Maura Healey, Governor
Kimberley Driscoll, Lieutenant Governor
Monica Tibbits-Nutt, Secretary & CEO
Jonathan L. Gulliver, Highway Administrator

massDOT
Massachusetts Department of Transportation
Highway Division

December 27, 2023

Donna A. Fisher
Bridge Program Manager
First Coast Guard District
408 Atlantic Avenue
Boston, MA 02110
Donna.A.Fisher@uscg.mil

SUBJECT: MassDOT Project No. 605311
Route 6 (Marion & Wareham Roads) over Weweantic River
M-05-001=W-06-013 & W-06-016
Bridge Replacement Project
Request for Advanced Approval - Bridge Project Jurisdiction Questionnaire

Dear Ms. Fisher,

The Massachusetts Department of Transportation (MassDOT) respectfully requests the US Coast Guard's concurrence that the reach of the Weweantic River in the location of Bridge M-05- 001=W-06-013 in Marion and Wareham, Massachusetts and Bridge W-06-016 in Wareham, Massachusetts qualifies for Advance Approval pursuant to 33 CFR 115.70 - Advance approval of bridges.

As a supplement to the original request sent December 1, 2023, we have provided a US Coast Guard Bridge Project Jurisdiction Questionnaire. Attachments A through D referenced in the Questionnaire were included in the original request and have been included again to aid in your review. Additional photos have been added to Attachment E. Attachments F through H were not included in the original request.

The proposed bridge replacements of M-05-001=W-06-013 and W-06-016 will benefit mariners, increase navigability of the Weweantic River, address sea level rise, and provide structurally sound crossings of the Weweantic River for motorists, bicyclists, and pedestrians.

If you have questions regarding the subject project, please contact me by email at bryan.cordeiro@dot.state.ma.us or by phone at (774) 993-9632.

Sincerely,

Bryan Cordeiro

Bryan Cordeiro
Project Manager
MassDOT Highway Division

CC: Melissa Lenker, MassDOT
Kylie Abouzeid, MassDOT
Courtney Walker, MassDOT
Timothy Dexter, MassDOT
Sara Kreisel, PWS, BSC Group
Steve Dylingowski, Parsons Transportation Group

Table of Contents

USCG Bridge Project Questionnaire

Attachment A	USGS Map and Google Satellite view of the Project area
Attachment B	NOAA Chart View of Buzzard Bay Cape Cod Canal and Approaches
Attachment C	Navigability Survey – Marion Harbormaster Navigability Survey – Wareham Harbormaster
Attachment D	Contemporaneous Notes: August 24, 2023 Visit to the Wareham Marina (USCG / MassDOT / BSC Group / Wareham Marina Employees)
Attachment E	Photographs of Existing Structures and Vessels in the Weweantic River, north of Route 6
Attachment F	Tidal Flushing Study
Attachment G	Bridge Permit
Attachment H	Bridge Plans

U.S. Department of Homeland Security
United States Coast Guard

Commander
First Coast Guard District

1 South Street
New York, NY 10004

Bridge Project Jurisdiction Questionnaire

The General Bridge Act of 1946 requires approval of the location and plans of bridges over navigable waterways prior to the start of construction. In some instances, based on the location of the project, the characteristics of the waterway, and use of the waterway, the Coast Guard can issue an exemption from this requirement or grant an Advance Approval if the conditions stipulated in 33 CFR 115.70 are met.

An Advance Approval waterway is a waterway that is navigable in law, but not actually navigated other than by logs, log rafts, canoes, and small motorboats.

To assist us in making a determination regarding the requirement for a bridge permit or the availability of an Advance Approval determination, please provide the following information in as much detail as possible.

MassDOT Project 605311
Route 6 (Marion & Wareham Rds)
Over Weweantic River (M-05-001=W-06-013 & W-06-016)
Bridge Replacement Project
Marion and Wareham, MA

A. NAVIGATION DATA:

1. **Name of Waterway:** Weweantic River

1a. **Mileage along waterway measured from mouth or confluence**: The bridges are located approximately 2 miles upstream from the confluence of Weweantic River and Buzzards Bay measured from Cromeset Point.

1b. **Tributary of**: N/A, Buzzards Bay
At mile: Confluence of Weweantic River and Buzzards Bay, located approximately at Cromeset Point (See 1a).

2. Geographic Location of proposed bridge (include Road Number, City, County, State) and Latitude and Longitude in NAD 83 form):
Route 6 (Marion & Wareham Roads), Marion and Wareham, Plymouth County, MA

Bridge No. W-06-016
West abutment, center of roadway - N41º-44'-18.89", W70º-44'-46.05"
East abutment, center of roadway - N41º-44'-19.59", W70º-44'-45.22"

Bridge No. M-05-001=W-06-013
West abutment, center of roadway - N41º-44'-15.45", W70º-44'-50.09"
East abutment, center of roadway - N41º-44'-14.63", W70º-44'-51.05"

3. Township, section and range, if applicable:
Not applicable. The Public Land Survey System (PLSS) was created by the Land Ordinance of 1785 and applies only to lands outside of the original thirteen states.

4. Is the waterway tidally influenced at proposed bridge site?
Yes X **No** ___

Range of tide: Above Bridge: -2.76 ft – 3.40 ft
Below Bridge: -2.72 ft – 3.47 ft

Tidal data source: 2020 Tidal Flushing Study (**Attachment F**)

5. Depth and width of waterway at proposed bridge site:

Bridge No. M-05-001=W-06-013

	Depth	Width
At Mean High Tide	**21.65**	**60 feet (horizontal cl. between substructures)**
At Mean Low Tide	**17.63**	**60 feet (horizontal cl. between substructures)**

Bridge No. W-06-016

	Depth	Width
At Mean High Tide	**28.65**	**68 feet (horizontal cl. between substructures)**
At Mean Low Tide	**23.63**	**68 feet (horizontal cl. between substructures)**

6. Character of present vessel traffic on waterway. If none, so state:

M-05-001=W-06-013
None _____
Canoe/Kayak X **Rowboat** _____ **Small Motorboat** ____ **Cabin Cruiser** _____
Freight Ship _____ **Tank Ship** _____ **RO/RO** _____ **Sailboat** _____
Houseboat _____ **Pontoon Boat** _____ **Tug/Barge** _____ **Other** _____

Bridge No. M-05-001=W-06-013
According to the Marion Harbormaster (**Attachment C**), no boats over 21-feet pass under this bridge due to the shallower bathymetry of the river around the bridge, whereby the water is too shallow for the passage of motorboats. This was also confirmed by two long-term employees of the Wareham Marina (**Attachment D**), who identified that only jet skis, canoes, or kayaks cross under the bridge. No sail boats were observed or reported.

W-06-016
None _____
Canoe/Kayak X **Rowboat** ____ **Small Motorboat** X **Cabin Cruiser** X
Freight Ship _____ **Tank Ship** _____ **RO/RO** _____ **Sailboat** _____
Houseboat _____ **Pontoon Boat** _____ **Tug/Barge** _____ **Other** _____

Bridge No. W-06-016
A Navigation Survey is included from the Wareham Harbormaster (**Attachment C**). Most marine vessels including speedboats, center consoles, and dingy boats pass under Bridge No. W-06-016 as a result of the river bathymetry. According to two long-term employees of the

Wareham Marina (**Attachment D**), the maximum length of boats crossing under this bridge are up to 26-feet in length. No sail boats were observed or reported.

6a. Provide the vertical clearance requirement for largest vessel using the waterway.

There are no commercial vessels that utilize this crossing, only recreational vessels, and none are sailboats. The largest recreational boat identified on-site, seen in **Attachment E** (Photo 11), has a bridge clearance of approximately 8.5-feet. That said, there are proposed improvements to increase the low chord. For this, please see question 9b.

6b. Provide a photograph of each type of vessel using the waterway.

Please see attached photographs. (**Attachment E**).

7. Is this waterway used to transport interstate or foreign commerce?
Yes ___ No _X__

7a. Is this waterway susceptible to use in its natural condition or by reasonable improvement as a means to support interstate or foreign commerce?
Yes ___ No _X__

7b. To your knowledge, are there any planned waterway improvements to permit larger vessels to navigate?
Yes ___ No _X__
If so, what are they?

On August 24, 2023, Elijah LeMacchio (USCG), Bryan Cordeiro (MassDOT), and Sara Kreisel (BSC Group) visited the Wareham Marina, approximately 0.4 miles upstream, to discuss the proposed project. While the owner was unavailable to join the meeting, two long-term employees spoke with the USCG and the Project Proponents.

Contemporaneous notes of the visit are included in **Attachment D**, and are summarized here:

- There is a significant history of sedimentation in the Weweantic River, which has already been dredged before. The sediment has since returned, which has resulted in 20% of the marina slips being inoperable.
- The marina confirmed that only jet skis and kayaks (or equivalent) utilize the Marion-Wareham (M-05-001=W-06-013) bridge.
- Commercial boats do not use this Marina, only recreational boaters.
- Boats up to 26-feet in length use bridge W-06-016.
- Raising the low chord of the bridges would add 1.5-2 hours of usage time for mariners each day but will not change what boats can use the marina. Navigable channels will also be widened as the bridge piers of the new structure will be moved.
- Anticipated future conditions are that existing users of the marina will be able to get more usable waterway time; *however, there will likely not be an increase to the number of boats using the marina or the size of boats.*

8. Are there any natural or manmade obstructions, bridges, dams, weirs, etc. downstream or upstream?
Yes _X__ No ___

8a. If yes, provide the name, location of the obstruction, and indicate the type of structure (pedestrian, highway, railroad, culvert, etc.):

- There are dams far upstream of the existing bridges that are no longer in operation.
- I-95 Northbound / Southbound bridges over Weweantic River, approximately 2 miles upstream.
- Horseshoe Pond Hydro Dam approximately 0.25 miles upstream of the I-95 Bridges. The dam is no longer in operation.
- Overhead utility lines are approximately 0.5 miles downstream.

8b. Provide a photograph of the bridge or structures from the waterway showing channel spans.

Please see attached photographs. (**Attachment E**).

9. Will the structure replace an existing bridge? Yes _X_ No ___

9a. If so, provide a permit number and issuing agencies of permits for bridge(s) to be replaced.

