective riprap. Inspection of over 30 years of record at Boston Harbor reveals that the maximum elevation of tide occurring once a year is 3.1 feet above Mean High Water. Therefore, the design tide elevation is 12.6 feet above Mean Low Water (Mean range of tide plus 3.1 feet).

3. Design Wave. - The design wave used herein is that generated over the limited fetch and depth offshore from Germantown Point with a wind velocity of 50 miles per hour (or 73.3 feet per second). The maximum fetch lies in a north-northeasterly direction from Germantown Point to Pemberton Point, Hull. The distance is 20,000 feet. Because of limitations in the width of fetch, studies show that the effective fetch to be 50 percent of the measured distance or 10,000 feet. In 1959, a study was made in cooperation with the Town of Weymouth, Massachusetts at Wessagussett Beach. The purpose of the study was to determine the most suitable methods of shore protection, prevention of further erosion and improvement of beaches. This project which the Division Engineer recommended that the United States adopt projects authorizing Federal participation, was submitted to the Chief of Engineers on 17 April 1959. The recommendation was approved and the project has been completed. An extensive study of wave conditions in the area was made at that time. The computed offshore wave was 3.0 feet. At that time, it was considered that refraction effects using the graphic method described in TR-4 might be estimated to result in a wave reduced to two-thirds of its original height. However, application of the wave theory to the peculiar physiography of the area to forecast probable wave characteristics can be expected to yield somewhat doubtful results and, therefore, the offshore wave height of 3 feet was used as the design wave. Germantown Point is located on the opposite side of the river from Wessagussett Beach and for all practical purposes it is considered that a wave height of 3.0 feet should be used as the design wave.

4. The sizes of stone required for the revetment are estimated on the basis of methods presented in TR-4 for a graded riprap armor stone. The equation is as follows:

$$W_{50} = \frac{w_r H^3}{K_{RR} (S_r - 1)^3} \cot \alpha$$

Where W_{50} = Weight of 50% size of the stone in the gradation.

w_r = Unit weight of stone in lbs./cu.ft. (165 lbs./cu.ft.)

H = Design wave height at the structure.

K_{RR} = A stability coefficient 1.7 for depths at toe of structure greater than 20 feet.

S_r = Specific gravity $\frac{w_r}{w_w} = \frac{\text{Unit wt. of stone}}{\text{Unit wt. of water}} = \frac{165}{64}$

α = Angle of slope measured from horizontal, degrees.

From the above equation W_{50} computes to be 220 pounds. The maximum weight of graded rock is 3.6 W_{50} or 800 pounds. The minimum weight of graded rock is 0.22 W_{50} or 50 pounds. It is recommended that the maximum weight of graded rock be increased to 1,000 pounds. The recommended thickness of the graded riprap armor stone is computed from Table 4 - 4 shown in TR-4 as follows:

