RETURN TO SER AR INDEX

From:	Bachand, Michael L NAE
To:	Sneeringer, Paul J NAE; Michalak, Scott C NAE
Cc:	Keegan, Michael F NAE; Schmidt, Rosemary A NAE
Subject:	RE: South Terminal Project in New Bedford - Discussion of Potential Impacts to the New Bedford Hurricane Barrier from the Blasting (UNCLASSIFIED)
Date:	Monday, August 20, 2012 2:57:32 PM
Attachments:	NBHB Geology.pdf

Classification: UNCLASSIFIED
Caveats: NONE

Scott, Rose,
Here is some geology information for the NBHB from the Design Memorandum.

Michael L. Bachand, P.E.
Levee Safety Program Manager

United States Army Corps of Engineers
New England District
696 Virginia Road
Concord, Massachusetts 01742
Office: 978.318.8075
Cell: 978.551.1656

-----Original Message-----
From: Sneeringer, Paul J NAE
Sent: Monday, August 20, 2012 1:54 PM
To: Michalak, Scott C NAE
Cc: Keegan, Michael F NAE; Bachand, Michael L NAE; Schmidt, Rosemary A NAE
Subject: RE: South Terminal Project in New Bedford - Discussion of Potential Impacts to the New Bedford Hurricane Barrier from the Blasting (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Scott:

I have limited information on the potential blasting impacts associated with the South Terminal Project. I am attaching 1.) the blasting overview narrative from the June 18, 2012 supplemental package; 2.) Attachment B - Draft Proposed Specification for Blasting; and 3.) Appendix C- Corps "The Environmental Effects on Underwater Explosions with Methods to Mitigate Impacts". Apex should be able to provide better maps showing the scope of proposed blasting and background boring or rock core information as part of tomorrow's meeting. Feel free to contact me if you have any questions with regards to this e-mail. Thanks.

Paul Sneeringer
(978) 505-9216

-----Original Message-----
From: Michalak, Scott C NAE
Sent: Monday, August 20, 2012 12:10 PM

SDMS Doc ID 526338

To: Sneeringer, Paul J NAE; Keegan, Michael F NAE; Bachand, Michael L NAE; Schmidt, Rosemary A NAE
Subject: RE: South Terminal Project in New Bedford - Discussion of Potential Impacts to the New Bedford Hurricane Barrier from the Blasting (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Would love to know the actual area and proposed blasting plan if one exists. Plus any background boring or rock core information

Regards,
Scott C. Michalak, P.E.
Chief, Geotechnical/Water Resources Branch
Dam & Levee Safety Officer

United States Army Corps of Engineers
New England District
696 Virginia Road
Concord, Massachusetts 01742
Phone: 978.318.8350

-----Original Message-----
From: Sneeringer, Paul J NAE
Sent: Monday, August 20, 2012 12:06 PM
To: Keegan, Michael F NAE; Michalak, Scott C NAE; Bachand, Michael L NAE; Schmidt, Rosemary A NAE
Subject: South Terminal Project in New Bedford - Discussion of Potential Impacts to the New Bedford Hurricane Barrier from the Blasting (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Mike, Scott, Mike, and Rosemary:

I wanted to check-in with you to see if you needed any background information in order to prepare for tomorrow's meeting with the Commonwealth of Massachusetts and Apex Companies on potential impacts to the New Bedford Hurricane Barrier associated with blasting at the South Terminal project site in New Bedford. Feel free to contact me if you need any background information. Thanks.

Paul Sneeringer
(978) 505-9216 (cell)

Classification: UNCLASSIFIED
Caveats: NONE

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Caveats: NONE

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Caveats: NONE

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Caveats: NONE

C. SITE GEOLOGY.

3. The area lies on the seaboard lowland, the submerged fringe of an old hardrock peneplane surface. It is somewhat of an outlying segment of the old crystalline mass, since it is separated from it by the Carboniferous soft rock Narragansett Basin on the west, and on the north by the Narragansett Basin (which arcs around) and the Norfolk Basin. Bedrock is concealed to the east by thick glacial sediments and to the south by the ocean. An arc bounding the northwest quadrant of a compass rose and having a 15-mile radius would approximate the boundary between the soft rocks and the older igneous and metamorphic complex on which New Bedford rests.

4. Bedrock at the site is granitic gneiss, the product of the intrusion of Lower or pre-Paleozoic schist by granitic magma. Surface exposures are largely pegmatitic with frequent schistose phases and distinct schist intercalations.

5. Principal soils are glacial sands and gravels, overlain in part by alluvial materials, generally redeposited glacial sediments and, in the case of the harbor, an accumulation of mud.

6. Pre-glacial drainage relief appears relatively small in the New Bedford - Fairhaven vicinity. The most conspicuous erosional feature is the bedrock valley between Palmer Island and Fort Phoenix which extends only to about elevation minus 70 feet, M.S.L., in contrast with the Sakonnet River Valley to the west, which attains depths probably in the vicinity of elevation minus 400 feet, and the Cape Cod area, to the east, where comparable bedrock depths appear to exist.