Existing USCG Permit 1264 (**Attachment G**).
Approvals are being concurrently sought from the following agencies for the replacement:

- USACE / MassDEP – Individual Section 404 / Individual Section 401
- CZM Consistency
- USFWS – Programmatic Approval
- NOAA – Programmatic and Expanded Approvals (EFH and Section 7)
- NHESP – No-Take Determination
- NEPA – Individual Categorical Exclusion

9b. Provide vertical clearance at mean high water and mean low water, and horizontal clearance normal to the axis of the channel for the proposed bridge.

W-06-016 existing low chord is 5.90-feet
M-05-001=W-06-013 existing low chord is 4.92-feet

The proposed clearances for the bridges are greater than clearances of the existing bridges. The vertical profile of Bridge No. M-05-001=W-06-013 will be increased 2.15-feet to provide a hydraulic minimum vertical clearance of 8.05 feet, and Bridge No. W-06-016 will be increased 2.5-feet to provide a hydraulic minimum vertical clearance of 7.42-feet. The width of the navigable channels will also be expanding, as the proposed bridges will include shifted piers. The proposed improvements on the bridge dimensions are summarized in Table 1 below:

Table 1 – Summary of Major Dimensions and Overall Proposed Improvements

Bridge No.	Span Length		Widest Navigable Channel		Hydraulic Min. Vertical Clearance	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
Marion/Wareham M-05-001=W-06-013	109-feet	136-feet	49.75-feet	60-feet	5.90-feet	8.05-feet
Wareham W-06-016	147.5-feet	184-feet	51.5-feet	68-feet	4.92-feet	7.42-feet

10. List names and addresses of persons whose property adjoins bridge right-of-way.

Bridge M-05-001=W-06-013 is located in SHLO No. 4354
There are two abutters to the west and bridge W-06-016 to the east:

- Richard T. Dix and Lisa M. Dix of 9 River Road to the northwest
- Jeffrey Kahler and Lori Kahler of 28 Wareham Street to the southwest

Bridge W-06-016 is located in SHLO No. 4355 There are two abutters to the east and bridge M-05-001=W-06-013 to the west. The abutters are:

- Ninety-Six Realty LLC of 0 Marion Road to the northeast
- Briarwood Beach Club Motel LLC of 388 Marion Road to the southeast

11. List names and addresses/location of marinas, marine repair facilities, public boat ramps, private piers/docks along the waterway within 1 mile of the bridge site:

Upstream Weweantic River

- Wareham Marina - 73 Leonard St, West Wareham, MA 02576
- I-195 Wareham Boat Ramp / Upper Weweantic River Public Boat Ramp - Unnamed Road, West Wareham, MA 02576
- DiPina Town Beach (small dirt ramp), ~ 29 River Road, Marion, MA 02738 (Sippican River)

Downstream Weweantic River

- 0 Cromesett Road, Wareham MA

Sippican River

- 120 Bullivant Farm Rd Marion, Ma 02738
- Bullivant Farm Rd Marion, Ma 02738
- 17 River Rd Marion, Ma 02738
- Rose Point Improvement Association Inc, PO Box 542, West Wareham, MA 02576
- 4, 8, 10, 12, and 16 Canedy Street, West Wareham, MA 02576
- 19, 23, 27, 31, 39, 41, 43, 47, 51/53, 55 Rose Point Avenue, West Wareham, MA 02576

Beaverdam Creek

- 14, 16, 20 Fillmore Street, Wareham, MA 02571
- 11 Madison Street, Wareham, MA 02571

12. Briefly describe the scope of the project.

Massachusetts Department of Transportation – Highway Division (MassDOT) is proposing the replacement of the structurally deficient, functionally obsolete bridge structures over the Weweantic River: the Marion / Wareham (M-05-001=W-06-013) and the Wareham (W-06-016) located on Route 6 (Wareham Road, Marion / Marion Road, Wareham) in Marion and Wareham, MA. The existing bridges are structurally deficient and undersized and provides inadequate pedestrian facilities. The Applicant proposes to replace the bridge structures with new structures that will accommodate four 11-foot travel lanes, 4-foot shoulders and two 10-foot shared use paths (SUP) to improve vehicle, bicycle, and pedestrian infrastructure on US Route 6. The project involves mitigation measures intended to address resource impacts. These impacts are required to address design elements to rectify existing structural, clearance, and facility deficiencies, while also minimizing disturbances to the surrounding environment. The vertical hydraulic clearance will be increased to accommodate anticipated future sea level increases and existing vessel traffic.

13. Attach location map and plans for the proposed bridge; including vertical clearances above mean high water and mean low water and horizontal clearance normal to axis of the waterway.

See **Attachments A and H.**

14. Attach four (4) photographs taken at the proposed bridge site: one looking upstream, one looking downstream, one from the waterway showing channel spans, and one looking along the alignment centerline across the bridge site.

See **Attachment E.**

Name of applicant: Massachusetts Department of Transportation - Highway Division (MassDOT) (Bryan Cordeiro)

Applicant's telephone number: (774) 993-9632

Name of agent completing questionnaire:
Sara Kreisel, PWS (Ecological PM) Steve Dylingowski, PE (Design PM)

Name of agent's firm:
BSC Group, Inc (Ecological) Parsons (Design Engineer)

Agent's telephone number:
Sara Kreisel, PWS (Ecological PM) Steve Dylingowski, PE (Design PM)
617-896-4579 (603) 286-0013

Mailing address and email address for correspondence:
Bryan Cordeiro, PE (MassDOT PM) bryan.cordeiro@dot.state.ma.us
Melissa Lenker (MassDOT Wetlands) melissa.lenker@dot.state.ma.us
Courtney Walker (MassDOT Wetlands) courtney.l.walker@dot.state.ma.us
Kylie Abouzeid (MassDOT Wetlands) kylie.a.abouzeid@dot.state.ma.us
Sara Kreisel, PWS (Eco PM) skreisel@bscgroup.com
Steve Dylingowski, PE (Design PM) steven.dylingowski@parsons.com

MassDOT – Highway Division
10 Park Plaza, Room 7360
Boston MA, 02116

Date: 12/27/2023 Signature: Bryan Cordeiro

Please note: Incomplete information may delay processing,

Attachments:

Attachment A – USGS Map and Google Satellite View of the Project Area
Attachment B – NOAA Chart View of Buzzard Bay Cape Cod Canal and Approaches
Attachment C – Navigability Survey – Marion Harbor Master
Navigability Survey – Wareham Harbor Master
Attachment D – Contemporaneous Notes: August 24, 2023 Visit to the Wareham Marina (USCG / MassDOT / BSC Group / Wareham Marina Employees)
Attachment E – Photographs of Existing Structures and Vessels in the Weweantic River, North of Route 6
Attachment F – Tidal Flushing Study
Attachment G –Bridge Permit
Attachment H –Bridge Plans

Attachment A

MassDOT Project 605311
Route 6 (Marion and Wareham Roads) over Weweantic River (M-05-001=W-06-013 & W-06-016)
Bridge Replacement Project
USCG Request for Advanced Approval

USGS MAP
GOOGLE SATELLITE VIEW OF THE PROJECT AREA

BSC GROUP

File Location: \\bscbos\wor\GIS-WOR\GISPrj\8955003\Output\Maps\MXD\ReportMaps\MarionWareham_USGSLocus_20210315.mxd
Date Saved: 3/15/2021 2:45:48 PM

Scale:
1 inch = 2,000 feet
0 1,000 2,000
Feet
(Page Size 8.5 x 11)

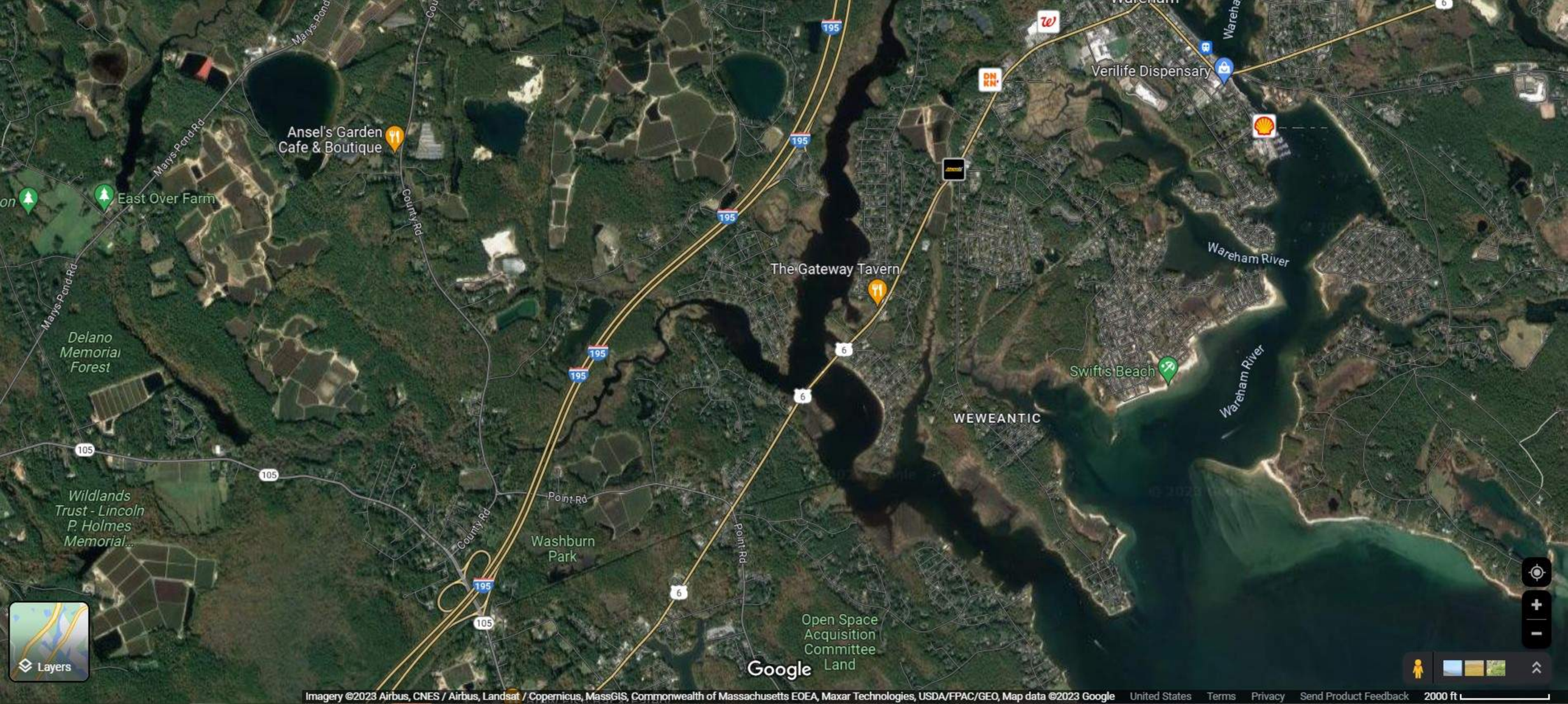
MASSDOT PROJECT 605311, ROUTE 6 OVER THE WEWEANTIC RIVER
MARION / WAREHAM BRIDGE REPLACEMENT PROJECT

USGS Site Location Map
Marion & Wareham, MA

Source: Copyright:© 2013 National Geographic Society, i-cubed

massDOT
BSC GROUP

THIS DOCUMENT IS INTENDED FOR GENERAL PLANNING & INFORMATION PURPOSES ONLY. ALL MEASUREMENTS & LOCATIONS ARE APPROXIMATE.