Weight (pounds)	Average Cubic Dimension (feet)
1,000	1.82
50	0.67

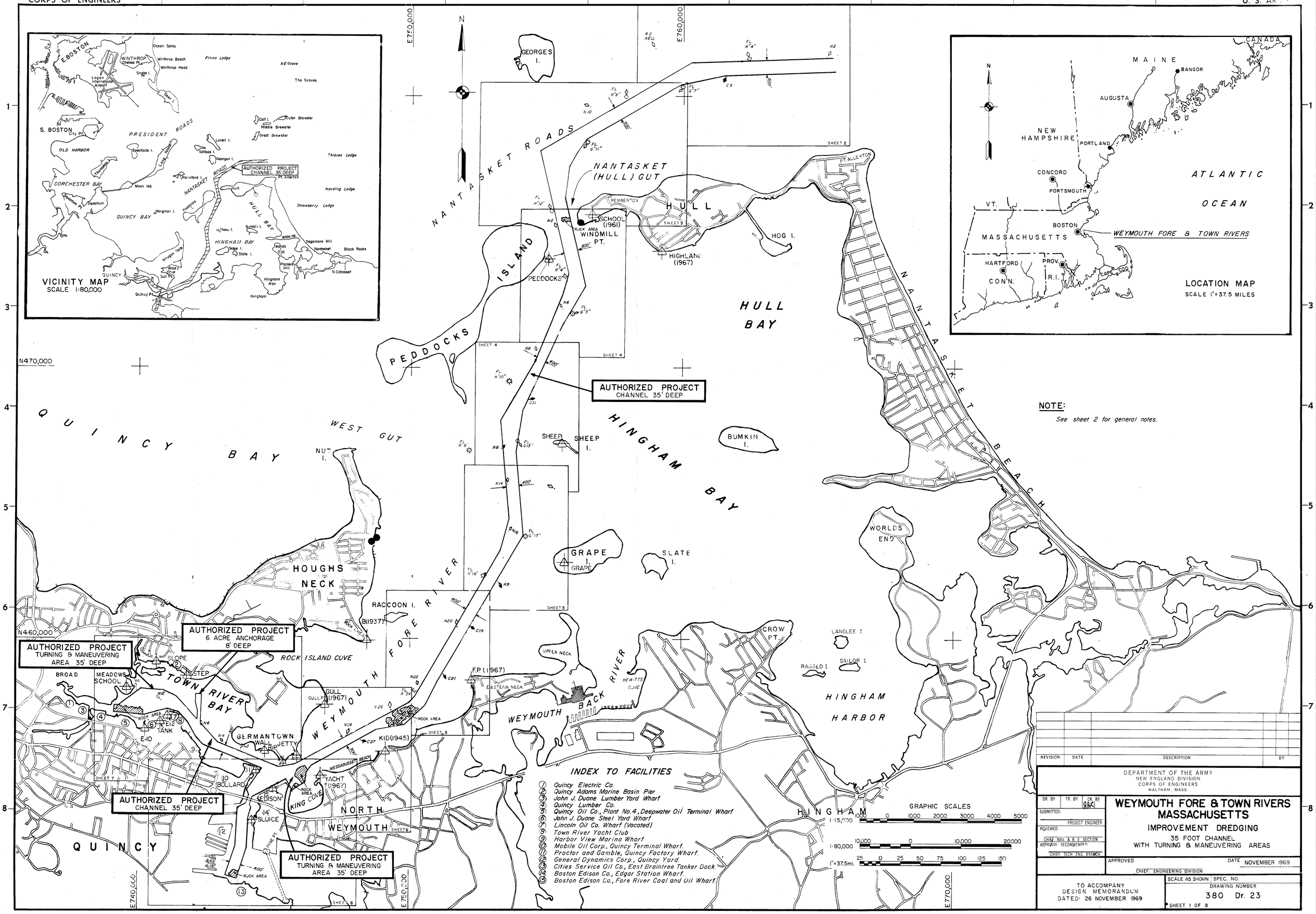
1.82 + 0.67 = 2.49

Use a thickness of 2.5 feet for the graded riprap armor stone.

5. The revetment will consist of a 1-foot thick blanket of well-graded quarried stone ranging in size from 0 to 6 inches placed on the dredged slope and covered by a 2½-foot thick layer of graded armor stone ranging in size from 50 pounds to 1,000 pounds. The bottom of the revetment would commence at a depth of 10 feet below mean low water and extend to the top of the dredged slope.

CORPS OF ENGINEERS

U. S. ARMY



INDEX TO FACILITIES

1. Quincy Electric Co.
2. Quincy Adams Marine Basin Pier
3. John J. Duane Lumber Yard Wharf
4. Quincy Lumber Co.
5. Quincy Oil Co., Plant No. 4, Deepwater Oil Terminal Wharf
6. John J. Duane Steel Yard Wharf
7. Lincoln Oil Co. Wharf (Vacated)
8. Town River Yacht Club
9. Harbor View Marina Wharf
10. Mobile Oil Corp., Quincy Terminal Wharf.
11. Proctor and Gamble, Quincy Factory Wharf.
12. General Dynamics Corp., Quincy Yard.
13. Cities Service Oil Co., East Braintree Tanker Dock.
14. Boston Edison Co., Edgar Station Wharf.
15. Boston Edison Co., Fore River Coal and Oil Wharf.

NOTE:

See sheet 2 for general notes.