7. Post-glacial surficial drainage is poor, consisting of numerous small ponds, winding streams and marshes.

8. Shoreline features are bayhead and baymouth bars, spits and tombolos. Beaches are somewhat under-nourished because of thin overburden cover. Ocean exposure is rather severe in the outer harbor area, although longer fetches are restricted by the Elizabeth Islands chain lying about 10 miles to the south.

D. FOUNDATION INVESTIGATIONS.

9. One hundred and five foundation borings have been made for the project. Nine borings were made on upstream alignments in the Acushnet River and forty borings were made on or near the present alignment during survey report studies made in 1955-1956. The rest of the borings were made in 1959. Forty-three borings determined foundation conditions for the gate and barrier, 14 for the Rodney French Boulevard Dike, 10 for the Fairhaven Dike, 11 for the Clark Cove Dike, and 3 for the street gate structures. In addition, 11 borings were made in the bypass channel and 3 borings in Blackmer Street, New Bedford, to determine the character of materials to be encountered in excavation of

the bypass channel and sewer relocation, respectively. Undisturbed sampling using the Hvorslev fixed piston with split cone clamp and Shelby tubes, and bedrock diamond drilling were involved in the investigations. Other explorations included 14 hand dug test pits and 1 test trench for the dikes, a street gate structure, and the sewer relocation; 57 drill rod probings washed and hammered to refusal, to more closely define bedrock surface for the gate and bypass channel; and 8 borings in the outer harbor and 6 in Clark Cove, to determine the availability of dredge borrow. The locations are shown on Plates 2 and 3.

E. FOUNDATION CONDITIONS FOR THE HARBOR BARRIER.

10. Bearing conditions for the main harbor barrier are largely favorable, involving from zero to four feet of partially displaceable organic silts and sands west of Palmer Island and from zero to seven feet of similar material east of Palmer Island. A thick soft organic silt pocket occurs east of the gate structure, but dredging of the bypass navigation channel and placement of cofferdam cells will involve removal and replacement of much of these undesirable materials (See geologic section on Plate 3).

11. Western Section. Bedrock is shallow west of Palmer Island attaining a maximum depth to about elevation minus 31 feet, M.S.L., 300 feet west of boring FD-95. Maximum water depth is attained in the area of borings FD-95, FD-96 and FD-97 which represent the former site of a large conduit now replaced for improved flushing reasons by two smaller conduits as shown on Plate 3. Bedrock is assumed to lie slightly below elevation minus 25 feet at these two structures. With water depths of less than 10 feet, less than 5 feet of sandy organic silt is indicated for the structure nearest New Bedford, while little or no harbor mud is expected beneath the eastern structure. The remaining overburden materials are granular largely sandy glacial till beneath the structure near Palmer Island and some till-like material underlying silty gravelly sand beneath the western structure. Bedrock in general, in the western section, is overlain by granular materials capped by 1 to 4 feet of organic silts and organic silty sands.

12. Eastern Section. A bedrock depression with maximum depth along the alignment to about elevation 65 feet lies between the existing 32 foot, M.S.L., navigation channel and Fort Phoenix. Maximum overburden thickness occurs there since the water depth is only about 5 feet, M.S.L. Immediately above the bedrock there, and directly on much of the bedrock east of the existing channel, is a deposit of silts and sands, largely rock flour, attaining its maximum thickness of about 35 feet directly beneath the bypass channel. The top of this bed will be exposed in the bottom of the bypass channel excavation, if carried to existing channel grade, possibly warranting a gravel blanket to protect against scour. Overlying this is a layer 3 to 10 feet thick of variably silty gravelly sands and sandy gravels (its continuation west of the existing channel is partially till-like). Above this layer, east of the ship channel, is a wedge of organic silts which are sandy in part, thin at the east shore but thickening to about 12 feet at the existing ship channel.

These are the materials previously mentioned as partially being removed during excavation of the bypass channel. A layer of sands and silty sands, for the most part 6 or 7 feet thick, covers the organic wedge and is overlain by a thin layer of sandy harbor mud. East of the bedrock depression, bedrock rises rapidly to outcrop at Fort Phoenix. It rises more gently west of the depression to outcrop on Palmer Island. Between Palmer Island and the existing channel, and between Fort Phoenix and the bedrock depression, the bedrock is overlain by a deposit of variably silty sandy gravels and gravelly sands, attaining a maximum thickness of about 10 feet. This is overlain between the island and the ship channel by a thin continuation of the rock flour horizon, a few feet of the partially till-like material mentioned above, and a thin cover of organic silty sands and sandy silts, with maximum water depth at the top of slope of the ship channel of about 20 feet.