Marys Pond Rd
Ansel's Garden Cafe & Boutique
East Over Farm
Marys Pond Rd
County Rd
195
Delano Memorial Forest
105
Wildlands Trust - Lincoln P. Holmes Memorial...
Point Rd
Washburn Park
Open Space Acquisition Committee Land
The Gateway Tavern
6
Verilife Dispensary
Wareham River
Swifts Beach
WEWEANTIC
Layers
Google
Imagery ©2023 Airbus, CNES / Airbus, Landsat / Copernicus, MassGIS, Commonwealth of Massachusetts EOEA, Maxar Technologies, USDA/FPAC/GEO, Map data ©2023 Google
United States
Terms
Privacy
Send Product Feedback
2000 ft

Attachment B

MassDOT Project 605311
Route 6 (Marion and Wareham Roads) over Weweantic River (M-05-001=W-06-013 & W-06-016)
Bridge Replacement Project
USCG Request for Advanced Approval

NOAA CHART VIEW OF BUZZARD BAY CAPE COD CANAL AND APPROACHES

BSC GROUP

SOUNDINGS IN FEET

13236

Formerly C&GS 231, 1st Ed., Apr. 1904 C-1942-061 KAPP 2127

SOURCE DIAGRAM

The outlined areas represent the limits of the most recent hydrographic survey information that has been evaluated for charting. Surveys have been banded in this diagram by date and type of survey. Channels maintained by the U.S. Army Corps of Engineers are periodically resurveyed and are not shown on this diagram. Refer to Chapter 1, United States Coast Pilot.

SOURCE

A	1990-2015	NOS Surveys	full bottom coverage
B1	1990-2015	NOS Surveys	partial bottom coverage
B2	1970-1989	NOS Surveys	partial bottom coverage
B3	1940-1969	NOS Surveys	partial bottom coverage
B4	1900-1939	NOS Surveys	partial bottom coverage
B5	Pre-1900	NOS Surveys	partial bottom coverage

SCALE 1:20,000
Nautical Miles
Yards

NOTE Z
NO-DISCHARGE ZONE, 40 CFR 140

This chart falls entirely within the limits of a No-Discharge Zone (NDZ). Under the Clean Water Act, Section 312, all vessels operating within a No-Discharge Zone (NDZ) are completely prohibited from discharging any sewage, treated or untreated, into the waters. All vessels with an installed marine sanitation device (MSD) that are navigating, moored, anchored, or docked within a NDZ must have the MSD disabled to prevent the overboard discharge of sewage (treated or untreated) or install a holding tank. Regulations for the NDZ are contained in the U.S. Coast Pilot. Additional information concerning the regulations and requirements may be obtained from the Environmental Protection Agency (EPA) web site: https://www.epa.gov/vessels-marinas-and-ports.

NOTE C

Private seasonal aids are placed to mark the channel to the following places:
Sippican Harbor (upper part) ..... Apr 15 to Oct 15
Acoost Cove ..... May to Dec (reported)

CAUTION
SUBMARINE PIPELINES AND CABLES

Charted submarine pipelines and submarine cables and submarine pipeline and cable areas are shown as:

Pipeline Area — Cable Area

Additional uncharted submarine pipelines and submarine cables may exist within the area of this chart. Not all submarine pipelines and submarine cables are required to be buried, and those that were originally buried may have become exposed. Mariners should use extreme caution when operating vessels in depths of water comparable to their draft in areas where pipelines and cables may exist, and when anchoring, dragging, or trawling.
Covered wells may be marked by lighted or unlighted buoys.

CAPE COD CANAL LIGHTS

Yellow low pressure sodium lights are installed on the north and south banks, except for the south bank between the highway bridges, which has white mercury vapor lamps. The lights are located 140 feet from the edge of the channel and in general are 500 feet apart on both banks.

CAPE COD CANAL REGULATIONS
207.20 (see note A)

NO-DISCHARGE ZONE
(See note Z)

SPECIAL ANCHORAGE
110.8 & 110.60
(see note A)

ANCHORAGE C
110.140 (see note A)

ANCHORAGE D
110.140 (see note A)

CAUTION

This chart has been corrected from the Notice to Mariners (NM) published weekly by the National Geospatial-Intelligence Agency and the Local Notice to Mariners (LNM) issued periodically by each U.S. Coast Guard district to the dates shown in the lower left hand corner. Chart updates corrected from Notice to Mariners published after the dates shown in the lower left hand corner are available at nauticalcharts.noaa.gov.

NOAA encourages users to submit inquiries, discrepancies or comments about this chart at http://www.nauticalcharts.noaa.gov/staff/contact.htm.

Published at Washington, D.C.
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE
COAST SURVEY

SOUNDINGS IN FEET

FATHOMS						
FEET						
METRES						

Cape Cod Canal and Approaches
SOUNDINGS IN FEET - SCALE 1:20,000

13236

This is the Last Edition of this chart. It will be canceled on Jul 5, 2023

33rd Ed., Apr. 2020. Last Correction: 1/30/2023. Cleared through:
LNM: 07/23 (27/4/2023), NM: 08/23 (22/5/2023), CHS: 5123 (1/27/2023)

To ensure that this chart was printed at the proper scale, the line below should measure six inches (152 millimeters).

If the line does not measure six inches (152 millimeters), this copy is not certified safe for navigation.

(POD) providers fulfill a vessel's requirement to carry a navigational chart "published by the National Ocean Service" in accordance with federal regulations, including but not limited to 33 C.F.R. 164.33(a), 33 C.F.R. 164.72(b), and 46 C.F.R. 28.225(a). POD charts meet stringent print standards and can be recognized by an official certification of authenticity printed on the chart. A list of POD providers can be found at: nauticalcharts.noaa.gov/pod

CONTINUED ON CHART 13230

JOINS CHART 13232

JOINS SHEET

CONTINUED ON CHART 13246

KAPP 2126

CAPE COD BAY

NO-DISCHARGE ZONE
(See note Z)

PRECAUTIONARY AREA
(See note B)

RESTRICTED AREA
33 CFR 334.1110 (see note A)

MARINER ACTIVATED SOUND SIGNALS
Sound signals labeled with (MRASS) require user activation. See USCG Light List.

CAPE COD CANAL LIGHTS
Yellow low pressure sodium lights are installed on the north and south banks, except for the south bank between the highway bridges, which has white mercury vapor lamps. The lights are located 140 feet from the edge of the channel and in general are 500 feet apart on both banks.

CAPE COD CANAL REGULATIONS
207.20 (see note A)

NOTE B
RIGHT WHALE SEASONAL MANAGEMENT AREA

All vessels greater than or equal to 65 feet in length must slow to speeds of 10 knots or less in seasonal management areas.

NOTE B
RECOMMENDED WHALE AVOIDANCE PRECAUTIONARY AREA

The precautionary area shown on this chart is RECOMMENDED for use by all vessels traveling within its limits. This precautionary area has been established to reduce the likelihood of ship strikes of endangered North Atlantic right whales. CAUTION: Full bottom coverage surveys have not been conducted within the precautionary area, so uncharted dangers may exist. See Source Diagram and Chapter 1, U.S. Coast Pilot.

CAPE COD CANAL PROJECT DEPTHS (see note)	
NAME OF CHANNEL	PROJECT DEPTH MLLW (FEET)
EAST ENTRANCE APPROACH	32
SAGAMORE BRIDGE CHANNEL	32
BOURNE BRIDGE CHANNEL	32
BUZZARDS BAY CHANNEL	32
HOG ISLAND CHANNEL	32
CLEVELAND LEDGE CHANNEL	32

PROJECT DEPTHS

Channel legends and tabulations, where indicated, reflect the U.S. Army Corps of Engineers (USACE) project depths. The channel may be significantly shoaler, particularly at the edges. For detailed channel information and minimum depths as reported by USACE, see NOAA Electronic Navigational Charts. USACE surveys and channel condition exists are available at http://navigation.usace.army.mil/Survey/Hydro.

CAPE COD CANAL TRAFFIC LIGHTS

Traffic lights are maintained at the Cape Cod Bay entrance to the canal for westbound vessels and at Wings Neck for eastbound vessels.
Information on operating conditions is available by telephone or radio at the Cape Cod Canal office, Buzzards Bay.
For detailed information consult monthly bulletins published by the Corps of Engineers, Concord, MA.

NOTE A

Navigation regulations are published in Chapter 2, U.S. Coast Pilot 2. Additions or revisions to Chapter 2 are published in the Notice to Mariners. Information concerning the regulations may be obtained at the Office of the Commander, 1st Coast Guard District in Boston, MA or at the Office of the District Engineer, Corps of Engineers in Concord, MA.
Refer to charted regulation section numbers.

NOAA WEATHER RADIO BROADCASTS

The NOAA Weather Radio stations listed below provide continuous weather broadcasts. The reception range is typically 20 to 40 nautical miles from the antenna site, but can be as much as 100 nautical miles for stations at high elevations.