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY | TR. BY | CK. BY

SUBMITTED: PROJECT ENGINEER

REVIEWED: CHIEF, NAV. & B. E. SECTION

APPROVAL RECOMMENDED: CHIEF, TECH. ENG. BRANCH

WEYMOUTH FORE & TOWN RIVERS MASSACHUSETTS

IMPROVEMENT DREDGING

35 FOOT CHANNEL
WITH TURNING & MANEUVERING AREAS

APPROVED: CHIEF, ENGINEERING DIVISION

DATE: NOVEMBER 1969

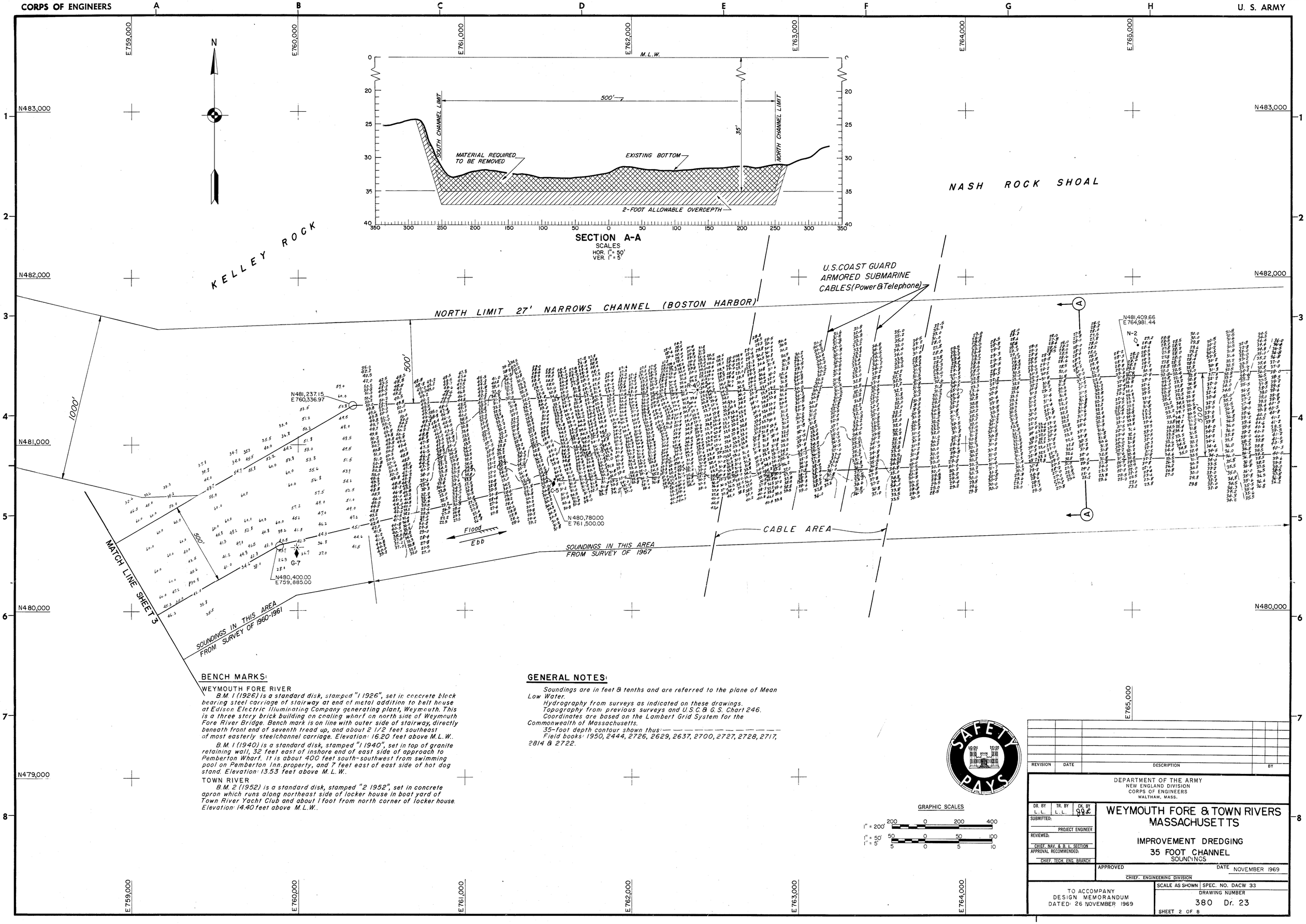
TO ACCOMPANY
DESIGN MEMORANDUM
DATED: 26 NOVEMBER 1969

SCALE AS SHOWN | SPEC. NO.

DRAWING NUMBER
380 Dr. 23

SHEET 1 OF 8

CORPS OF ENGINEERS — U. S. ARMY



BENCH MARKS:

WEYMOUTH FORE RIVER

B.M. 1 (1926) is a standard disk, stamped "1 1926", set in concrete block bearing steel carriage of stairway at end of metal addition to belt house at Edison Electric Illuminating Company generating plant, Weymouth. This is a three story brick building on coaling wharf on north side of Weymouth Fore River Bridge. Bench mark is on line with outer side of stairway, directly beneath front end of seventh tread up, and about 2 1/2 feet southeast of most easterly steelchannel carriage. Elevation: 16.20 feet above M.L.W..

B.M. 1 (1940) is a standard disk, stamped "1 1940", set in top of granite retaining wall, 32 feet east of inshore end of east side of approach to Pemberton Wharf. It is about 400 feet south-southwest from swimming pool on Pemberton Inn. property, and 7 feet east of east side of hot dog stand. Elevation: 13.53 feet above M.L.W..

TOWN RIVER

B.M. 2 (1952) is a standard disk, stamped "2 1952", set in concrete apron which runs along northeast side of locker house in boat yard of Town River Yacht Club and about 1 foot from north corner of locker house. Elevation: 14.40 feet above M.L.W..

GENERAL NOTES:

Soundings are in feet & tenths and are referred to the plane of Mean Low Water.

Hydrography from surveys as indicated on these drawings.

Topography from previous surveys and U.S.C.& G.S. Chart 246.

Coordinates are based on the Lambert Grid System for the Commonwealth of Massachusetts.

35-foot depth contour shown thus: — — — — — — — — — —

Field books: 1950, 2444, 2726, 2629, 2637, 2700, 2727, 2728, 2717, 2814 & 2722.