13. Gate Area. The 150-foot navigation opening will be provided with sector gates that close during a hurricane. They will be contained in recesses in the abutments during normal periods. The gates consist of two similar leaves with radii of 90 feet and overall height of 61 feet. The sill elevation will be minus 39 feet, M.S.L. The gate structure will be constructed in the dry on sound granitic gneiss, involving little or no removal of weathered rock, ranging in elevation from approximately minus 50 feet, M.S.L., to about elevation minus 60 feet (See Plate 2). Unconfined compression tests of rock samples from boring FD-77, located beneath the center of the gate structure required an average breaking load slightly under 12,000 psi. Probings on 100-foot centers indicate a fairly regular surface averaging approximately elevation minus 55 feet. Reliability of the bedrock contours on Plate 3 is limited to the area covered by the probings indicated. Final design and location of the cofferdam may require additional explorations to further configure the rock surface. Some bedrock removal will be involved in excavating the bypass channel (See Plate 3). The existing navigation channel required considerable rock removal along its western edge in the vicinity of Palmer Island light. Explorations for this project, however, did not indicate rock above grade north of the barrier in the proposed bypass channel.

F. FOUNDATION CONDITIONS FOR THE DIKES AND WALLS.

14. Most of the dikes and walls will be on firm granular soils. Exceptions include the dike on the north side of Clark Cove where the eastern half will involve the removal of trash fill and the western half may require a cut-off through riprap fill. Another small area of trash and earth fill will require partial removal on the east side of Clark Cove. Parts of the Rodney French Boulevard Dike toe will rest on thin harbor mud deposits, and an alternate alignment of the Fairhaven Dike crosses an area of salt marsh involving about 2 feet of peaty organic silt. The present alignment of Fairhaven Dike is mostly along an abandoned railroad bed. Both alignments also involve the removal of some trash fill. Additional borings are needed for detail on the marsh crossing, the character of the Clark Cove fills, and the foundations for the street gates, Clark Cove pumping station and the harbor barrier conduits.

G. AVAILABILITY OF CONSTRUCTION MATERIALS.

15. An approximate dividing line can be drawn longitudinally through New Bedford - Fairhaven Harbor west of which can be found relatively impervious glacial tills accompanied by sands and gravels, while east of that line, toward Cape Cod, only sands and washed tills containing little or no silt or clay occur. The best source of land borrow, therefore, lies a few miles west of the harbor. Dredging of the bypass channel, however, will involve the removal of large quantities of mostly granualr material suitable for placement within the structures and, supplemented with other materials dredged from the immediate vicinity, will provide the bulk of earthen borrow requirements.

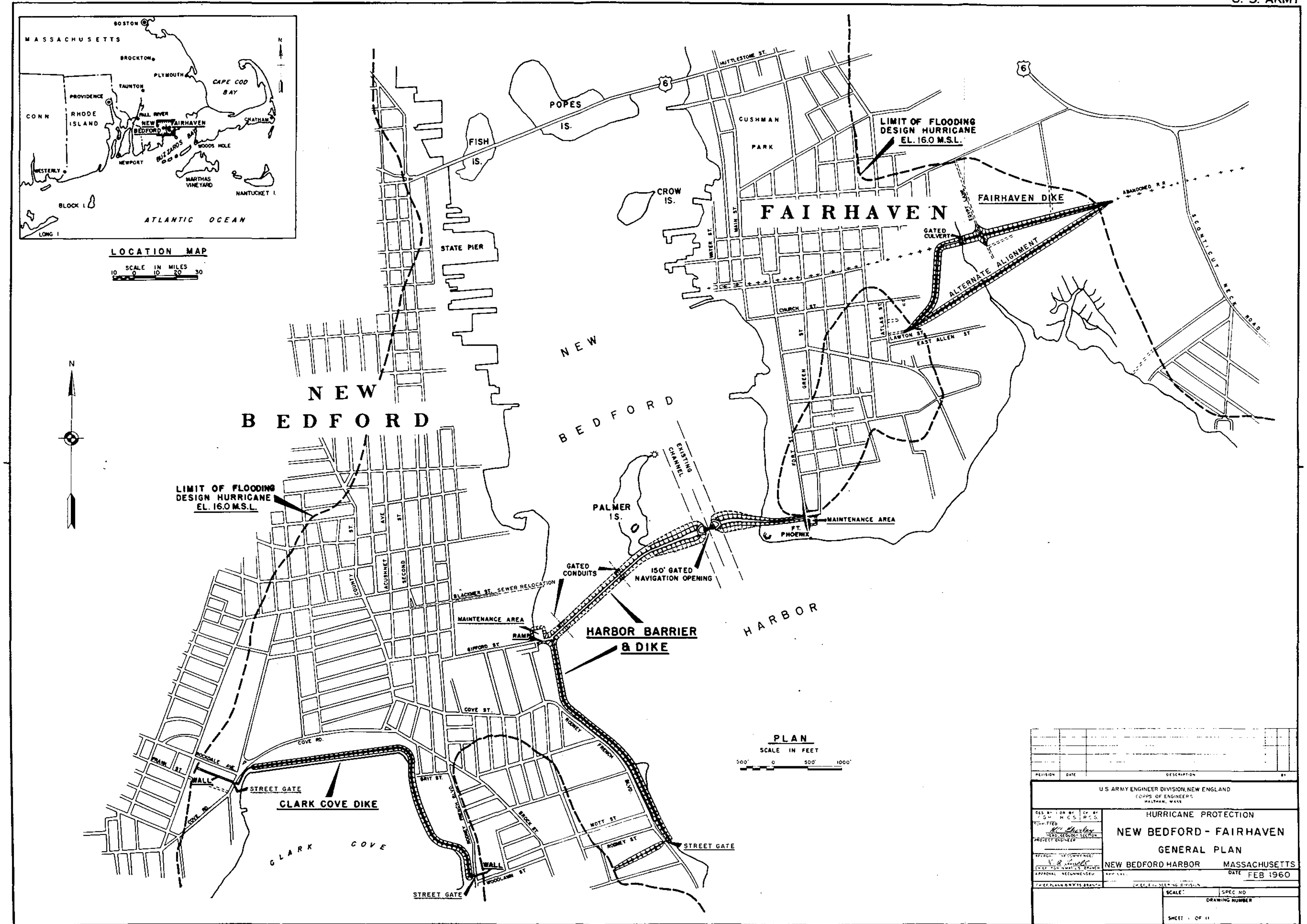
16. The coast from Duxbury on Cape Cod Bay, to Buzzards Bay, is devoid of bedrock exposures. Elevations gradually increase west of Mattapoisett with occasional exposures until the bedrock appears conspicuously at Fort Phoenix in Fairhaven. Higher land inshore from Fort Phoenix, therefore, provides the easternmost nearshore quarry site of appreciable reserve where a large operating quarry exists in Acushnet, 3-1/2 miles north of Fort Phoenix.