Boston, MA	KHB-35	162.475 MHz
Hyannis, MA	KEC-73	162.550 MHz
Providence, RI	WXJ-39	162.400 MHz

THE NATION'S CHARTMAKER SINCE 1807

UNITED STATES - EAST COAST

MASSACHUSETTS

CAPE COD CANAL

AND APPROACHES

Mercator Projection
Scale 1:20,000 at Lat. 41°42'

North American Datum of 1983
(World Geodetic System 1984)

SOUNDINGS IN FEET
AT MEAN LOWER LOW WATER

Additional information can be obtained at nauticalcharts.noaa.gov.

HEIGHTS
Heights in feet above Mean High Water.

AUTHORITIES
Hydrography and topography by the National Ocean Service, Coast Survey, with additional data from the Corps of Engineers, Geological Survey, and U.S. Coast Guard.

HORIZONTAL DATUM
The horizontal reference datum of this chart is North American Datum of 1983 (NAD 83), which for charting purposes is considered equivalent to the World Geodetic System 1984 (WGS 84). Geographic positions referred to the North American Datum of 1927 must be corrected an average of 0.360" northward and 1.880" eastward to agree with this chart.

POLLUTION REPORTS
Report all spills of oil and hazardous substances to the National Response Center via 1-800-424-8802 (toll free), or to the nearest U.S. Coast Guard facility if telephone communication is impossible (33 CFR 153).

FISH TRAP AREAS
Boundary lines of fish trap areas are shown thus:
Submerged piling may exist in these areas.

CAUTION
BASCULE BRIDGE CLEARANCES
For bascule bridges, whose spans do not open to a full upright or vertical position, unlimited vertical clearance is not available for the entire charted horizontal clearance.

CAUTION
Limitations on the use of radio signals as aids to marine navigation can be found in the U.S. Coast Guard Light Lists and National Geospatial-Intelligence Agency Publication 117.
Radio direction-finder bearings to commercial broadcasting stations are subject to error and should be used with caution.
Station positions are shown thus:
(Accurate location) (Approximate location)

AIDS TO NAVIGATION
Consult U.S. Coast Guard Light List for supplemental information concerning aids to navigation.

CAUTION
Temporary changes or defects in aids to navigation are not indicated on this chart. See Local Notice to Mariners.
During some winter months or when endangered by ice, certain aids to navigation are replaced by lighter types or removed. For details see U.S. Coast Guard Light List.

SUPPLEMENTAL INFORMATION
Consult U.S. Coast Pilot 2 for important supplemental information.

CAUTION
Improved channels shown by broken lines are subject to shoaling, particularly at the edges.

WARNING
The prudent mariner will not rely solely on any single aid to navigation, particularly on floating aids. See U.S. Coast Guard Light List and U.S. Coast Pilot for details.

CAUTION
Mariners are warned to stay clear of the protective riprap surrounding navigational light structures shown thus:

RADAR REFLECTORS
Radar reflectors have been placed on many floating aids to navigation. Additional radar reflector identification on these aids has been omitted from this chart.

RACING BUOYS
Racing buoys within the limits of this chart are not shown hereon. Information may be obtained from the U.S. Coast Guard District Offices as racing and other private buoys are not all listed in the U.S. Coast Guard Light List.

ABBREVIATIONS (For complete list of Symbols and Abbreviations, see Chart No. 1.)
Aids to Navigation (lights are white unless otherwise indicated)

AERO aeronautical	G green	Mo morse code	R TR radio tower
Al. alternating	IQ interrupted quick	N nun	Rot rotating
B black	Iso isophase	OBSC obscured	s seconds
Bn beacon	LT HO lighthouse	Oc occulting	SEC sector
C can	M nautical mile	Or orange	St M statute miles
DIA. diaphone	m minute	Q quick	VQ very quick
F fixed	MORO TR microwave tower	R red	W white
Fl flashing	Mkr marker	Ra Ref radar reflector	WHIS whistle
		R Bn radiobeacon	Y yellow

Bottom characteristics:

Bldr boulders	Co coral	gy gray	Oys oysters	so soft	
bk broken	G gravel	h hard	R rock	Sh shells	
Cy clay	Grs grass	M mud	S sand	sy sticky	

Miscellaneous:

AUTH authorized	Obstn obstruction	PD position doubtful	Subm submerged
ED existence doubtful	PA position approximate	Rep reported	

⚓ Wreck, rock, obstruction, or shoal swept clear to the depth indicated.
(2) Rocks that cover and uncover, with heights in feet above datum of soundings.
COLREGS: International Regulations for Preventing Collisions at Sea, 1972.
Demarcation lines are shown thus:

TIDAL INFORMATION

PLACE		Height referred to datum of soundings (MLLW)		
NAME	(LAT.&LONG.)	Mean Higher High Water	Mean High Water	Mean Low Water
		feet	feet	feet
Cape Cod Canal (east entrance)	(41°46'N,70°30'W)	9.4	8.0	0.2
Abeels Ledge	(41°42'N,70°40'W)	4.4	4.1	---

Dashes (- - -) located in datum columns indicate unavailable datum values for a tide station. Real-time water levels, tide predictions, and tidal current predictions are available on the Internet from http://tidesandcurrents.noaa.gov. (Mar 2012)

SCALE 1:20,000
Nautical Miles
Yards

NOAA/NOS/OCS

Attachment C

MassDOT Project 605311
Route 6 (Marion and Wareham Roads) over Weweantic River (M-05-001=W-06-013 & W-06-016)
Bridge Replacement Project
USCG Request for Advanced Approval

NAVIGABILITY SURVEY – MARION HARBORMASTER
NAVIGABILITY SURVEY – WAREHAM HARBORMASTER

BSC GROUP

The Commonwealth of Massachusetts

Massachusetts Department of Transportation

NAVIGABILITY SURVEY
For
Marion Harbormaster-Sippican/Weweantic River bridge

Directions: This form must be completed and signed by the local harbormaster where a proposed project involves the reconstruction or replacement of an existing bridge over a US Coast Guard navigable waterway.

1. From your personal observations, please describe the current extent of recreational and/or commercial boating use of this waterbody, particularly upstream of the above bridge.

Very minimal…only have a few moored boats north of the bridge (small 13-15' skiffs/whalers)

2. Are there any moorings, boat ramps, marinas, etc., located up river of the bridge? Please describe.

A few moorings plus a small kayak launch area on River Rd (Sippican River), small marina/ramp and state ramp on the Wareham side

3. Do boats 21 feet in length or greater navigate under the bridge?
   Not from the Marion Side

4. Are the banks of the river at the bridge currently or potentially used for launching vessels or for putting in canoes or kayaks? Please explain.

Canoes, kayaks and rowboats only

5. Are there any historical records of vessels using the river for recreational and /or commercial purposes? If so, please explain the extent of the use.

unknown

6. If information is available, please provide the elevations of mean low, mean high and spring high tides where the bridge crosses the river.

   Spring High Tide: estimated 3'

   Mean Low Tide: estimated 9' clearance under the bridge

   Mean High Tide: estimated 4-5'

7. Please provide information as to whether there are any active shellfish resources in the immediate area of the bridge?

Minimal

Signature: Isaac Perry, Marion Harbormaster Date: 4/21/21

The Commonwealth of Massachusetts

Massachusetts Department of Transportation

NAVIGABILITY SURVEY
For
Town of Wareham Weweantic River

Directions: This form must be completed and signed by the local harbormaster where a proposed project involves the reconstruction or replacement of an existing bridge over a US Coast Guard navigable waterway.

1. From your personal observations, please describe the current extent of recreational and/or commercial boating use of this waterbody, particularly upstream of the above bridge.

   Vessel traffic within this area is primarily recreational vessel with the occasional commercial small fishing vessel. We have a fairly large collection of seasonally moored vessels North of the bridge in addition to the Wareham Boatyard that has room for up to 50 vessels of varying size at time. The State of Massachusetts Boat Ramp located at the 195 Rest Area has also seen a significant increase in vessels launching.

   Wareham Boatyard in addition to being a Marina is also now a Massachusetts approve Shellfish Hatchery for growing out shellfish for aquaculture programs.

2. Are there any moorings, boat ramps, marinas, etc., located up river of the bridge? Please describe.

   1. **Two kayak and cartop launch sites**
   2. **Commonwealth of Massachusetts Boat Ramp, 195 Rest Area.**
   3. **Wareham Boatyard located at Rose Point, 73 Leonard Street, Wareham, MA 02576**
   4. **30 private moorings**
   5. **Shellfish Hatchery**
   6. **Private Boat Ramp located at Wareham Boatyard**
   7. **Marine Fuel Sales located at Wareham Boatyard**
   8. **Recreational and Commercial Shellfish grounds North of the bridge**
   9. **Private docks with vessels attached located along the Northern portion of Weweantic and Sippican River**

3. Do boats 21 feet in length or greater navigate under the bridge?

   Yes

4. Are the banks of the river at the bridge currently or potentially used for launching vessels or for putting in canoes or kayaks? Please explain.

   Canoes and kayaks launch from the nearby beaches. There is also a parcel of private property near the Wareham span of the bridges that has gained some interest from

the Division of Marine Fisheries and Mass. Public Access to potentially install a car-top launch site.

5. Are there any historical records of vessels using the river for recreational and /or commercial purposes? If so, please explain the extent of the use.

   This area has historically been utilized by commercial shellfishermen from the Town of Wareham and Marion for harvesting. The area is determined by the Division of Marine Fisheries to be "Conditionally Opened" for the harvesting of Shellfish primarily by boat.

6. If information is available, please provide the elevations of mean low, mean high and spring high tides where the bridge crosses the river.

   Spring High Tide: 4.5'-5.5'

   Mean Low Tide: 3.7'-4.5'

   Mean High Tide:3.7' – 4.5'

7. Please provide information as to whether there are any active shellfish resources in the immediate area of the bridge?