GRAPHIC SCALES

1" = 200' 200 0 200 400

1" = 50' 50 0 50 100

1" = 5' 5 0 5 10

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY L. L. | TR. BY L. L. | CK. BY GRE

SUBMITTED: PROJECT ENGINEER

REVIEWED: CHIEF, NAV. & B. L. SECTION

APPROVAL RECOMMENDED: CHIEF, TECH. ENG. BRANCH

WEYMOUTH FORE & TOWN RIVERS MASSACHUSETTS

IMPROVEMENT DREDGING 35 FOOT CHANNEL SOUNDINGS

APPROVED CHIEF, ENGINEERING DIVISION — DATE NOVEMBER 1969

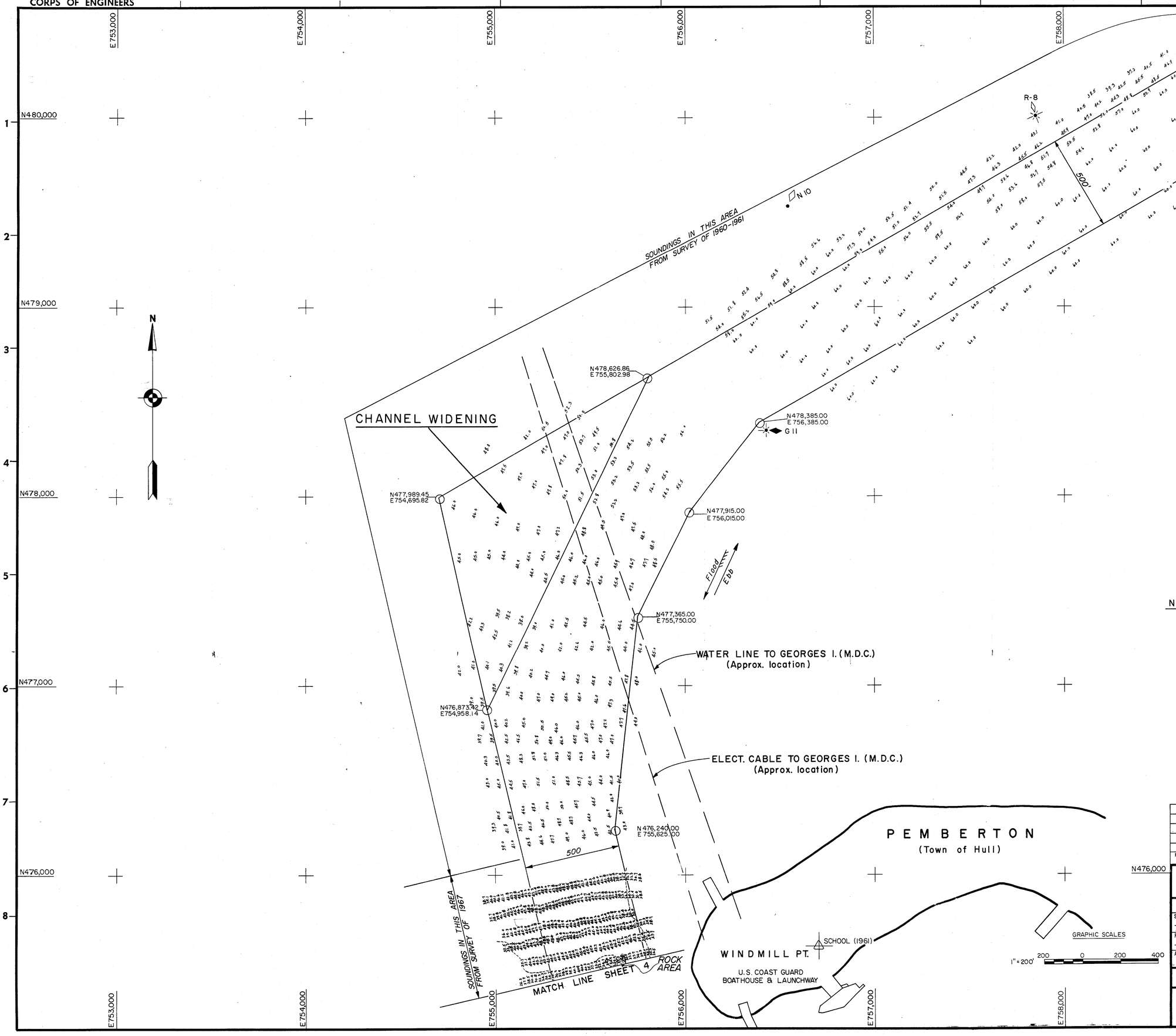
TO ACCOMPANY DESIGN MEMORANDUM DATED: 26 NOVEMBER 1969

SCALE AS SHOWN | SPEC. NO. DACW 33

DRAWING NUMBER 380 Dr. 23

SHEET 2 OF 8

CORPS OF ENGINEERS — U. S. ARMY



NOTE:

See sheet No. 2 for notes.

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY	TR. BY	CK. BY
W.J.R.	W.J.R.	