17. Earthen Borrow for Barriers and Dikes. Materials dredged from the bypass channel will consist essentially of variable sands and silty sands with silt pockets. They will provide most of the fill for the barriers and dikes, provided dredging is carried to the same grade as the existing navigation channel. Direct hydraulic placement is not considered practical because of the excessively flat slopes resulting from a hydraulic operation. It is planned, therefore, to stockpile materials on the New Bedford shore adjacent to the western abutment of the harbor barrier. Stockpiling will permit the drainage and examination with respect to possible selection or mixing of materials prior to placement within the structures. In addition, a limited dredge borrow area containing largely medium to fine sands will be provided about 1,500 feet south of the barrier, west of Palmer Island, to provide the balance of materials required. A large reserve dredge borrow area containing sand will be available in Clark Cove. Its use, however, is not anticipated at this time. Gravel requirements will depend on the selection of a final barrier section and will be obtained from land sources. Two sectional schemes are under consideration, one involving inshore side rock toes and the other utilizing natural gravel toes. Requirements for the former scheme involve relatively small gravel quantities and the materials probably would be provided by the contractor. The latter scheme involves larger quantities inasmuch as the section utilizes flatter slopes. The nearest sources of natural gravel are located in Dartmouth, 5 to 8 miles haul distance from the site.

18. Rock Borrow for Barriers and Dikes. Rock requirements are upwards of one-half million cubic yards, ranging in size from filter stone to 4-ton rough dimension stone. Cover stone for the barriers and dikes must meet rigid specifications, particularly with respect to durability. Fortunately, the nature of the underlying rock throughout this area is such that almost any exposure suitable for quarrying could produce good revetment. Bluestone quarry (in Acushnet), the only operating