   Area is opened conditionally and utilized during the fall months for the harvesting both by recreational and commercial shellfishermen each year

Signature: _____ Date: 4-22-21

Attachment D

MassDOT Project 605311
Route 6 (Marion and Wareham Roads) over Weweantic River (M-05-001=W-06-013 & W-06-016)
Bridge Replacement Project
USCG Request for Advanced Approval

CONTEMPORANEOUS NOTES
AUGUST 24, 2023 VISIT TO THE WAREHAM MARINA
(USCG / MASSDOT / BSC GROUP / WAREHAM MARINA EMPLOYEES)

BSC GROUP

On August 24, 2023, representatives from the US Coast Guard (USCG), Massachusetts Department of Transportation (MassDOT), and BSC Group, Inc (BSC) met at the Wareham Marina at 73 Leonard St in Wareham, MA to meet with the Marina. Below is a summary of items discussed:

- Surrounding Area Environmental History
    - The area around the Marina itself used to be plentiful with oyster beds but has become heavily sedimented / muddy due to offline dams upstream, cranberry bogs, erosion, and other factors.
    - Especially during storm events, the riverbanks continue to erode, and upstream mud and silt suffocates the oyster and riverbed fauna according to the Marina.
    - The river was dredged at least one time already, and has since filled back-in. The site would require continual dredging. It is unknown when the dredging last occurred.
    - During Hurricane Bob in 1991, the causeway protected the Northern side of Route 6. While the Marina flooded approximately 4.5 feet of water, water levels were another 1.5 feet higher south of the bridge, road, and causeway.
    - Recent tidal flushing analyses (completed in 2021 by BSC Group) identified that the water movement upstream and downstream of Route 6 is not hindered by the causeway.
- Business at the Wareham Marina
    - The Wareham Marina first opened in the 1970s with 25 slips. As of the 1980s, there are fifty slips; however, only forty are rented as ten of these slips are now too shallow or generally in areas with too much mud as a result of upstream sedimentation.
    - Commercial boats do not use this Marina, only recreational boaters.
    - The largest boat currently using the bridge / marina slips is 26-feet long. The marina has been generally losing customers with larger vessels because the slips cannot accommodate larger vessels as a result of the influx of sedimentation.
- Existing Bridge Crossings
    - Siltation in the river has limited mariners' ability to get into and out of the harbor which must be timed with low tides.
    - M-05-001=W-06-013 bridge is a two-equal-span bridge. It is used by jet skis and kayaks, only. Due to shallow bathymetry, the crossing is not usable by larger boats.
    - Boats crossing under Route 6 cross under W-06-016, a three-equal-span bridge.
- Impacts of the proposed bridges
    - The proposed bridge design will raise the low chord of each bridge:
        - Bridge W-06-016 will be raised 2.5 feet.
        - Bridge M-05-001=W-06-013 will be raised 2.15 feet.
    - Raising the low chord will not change what boats can use the marina; however, it will afford users 1.5-2 more hours of usage each day.
    - The bridge piers will be moved on both bridges which will effectively increase the width of each navigable channel:
        - Bridge No. M-05-001=W-06-013 will remain a two-span bridge, but with new unequal span lengths. The new wider navigable channel will increase to be 60-feet wide (approximately +8 feet).

        - Bridge No. W-06-016 will remain a three-span bridge, but with new unequal span lengths. The new wider navigable channel (center span) will increase to be 68-feet wide (approximately + 16-feet).
- Future Wareham Marina plans
    - Proposing a pontoon boat which will essentially be moored at the marina.
    - Anticipated future conditions are that existing users of the marina will be able to get more usable waterway time; however, there will likely not be an increase to the number of boats using the marina or the size of boats.

Attachment E

MassDOT Project 605311
Route 6 (Marion and Wareham Roads) over Weweantic River (M-05-001=W-06-013 & W-06-016)
Bridge Replacement Project
USCG Request for Advanced Approval

PHOTOGRAPHS OF EXISTING STRUCTURES & VESSELS IN THE WEWEANTIC RIVER, NORTH OF ROUTE 6

BSC GROUP

Photo #1: View northeast of Route 6 in Marion towards M-05-001=W-06-013, the Town line of Marion-Wareham, and the eastern end of the project area.

Photo #2: View southwest of Route 6 in Wareham towards Marion and Bridge W-06-016, and the western end of the project area.

Photo #3: View west/southwest of bridges W-06-016 and M-05-001=W-06-013, from www.wareham.theweektoday.com *(February 2022)*

Photo #4: View west/northwest of bridges W-06-016 and M-05-001=W-06-013, from www.wareham.theweektoday.com *(June 2023)*

Photo #5: View south of W-06-016 from Salt Marsh 6.

Photo #6: View southwest of the W-06-016 bridge from Salt Marsh 6.

Photo #7: View northeast of the north side of the M-05-001=W-06-013 bridge *(March 2018).*

Photo #8: View southeast of the north side of the M-05-001=W-06-013 bridge *(March 2018).*

Photo #9: View east of the north side of the W-06-016 bridge *(March 2018).*

Photo #10: View northeast of the causeway between bridges M-05-001=W-06-013 and W-06-016 *(June 2023).*

Photo #11: Cabin cruiser type-vessel with limited living space at the Wareham Marina (August 2023). It is believed to be a 25-foot 2005 Robalo R235 Walkaround and that this boat has a small interior compartment.

Photo #12: Example of a few of the boats docked at the Wareham Marina, including dinghies, speedboats, cabin cruisers, and center consoles.

Photo #13: Speedboat in the Weweantic River, upstream of the bridges at Route 6 (June 2023).

Photo #14: Center console vessel utilizing the Wareham bridge (W-06-016) at Route 6 (June 2023).

Photo #15: Speedboat parked at the Wareham Marina (August 2023).

Photo #16: Speedboat at the Wareham Marina (August 2023).

Photo #17: Center console-type vessel at the Wareham Marina (August 2023).

Attachment F

MassDOT Project 605311
Route 6 (Marion and Wareham Roads) over Weweantic River (M-05-001=W-06-013 & W-06-016)
Bridge Replacement Project
USCG Request for Advanced Approval

TIDAL FLUSHING STUDY

BSC GROUP

Tidal Flushing Study

Route 6 at Weweantic River in Marion and Wareham, Massachusetts

February 2021

BSC Group, Inc. performed a study on water levels in the Weweantic River directly above and below the bridge. Two water level loggers were deployed in the Weweantic River between 12/15/2020 and 12/22/2020 which was during a spring tide event. The loggers were programmed to record water depth every 15 minutes at the same time. The loggers were surveyed with RTK GPS when they were deployed and when they were recovered to ensure they were not moved while recording water levels. Figure 1 below shows the water level directly above the bridge and directly below the bridge during that period. The water level below the bridge is always slightly higher than the water level above the bridge. However, on average the difference in water level between above and below the bridge is less than an inch. This data suggests that the Route 6 bridges across the Weweantic River do not hinder tidal flushing.

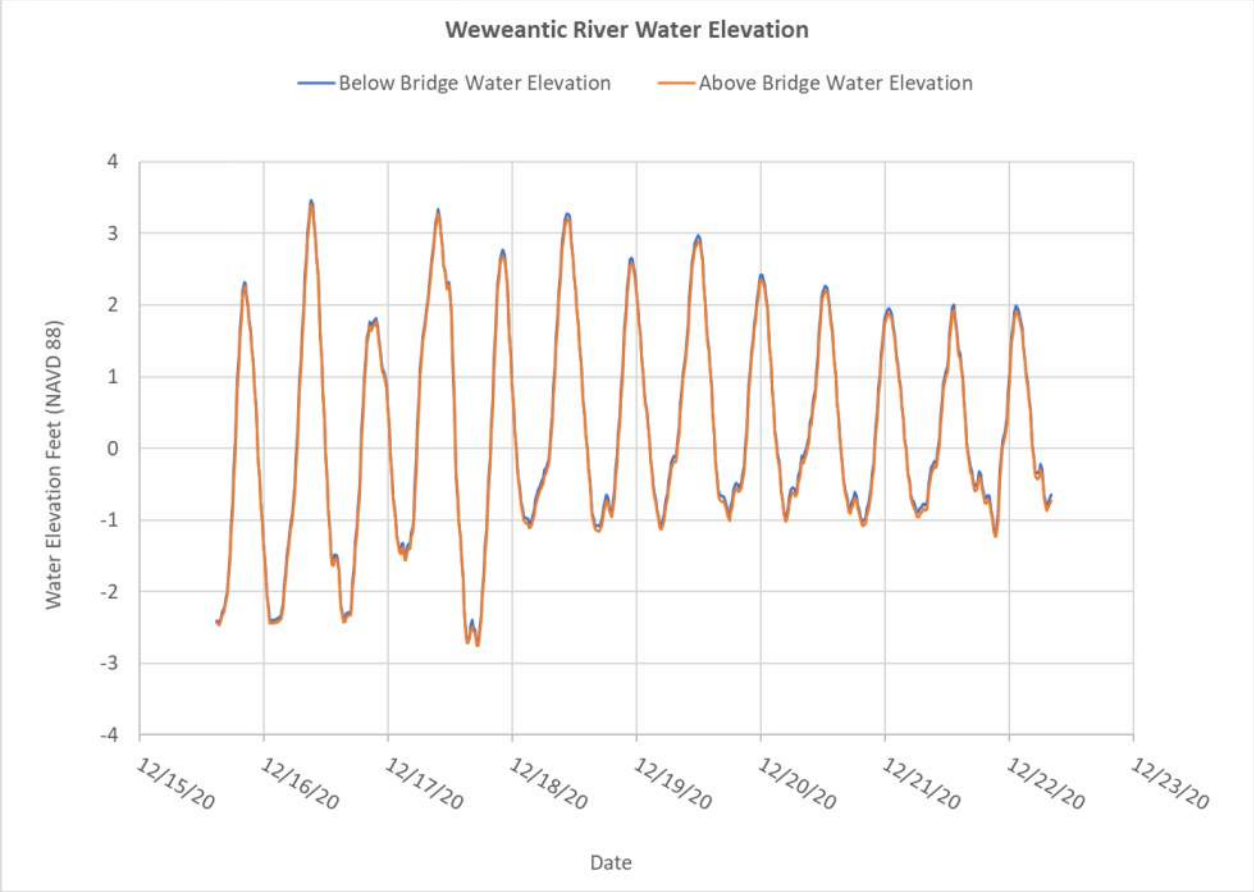


Figure 1: Water levels in the Weweantic River above and below the Route 6 bridges between the dates of 12/15/2020 and 12/22/2020.