SUBMITTED: PROJECT ENGINEER
REVIEWED: CHIEF, NAV. & B. E. SECTION
APPROVAL RECOMMENDED: CHIEF, TECH. ENG. BRANCH

WEYMOUTH FORE & TOWN RIVERS MASSACHUSETTS

IMPROVEMENT DREDGING 35 FOOT CHANNEL

SOUNDINGS

APPROVED — CHIEF, ENGINEERING DIVISION

DATE NOVEMBER 1969

TO ACCOMPANY DESIGN MEMORANDUM DATED 26 NOVEMBER 1969

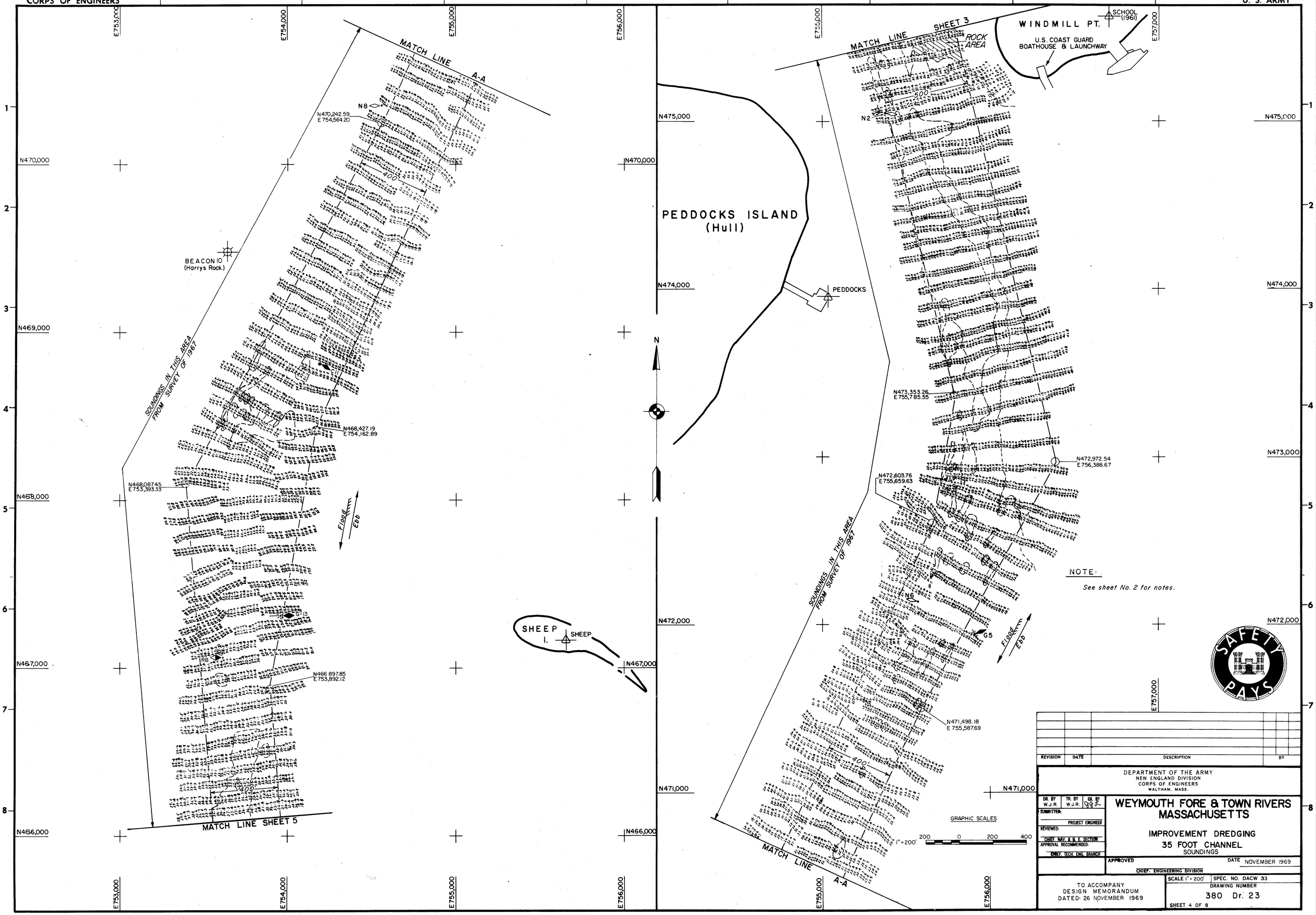
SCALE 1" = 200' | SPEC. NO. DACW 33

DRAWING NUMBER 380 Dr. 23

SHEET 3 OF 8

CORPS OF ENGINEERS

U. S. ARMY



NOTE:

See sheet No. 2 for notes.

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY W.J.R. | TR. BY W.J.R. | CK. BY

SUBMITTED: PROJECT ENGINEER

REVIEWED: CHIEF NAV. & W. E. SECTION

APPROVAL RECOMMENDED: CHIEF, TECH. ENG. BRANCH

WEYMOUTH FORE & TOWN RIVERS MASSACHUSETTS

IMPROVEMENT DREDGING 35 FOOT CHANNEL

SOUNDINGS

APPROVED CHIEF, ENGINEERING DIVISION

DATE NOVEMBER 1969

TO ACCOMPANY DESIGN MEMORANDUM DATED: 26 NOVEMBER 1969

SCALE 1" = 200' | SPEC. NO. DACW 33

DRAWING NUMBER 380 Dr. 23

SHEET 4 OF 8

CORPS OF ENGINEERS

U. S. ARMY

NOTE:
See sheet No.2 for notes.