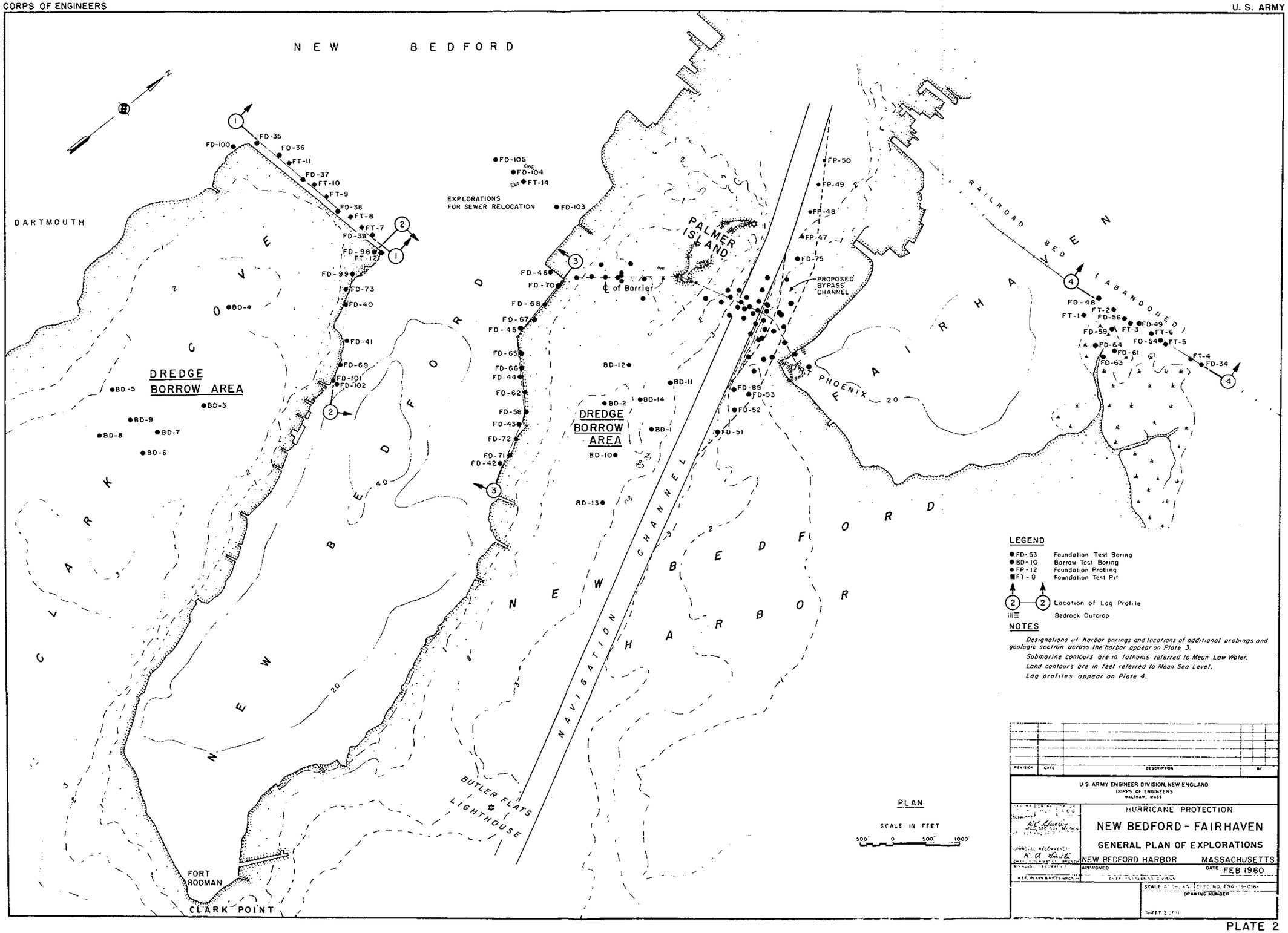
quarry in the vicinity, is removing granitic gneiss and gneissoid granodiorite for road metal. It is expected that stone from this source would meet specifications, but it is not known if they will be interested in opening a new face to provide dimension stone at competitive prices. Local quarries have operated on a very small scale in East Freetown and South Dartmouth, both areas offering major quarry possibilities. The Freetown area, 11 miles north of Palmer Island, consists of holocrystalline true granite, grading northward to granite porphyry, both excellent cover stone types. The Dartmouth area, 6 miles west of the site, consists of massive granitic gneiss and appears suitable for the production of large cover stone. Both areas possess favorable relief for the opening of major working faces. A possible smaller source convenient to the Fairhaven Dike and east side of the harbor barrier, exists in Mattapoisett, about 5 miles east of Fort Phoenix. The rock is exposed as a long narrow rib possessing considerable relief. It is at least partially fine-grained (aplitic) and appears suitable as a secondary source of rock fill and, possibly, cover sizes. It is possible, however, that the larger quarries of Connecticut and southwestern Rhode Island which produce, respectively, true trap rock and granite in large quantities and of any dimension may offer competitive prices at the site.

19. Concrete Aggregates. Three commercial aggregate sources within 20 miles haul distance have been sampled for testing and are expected to meet approval. Several processed crushed gravel and one quarry source of concrete aggregates are located within a four to nine-mile truck haul distance range from the site. Most of the sources are equipped with crushers and screens and range in production capacity from 600-1600 tons per day. The quarry source is rated at 800 tons per day. A detailed discussion of concrete aggregates will appear in Design Memorandum No. 6, Concrete Materials.