BSC Group also collected two water samples approximately 100m above and below the Weweantic River Bridge on 12/29/2020. The samples were collected at about mid tide as the tide was receding. The water samples were sent to a lab for analysis which are summarized in Table 1.

Table 1. Lab results for water samples collected above and below the Weweantic River Bridge.

Chemistry	Above Bridge	Below Bridge
Salinity (SU)	5.7	10
Nitrogen (mg/l)	0.10	ND
Fecal Coliform (MPN)	33	23

Natural estuarine dynamics will cause salinity concentrations to be lower upstream vs downstream and would cause nitrogen and fecal coliform concentrations to be higher upstream vs downstream. The further distance apart water samples are taken the larger a difference you would expect when measuring salinity, nitrogen, and fecal coliform. The place in the tide cycle would also affect these concentrations. These samples were collected at mid tide as the tide was receding. Therefore, the saltwater influence was retreating back to the mouth of the river and the freshwater influence was coming down the river. This could explain the difference in the concentrations between both water samples. The freshwater coming back down stream as the tide recedes would cause lower salinity above the bridge versus below. The freshwater coming down stream would be expected to have higher nitrogen and fecal coliform concentrations as all of the nitrogen and fecal coliform from the watershed are draining into the river from groundwater and surface flows.

The tidal portion of Weweantic River has an estimated surface area of about 7 acres and a daily tidal range of 3.8 feet. This translates to 286 acres-feet of water entering and exiting the river upstream of the bridge during every tide cycle and 572 acre-feet every day.

A portion of the that water is made up of annual runoff and groundwater recharge coming from upgradient and a portion is seawater. The watershed to river is reported at 18,000 acres. The average annual runoff and groundwater recharge to the river is estimated at 24-inches. If these figures are accurate and half of this runoff groundwater leaves thought the river (the rest though groundwater), daily runoff and groundwater volume into the river is estimated (on a conceptual level) at 50 acre-feet per day such that on a daily basis there is about a 10% dilution of seawater with freshwater. If the groundwater/surface runoff is higher in nitrogen than the seawater, then it is expected that the nitrogen levels would be higher up gradient of the bridge whether the bridge existed or not.

BSC Group also flew a drone over a portion of the Weweantic River near the bridges to look at aerial coverage of *Phragmites* above and below the bridges. The results from the drone flight show that there are stands of *Phragmites* along the upland edge of the salt marsh above and below the bridge. The *Phragmites* stands captured from the drone photos are similar in size and position (located at the upland edge of the salt marsh) above and below the bridges; see *Phragmites* map on next page. The fact that *Phragmites* is growing along the upland edge of the salt marsh above and below the bridges suggests that the bridge is not causing a significant restriction leading to increased *Phragmites* stands. Instead that there is a freshwater influence along the landward edge of the salt marsh diluting the salinity content and allowing the *Phragmites* to grow. If the stream was tidally restricted we would expect to see the *Phragmites* stands extended to the seaward edge of the salt marsh above the bridge as the salinity content would be lower in the river itself and not just along the landward edge of the salt marsh.

Overall, the bridges and causeway are a restriction within the river system. One cannot install a causeway in the center of a river and say it's not a restriction. However, the concern is whether or not the bridges and causeway are restricting tidal flushing within the system. The evidence provided and the research conducted by various entities has documented that this system is flushing fully in less than one day and that the bridges and causeway do not significantly restrict the flushing of the system.

Attachment G

MassDOT Project 605311
Route 6 (Marion and Wareham Roads) over Weweantic River (M-05-001=W-06-013 & W-06-016)
Bridge Replacement Project
USCG Request for Advanced Approval

BRIDGE PERMIT

BSC GROUP

R&Hs 4/81 (By SofW)

FILE COPY

1264

U. S. ENGINEER OFFICE,
Providence, R. I.
MAR 19 1929
Original to permittee,
Copy to Div. Engr.

APPROVAL OF LOCATION AND PLANS OF BRIDGE

(Authorized by State Law)

Completed March, 1930.
Reported July 14, 1930.

Copy of Engr. 637 (Mass.-Weweantic R.-Wareham-Marion)-1/22.

Whereas, By Section 9 of an act of Congress, approved March 3, 1899, entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," it is provided that bridges, dams, dikes, or causeways may be built under authority of the legislature of a State across rivers and other waterways, the navigable portions of which lie wholly within the limits of a single State, provided the location and plans thereof are submitted to and approved by the Chief of Engineers and by the Secretary of War before construction is commenced;

And whereas, The MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS has submitted plans and a map of the location of two bridges to be constructed across the WEWEANTIC RIVER, between Wareham and Marion, in the State of Massachusetts, under authority of the legislature of said State, which plans and map of location are hereto attached;

Now, therefore, This is to certify that the location and attached plans of said bridges are hereby approved by the Chief of Engineers and by the Secretary of War, pursuant to the above-mentioned provision of the act of March 3, 1899, subject to the following conditions:

1. That the District Engineer of the Engineer Department at Large in charge of the district within which the bridges are to be built may supervise their construction in order that said plans shall be complied with.

2. That all work shall be so conducted that the free navigation of the waterway shall not be unreasonably interfered with; that the present navigable depths shall not be impaired; and that the channel or channels through the structure shall be promptly cleared of all falsework, piling, or other obstructions placed therein or caused by the construction of the bridges, to the satisfaction of the said district engineer, when in his judgment the construction work has reached a point where such action should be taken, and in any case not later than ninety days after the bridges have been opened to traffic.

3. That the approval hereby given shall cease and be null and void unless the actual construction of the bridges be commenced within one year and completed within three years from the date of this instrument.

4. That all parts of the existing bridges not used in the construction of the new bridges shall be entirely removed down to the natural bottom of the river and the channels cleared to the satisfaction of the said District Engineer not later than sixty days after the said new bridges are opened to traffic.

5. That any material dredged in the prosecution of the work herein authorized shall be deposited to the satisfaction of the said District Engineer and in accordance with his prior permission or instructions either on shore above high water mark or on such dumping grounds in the waterways as may be designated by him, and that no material shall be deposited in the waterway except in the presence of an inspector appointed by said District Engineer, the expenses of the inspection to be borne by the grantee.

Witness *my hand this* 6th *day of* March , 1929.

(sgd)

Herbert Deakyne,
Brigadier General,
Acting *Chief of Engineers.*

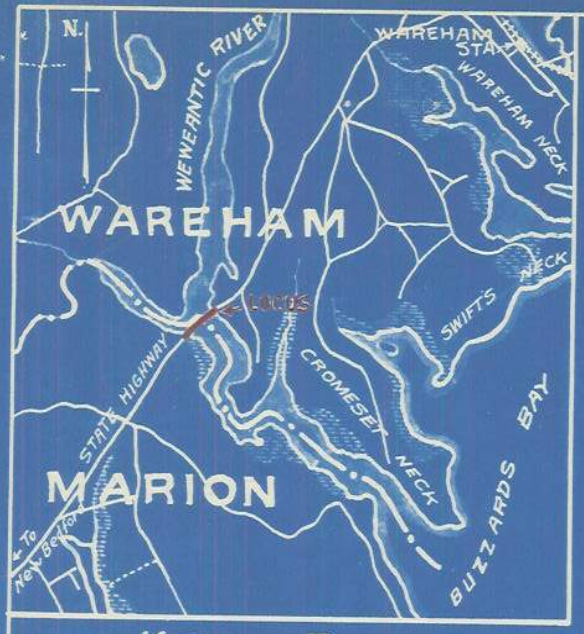
Witness *my hand this* 9th *day of* March , 1929.

(sgd) A B Robbins

The Assistant Secretary of War.

Form No. 92d
W. D., O. C. of E
Ed. 1926—2,000

GOVERNMENT PRINTING OFFICE.



KEY PLAN

SCALE OF MILES 1/2 0 1 — 1/62,500

COPIED FROM U.S.G.S. CHARTS - PLYMOUTH, FALMOUTH, MIDDLEBORO & NEW BEDFORD SHEETS

MAGNETIC MERIDIAN

SILVIA SOULE & EVERET FLANDERS

ARTHUR HAMMOND

M.H.W.

M.L.W.

℄ OF CHANNEL

WEWEANTIC ← FLOW

WAREHAM

RIVER EBB →

MARION

TOWN LINE

MEAN LOW WATER

MEAN HIGH WATER

BASE LINE

2 OF SURVEY N.41°20'-50"E

PROP. 3rd SLOPE

PROP. FOOT SLOPE

NOTE:
FIGURES SHOWN ARE ELEVATIONS AT BED OF STREAM (IN FEET)
MEAN LOW WATER = EL. 97.9

GENERAL PLAN

SCALE IN FEET 100' 50' 0 100'

PROPOSED BRIDGES
OVER WEWEANTIC RIVER IN TOWNS OF
MARION & WAREHAM, MASS.

SCALES AS NOTED
DEC. 1928

APPLICATION BY THE
DEPARTMENT OF PUBLIC WORKS
STATE HOUSE — BOSTON, MASS.