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY W.J.R. | TR. BY W.J.R. | CK. BY

SUBMITTED:
PROJECT ENGINEER
REVIEWED:
CHIEF, NAV. & B. E. SECTION
APPROVAL RECOMMENDED:
CHIEF, TECH. ENG. BRANCH

WEYMOUTH FORE & TOWN RIVERS MASSACHUSETTS

IMPROVEMENT DREDGING 35 FOOT CHANNEL

SOUNDINGS

APPROVED
CHIEF, ENGINEERING DIVISION

DATE NOVEMBER, 1969

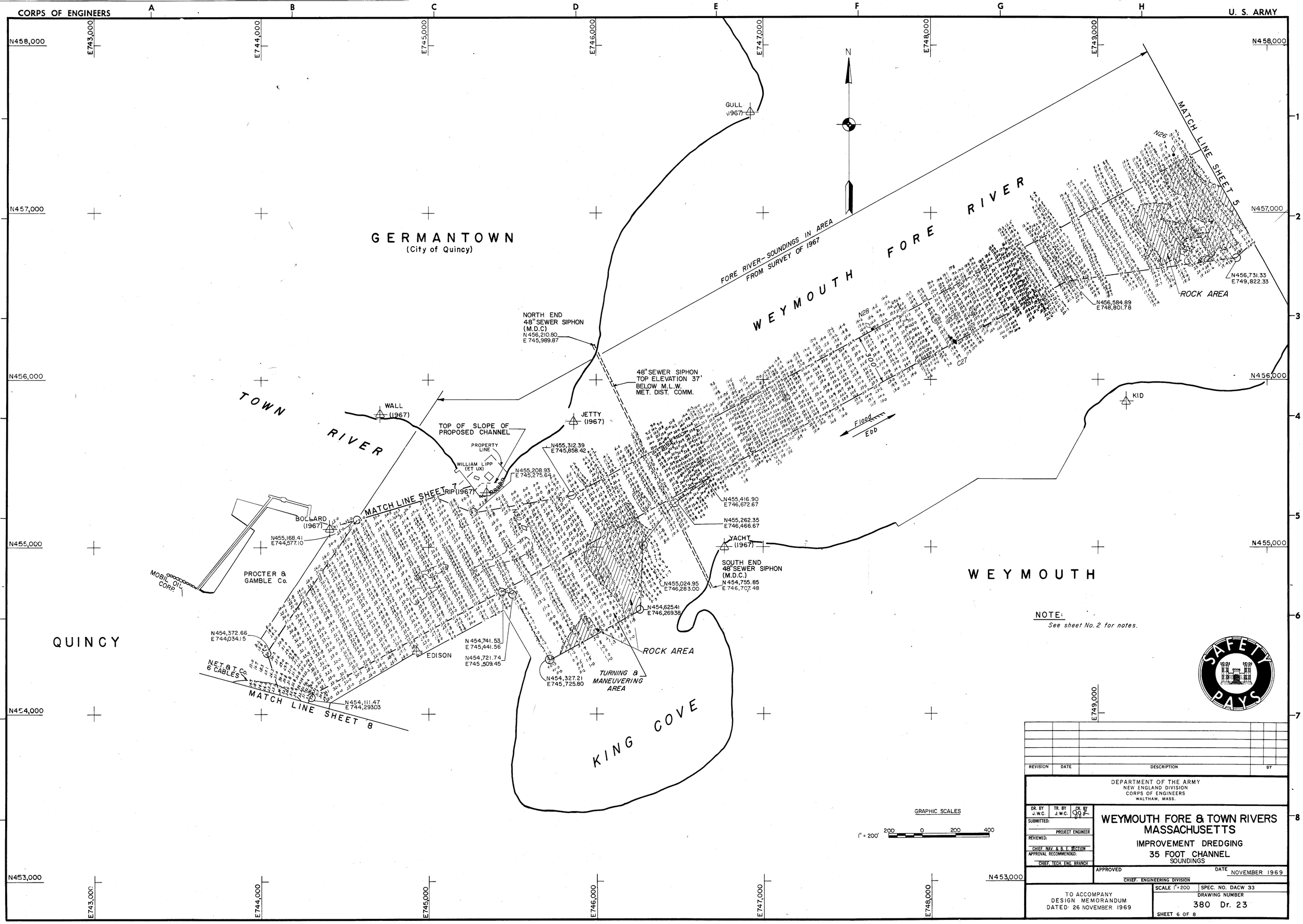
TO ACCOMPANY
DESIGN MEMORANDUM
DATED: 26 NOVEMBER 1969

SCALE 1" = 200'

SPEC. NO. DACW 33

DRAWING NUMBER
380 Dr. 23

SHEET 5 OF 8



REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY J.W.C. | TR. BY J.W.C. | CK. BY JJL

SUBMITTED: PROJECT ENGINEER

REVIEWED: CHIEF, NAV. & B. E. SECTION

APPROVAL RECOMMENDED: CHIEF, TECH. ENG. BRANCH

WEYMOUTH FORE & TOWN RIVERS MASSACHUSETTS

IMPROVEMENT DREDGING 35 FOOT CHANNEL SOUNDINGS

APPROVED CHIEF, ENGINEERING DIVISION

DATE NOVEMBER 1969

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SHEET 6 OF 8

CORPS OF ENGINEERS — U. S. ARMY

GERMANTOWN (City of Quincy)