LOCATION MAP
SCALE IN MILES
10 0 10 20 30
BOSTON
MASSACHUSETTS
BROCKTON
PLYMOUTH
CAPE COD BAY
TAUNTON
PROVIDENCE
CONN
RHODE ISLAND
FALL RIVER
NEW BEDFORD
FAIRHAVEN
CHATHAM
BUZZARDS BAY
WOODS HOLE
NEWPORT
WESTERLY
MARTHAS VINEYARD
NANTUCKET I.
BLOCK I.
ATLANTIC OCEAN
LONG I.
N
NEW BEDFORD
FAIRHAVEN
POPES IS.
FISH IS.
CROW IS.
PALMER IS.
CUSHMAN PARK
STATE PIER
NEW BEDFORD HARBOR
LIMIT OF FLOODING
DESIGN HURRICANE
EL. 16.0 M.S.L.
FAIRHAVEN DIKE
GATED CULVERT
ALTERNATE ALIGNMENT
ABANDONED R.R.
SCONTICUT NECK ROAD
HUTTLESTONE ST.
WATER ST.
MAIN ST.
CHURCH ST.
GREEN ST.
FORT ST.
LAWTON ST.
EAST ALLEN ST.
ATLAS ST.
EXISTING CHANNEL
MAINTENANCE AREA
FT. PHOENIX
150' GATED NAVIGATION OPENING
GATED CONDUITS
HARBOR BARRIER & DIKE
BLACKMER ST. SEWER RELOCATION
MAINTENANCE AREA
RAMP
GIFFORD ST.
COUNTY ST.
ACUSHNET AVE.
SECOND ST.
COVE ST.
COVE RD.
RODNEY FRENCH BLVD.
MOTT ST.
RODNEY ST.
STREET GATE
BRIT ST.
BROCK ST.
WOODLAWN ST.
WALL
STREET GATE
CLARK COVE DIKE
ROCKDALE AVE.
FRANK ST.
WALL
STREET GATE
CLARK COVE
PLAN
SCALE IN FEET
500' 0 500' 1000'
REVISION
DATE
DESCRIPTION
BY
U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.
HURRICANE PROTECTION
NEW BEDFORD - FAIRHAVEN
GENERAL PLAN
NEW BEDFORD HARBOR
MASSACHUSETTS
DATE FEB 1960
HEAD, GEOLOGY SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, PLANN & R'PTS BRANCH
CHIEF, ENGINEERING DIVISION
SCALE:
SPEC NO
DRAWING NUMBER

CORPS OF ENGINEERS

U. S. ARMY



LEGEND

- ● FD-53 Foundation Test Boring
- ● BD-10 Borrow Test Boring
- ● FP-12 Foundation Probing
- ■ FT-8 Foundation Test Pit
- (2)—(2) Location of Log Profile
- Bedrock Outcrop

NOTES

Designations of harbor borings and locations of additional probings and geologic section across the harbor appear on Plate 3.

Submarine contours are in fathoms referred to Mean Low Water.

Land contours are in feet referred to Mean Sea Level.

Log profiles appear on Plate 4.

PLAN

SCALE IN FEET

500' 0 500' 1000'