WALTER FARRAR

EAST MARION REALTY TRUST
ELLIOT PIERCE - AGENT
DELANO ROAD - MARION

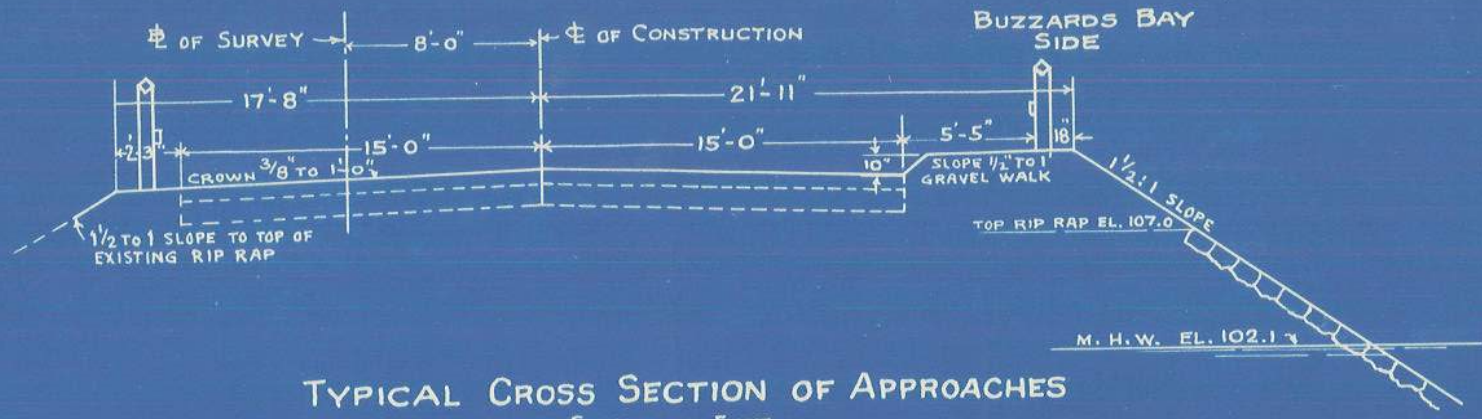
U. S. ENG. OFFICE
PROVIDENCE, R.I.
PERMIT DRAWING
RUBBER 1264 A

G.E. Harkness
BRIDGE ENGINEER

CHIEF HIGHWAY ENGINEER

5 SHEETS SHEET No. 1

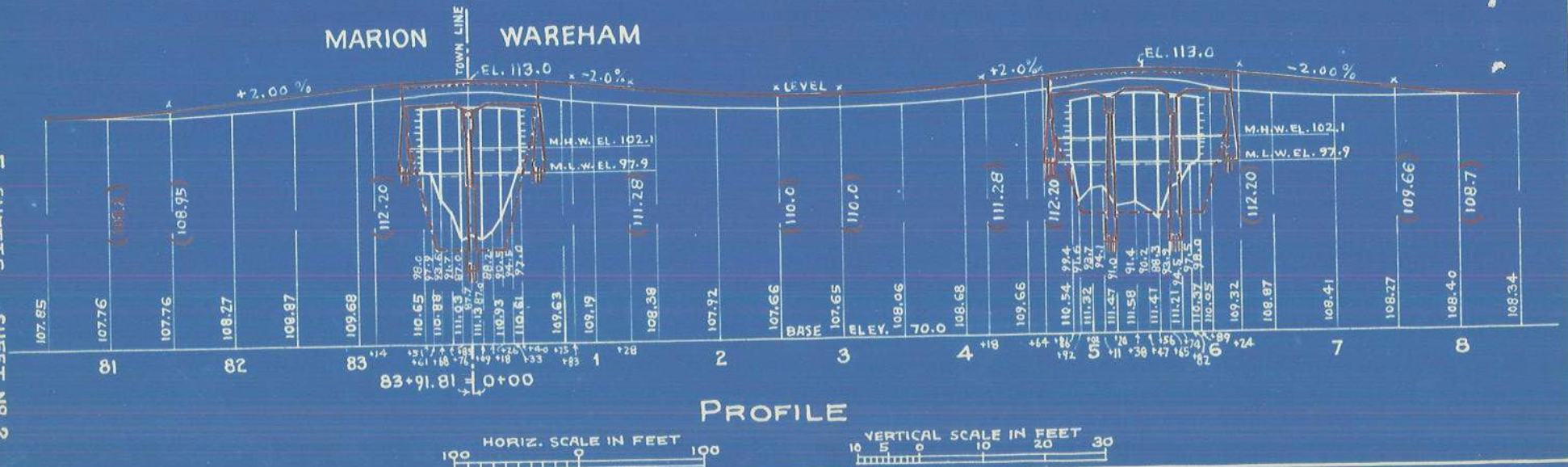
U. S. ENG. OFFICE
PROVIDENCE, R. I.
PERMIT DRAWING
NUMBER 12648