BAY

WEYMOUTH FORE RIVER

TOWN RIVER

Quincy Adams Marine Basin Pier

8-FOOT LOCAL MOORING BASIN

EXTENSION TO EXISTING 8-FOOT LOCAL MOORING BASIN

N458,000.00 E742,290.00
N458,026.27 E742,056.47
N457,756.49 E742,045.68
N457,304.33 E742,117.05
N457,104.49 E742,109.06
N456,951.35 E742,248.05
N456,136.63 E742,987.51
N457,816.99 E741,462.38
N458,062.17 E740,950.98
N457,235.00 E741,520.00
N456,824.28 E741,895.22
N456,288.73 E742,215.17
N456,030.33 E742,451.24
N457,342.00 E741,111.00
N458,129.11 E740,115.89
N457,132.00 E740,293.00
N457,460.69 E739,309.52
N457,474.22 E739,138.74
N457,225.00 E739,119.00

STEP (1960) — SLOPE — BLUFF (1967) — WALL — RIP (1967) — BOLLARD — EDISON — SCHOOL (1960) — HILL (1960) — E 32 — E-6

N-12 — N-14 — N-16 — N-2 — C-1 — C-7 — C-11

TURNING & MANEUVERING AREA

TOWN RIVER YACHT CLUB

LINCOLN OIL COMPANY

2-4" C.I. INTAKE PIPES

HARBOR MARINA — VIEW WHARF

Mobil Oil Corp.

PROCTER & GAMBLE MFG. CO.

CITY OF QUINCY ABANDONED SUBMARINE WATER PIPE

ABANDONED SUBMARINE CABLES EASTER MASS ST. RAILWAY CO.

MATCH LINE SHEET 6

Flood — Ebb

BROAD MEADOWS
Site of Proposed Power Plant

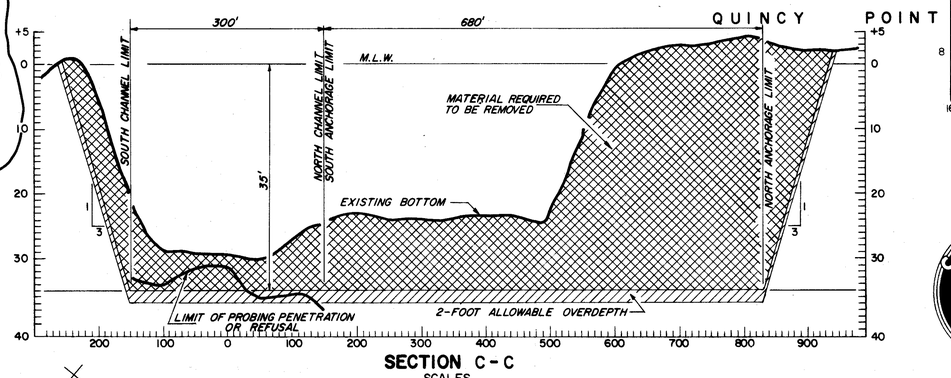
ROCK AREA

UPPER LIMIT OF AUTHORIZED 35-FOOT PROJECT

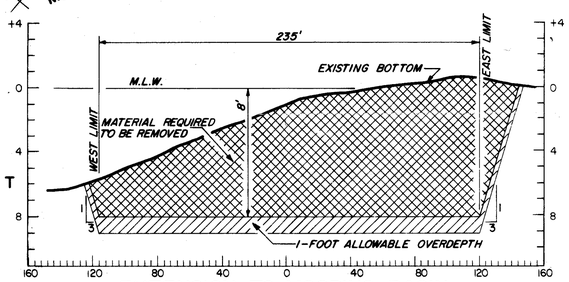
15-FOOT CHANNEL

QUINCY OIL CO.

QUINCY POINT



SECTION C-C
SCALES
HOR. 1" = 100'
VER. 1" = 10'



EXTENSION TO MOORING BASIN
SECTION D-D
SCALES
HOR. 1" = 40'
VER. 1" = 4'

GRAPHIC SCALES
1" = 200' 200 0 200 400
1" = 100' 100 0 100 200
1" = 40' 40 0 40 80
1" = 4' 4 0 4 8
1" = 10' 10 0 10 20

NOTE:
See sheet No.2 for notes.
Soundings on this sheet from survey of 1967-1968.