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

HURRICANE PROTECTION

NEW BEDFORD - FAIRHAVEN

GENERAL PLAN OF EXPLORATIONS

NEW BEDFORD HARBOR MASSACHUSETTS

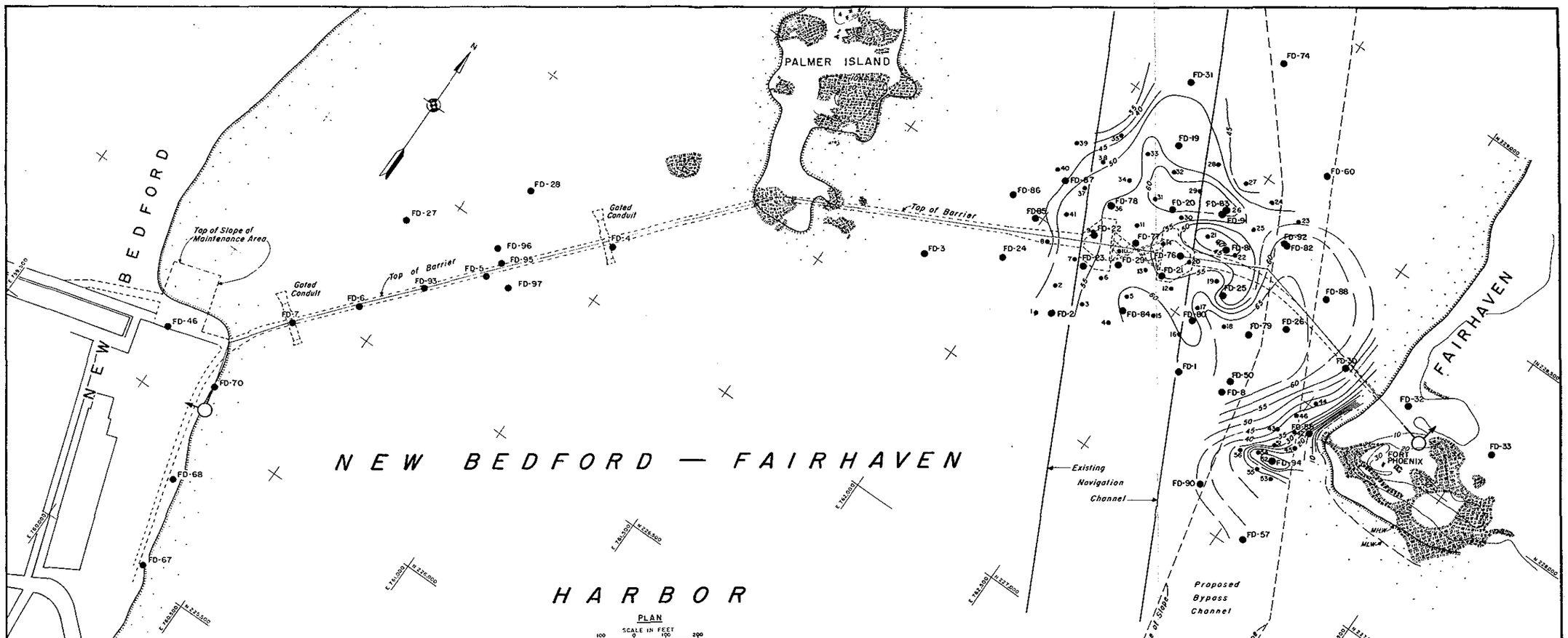
APPROVED DATE FEB 1960

SCALE CORPS NO. ENG-19-016-

DRAWING NUMBER

SHEET 2 OF 11

PLATE 2



GEOLOGIC SECTION — HARBOR ALIGNMENT
(LOOKING NORTH)

LEGEND

- FD-8 Foundation Test Boring
- 22 Foundation Test Probing
- Bedrock Outcrop
- Marsh
- Location and Orientation of Geologic Section

NOTES

Contours within the harbor represent assumed bedrock surface referred to Mean Sea Level.

Coordinates refer to the Massachusetts Grid System.

FD-91 and FD-92 are undisturbed sample borings.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY C.G.M. | DR. BY H.C.S. | CH. BY R.C.G.

SUBMITTED: [signature] CHIEF, ENGINEERING DIVISION

APPROVAL RECOMMENDED: [signature] CHIEF, PLANNING BRANCH

APPROVAL RECOMMENDED:

CHIEF, PLANNING BRANCH

HURRICANE PROTECTION

NEW BEDFORD - FAIRHAVEN

PLAN OF HARBOR EXPLORATIONS AND GEOLOGIC SECTION

NEW BEDFORD HARBOR MASSACHUSETTS

APPROVED: [signature]

CHIEF, ENGINEERING DIVISION

DATE FEB 1960

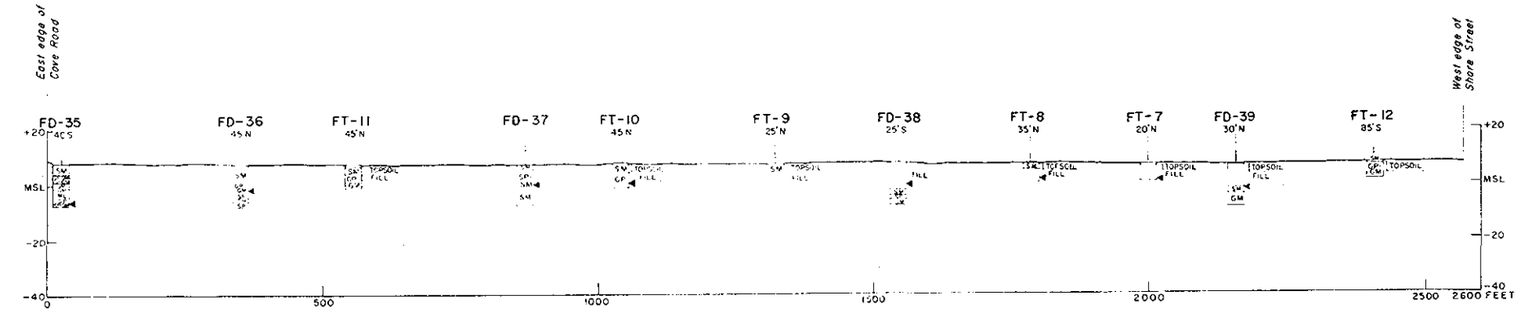
SCALE AS SHOWN | SPEC NO ENG-19-016-
DRAWING NUMBER