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY W.J.R. | TR. BY W.J.R. | CK. BY

SUBMITTED: PROJECT ENGINEER
REVIEWED: CHIEF, NAV. & B. E. SECTION
APPROVAL RECOMMENDED: CHIEF, TECH. ENG. BRANCH

WEYMOUTH FORE & TOWN RIVERS MASSACHUSETTS

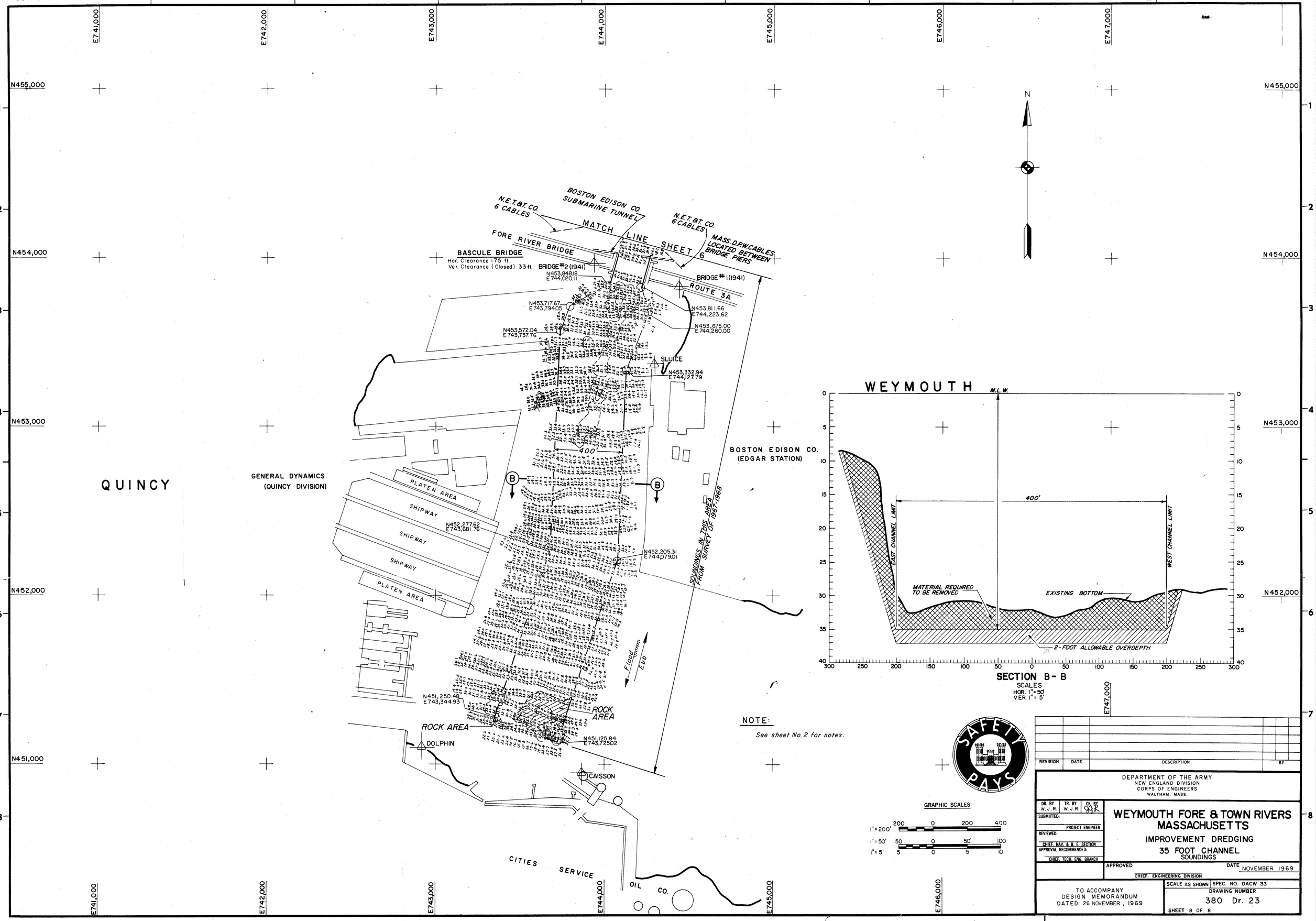
IMPROVEMENT DREDGING
35 FOOT CHANNEL
SOUNDINGS

APPROVED — CHIEF, ENGINEERING DIVISION
DATE NOVEMBER, 1969

TO ACCOMPANY DESIGN MEMORANDUM DATED: 26 NOVEMBER 1969

SCALE AS SHOWN | SPEC. NO. DACW 33
DRAWING NUMBER 380 Dr. 23
SHEET 7 OF 8

CORPS OF ENGINEERS — U. S. ARMY



SECTION B - B

SCALES
HOR. 1" = 50'
VER. 1" = 5'

NOTE:

See sheet No. 2 for notes.

GRAPHIC SCALES

1" = 200' 200 0 200 400
1" = 50' 50 0 50' 100
1" = 5' 5 0 5 10

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DR. BY W. J. R. | TR. BY W. J. R. | CK. BY

SUBMITTED: PROJECT ENGINEER

REVIEWED: CHIEF, NAV. & B. E. SECTION

APPROVAL RECOMMENDED: CHIEF, TECH. ENG. BRANCH

WEYMOUTH FORE & TOWN RIVERS MASSACHUSETTS

IMPROVEMENT DREDGING
35 FOOT CHANNEL
SOUNDINGS

APPROVED — CHIEF, ENGINEERING DIVISION — DATE NOVEMBER 1969

TO ACCOMPANY
DESIGN MEMORANDUM
DATED: 26 NOVEMBER, 1969

SCALE AS SHOWN | SPEC. NO. DACW 33

DRAWING NUMBER
380 Dr. 23

SHEET 8 OF 8