SHEET 3 OF 11

PLATE 3

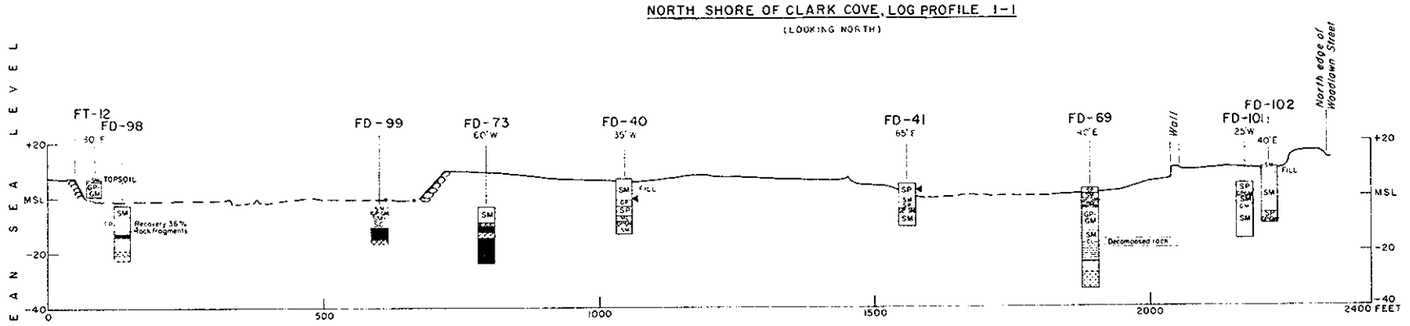
CORPS OF ENGINEERS

U. S. ARMY



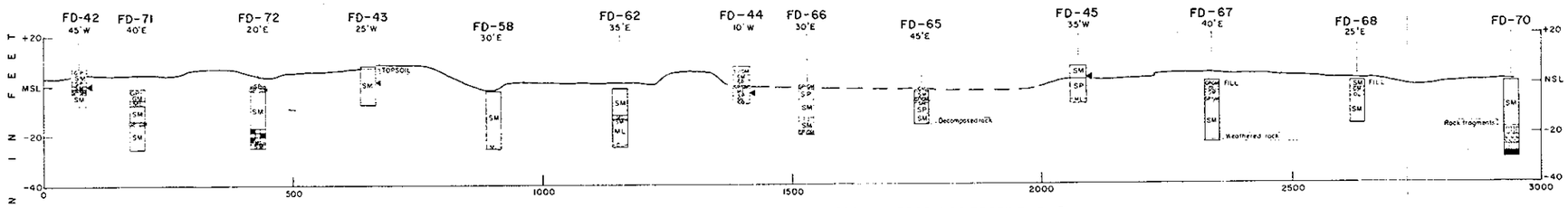
NORTH SHORE OF CLARK COVE, LOG PROFILE 1-1

(LOOKING NORTH)



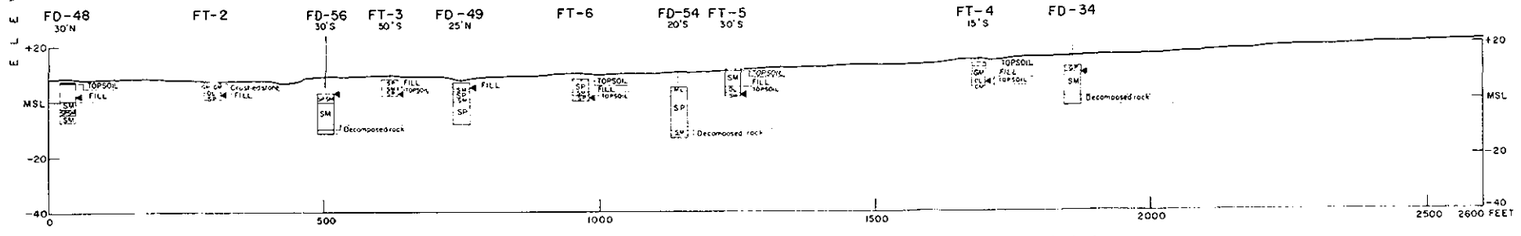
EAST SHORE OF CLARK COVE, LOG PROFILE 2-2

(LOOKING EAST)



WEST SHORE OF NEW BEDFORD HARBOR, LOG PROFILE 3-3

(LOOKING WEST)



ABANDONED RAILROAD EMBANKMENT-FAIRHAVEN, LOG PROFILE 4-4

(LOOKING NORTH)

LEGEND FOR GRAPHIC LOGS

FD-69 Foundation Test Boring

FT-12 Foundation Test Pit

40'E Offset from Profile Line

CD Core-drilled in overburden

Subsurface water level in boring at time of exploration

Group letter symbol according to Unified Soil Classification System

Cobbles or boulders continuous or nested (Core-drilled and/or blasted and chopped)

Rock core recovery 0 - 25 %

Rock core recovery 25 - 50 %

Rock core recovery 50 - 75 %

Rock core recovery 75 - 90 %

Rock core recovery 90 - 100 %

NOTES

Locations of Log Profiles are shown on Plate 2

Graphic Logs showing details of the explorations appear on Plates 5 through 9

Subsurface water levels in the explorations are subject to tidal fluctuations

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY C.G.M. | DR. BY R.A.W. | CH. BY R.C.G.

SUBMITTED: Chief, Geology Section, Project Engineer

APPROVED: Chief, Fdn. & Mats. Branch

APPROVAL RECOMMENDED: Chief, Plans & Surveys Branch

HURRICANE PROTECTION

NEW BEDFORD - FAIRHAVEN

LOG PROFILES ALONG DIKES

NEW BEDFORD HARBOR MASSACHUSETTS

APPROVED DATE FEB 1960

CHIEF, ENGINEERING DIVISION

SCALE | SPEC NO ENG-19-016-

DRAWING NUMBER

SHEET 4 OF 11

PLATE 4