TYPICAL CROSS SECTION OF APPROACHES

SCALE IN FEET

10 5 0 10



PROFILE

HORIZ. SCALE IN FEET

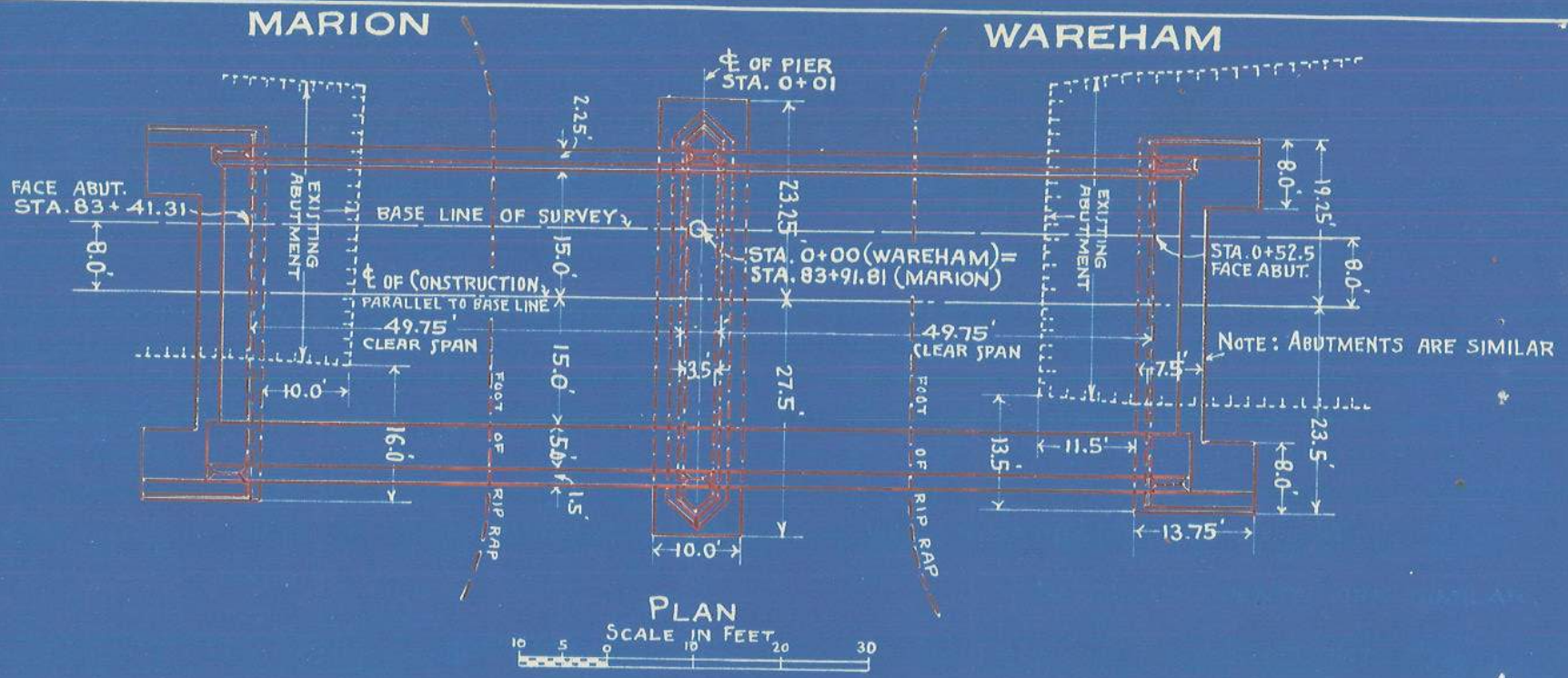
100 0 100

VERTICAL SCALE IN FEET

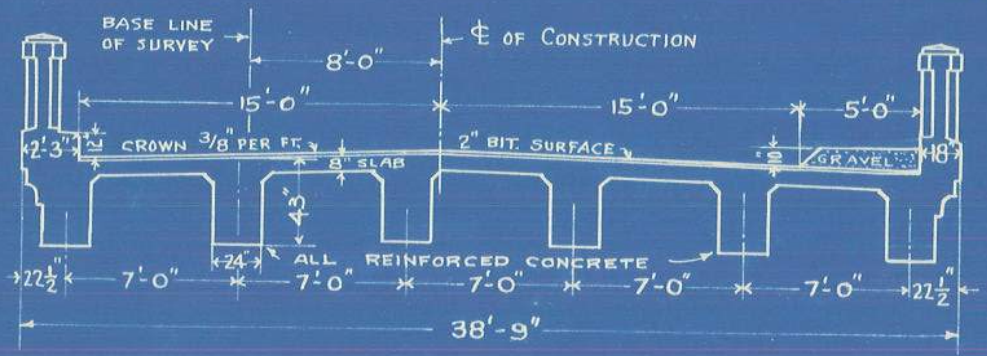
10 5 0 10 20 30

5 SHEETS SHEET No 2

U.S. ENG. OFFICE
PROVIDENCE, R.I.
PERMIT DRAWING
NUMBER 1264 C



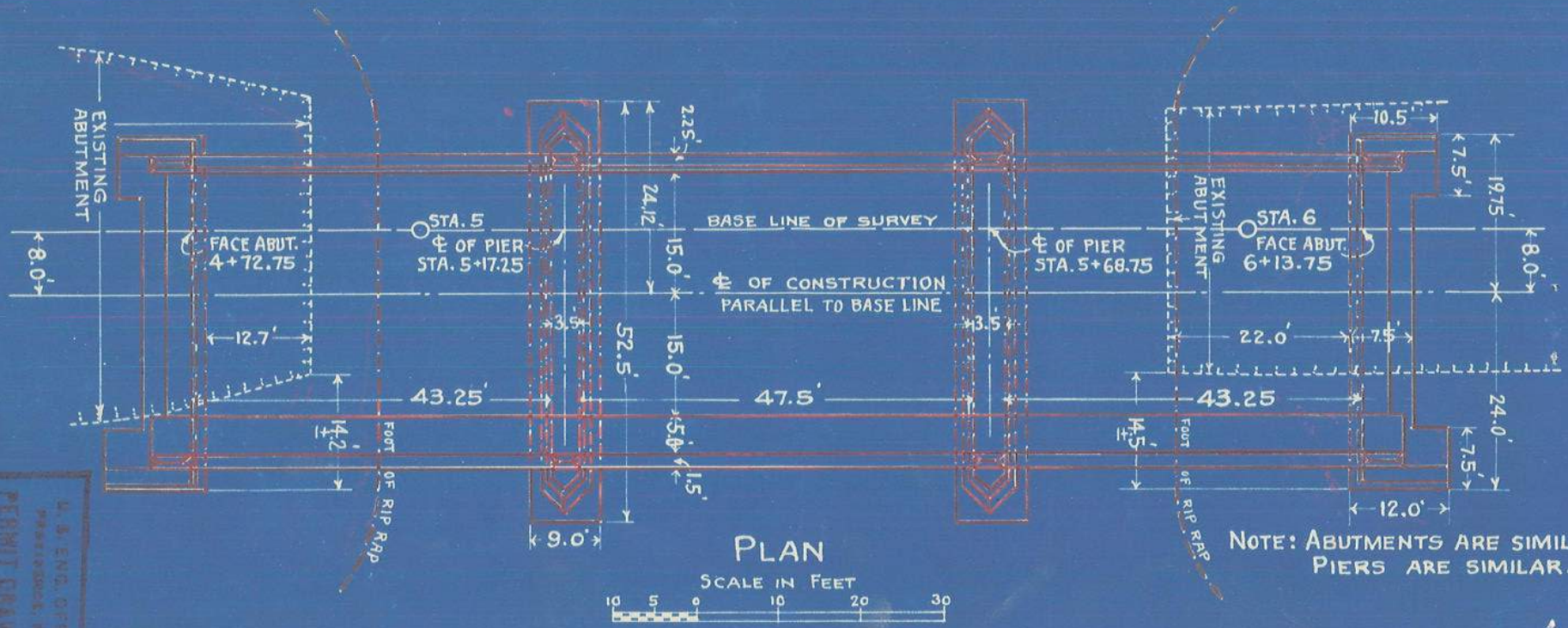
PLAN
SCALE IN FEET
10 5 0 10 20 30



CROSS SECTION OF SUPERSTRUCTURE
SCALE IN FEET
5 0 5 10 15

DETAILS OF BRIDGE AT MARION - WAREHAM TOWN LINE

5 SHEETS SHEET Nº 3

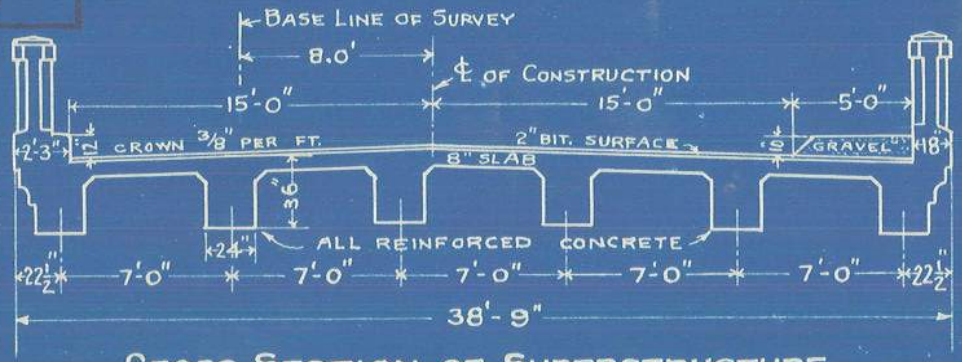


PLAN

SCALE IN FEET

10 5 0 10 20 30

NOTE: ABUTMENTS ARE SIMILAR. PIERS ARE SIMILAR.



CROSS SECTION OF SUPERSTRUCTURE

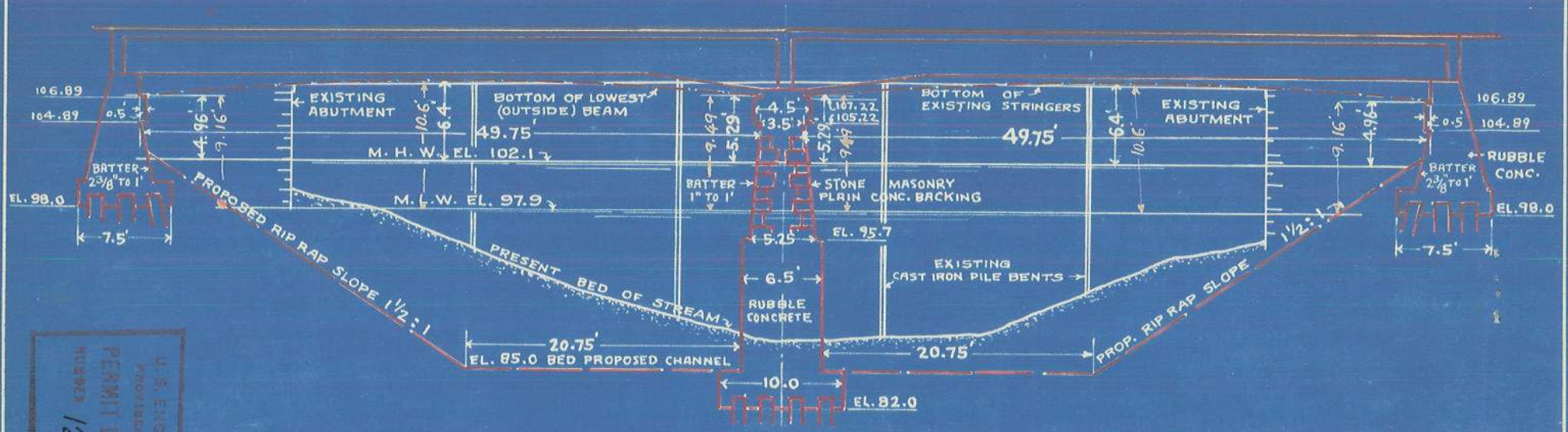
SCALE IN FEET

5 0 5 10 15

DETAILS OF BRIDGE AT STATION 5+ IN WAREHAM

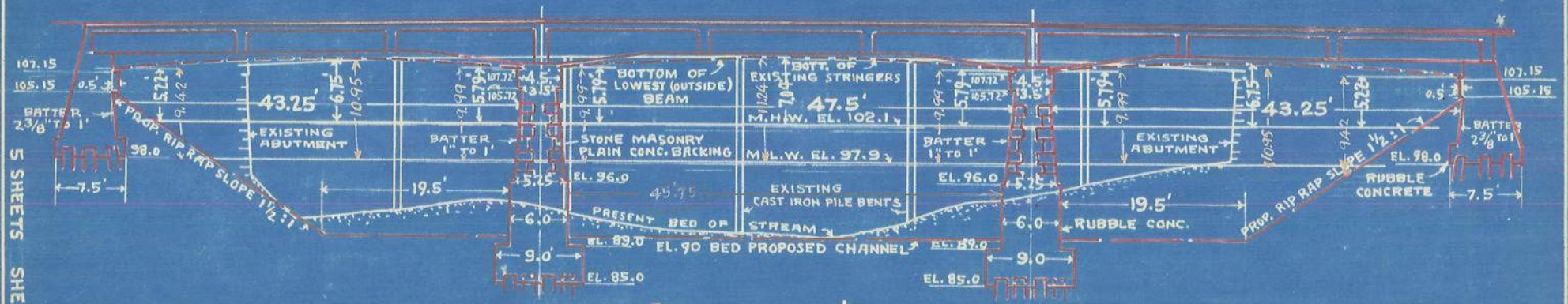
U. S. ENG. OFFICE PROVIDENCE, R. I. PERMIT DRAWING NUMBER 1264 D

5 SHEETS SHEET No. 4



LONGITUDINAL SECTION ON ℄ OF CONSTRUCTION
BRIDGE AT MARION-WAREHAM TOWN LINE
SCALE IN FEET
10 5 0 10 20 30

U. S. ENG. OFFICE
PROVIDENCE, R. I.
PERMIT DRAWING
NUMBER 1264 E



LONGITUDINAL SECTION ON ℄ OF CONSTRUCTION
BRIDGE IN WAREHAM
SCALE IN FEET
10 5 0 10 20 30

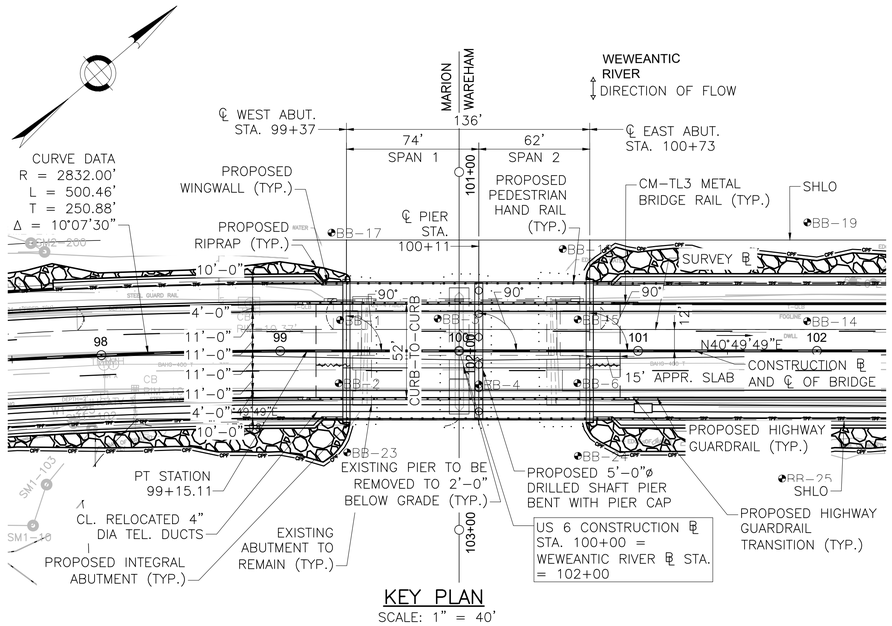
SHEETS SHEET No. 5

Attachment H

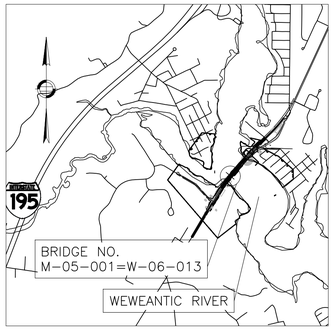
MassDOT Project 605311
Route 6 (Marion and Wareham Roads) over Weweantic River (M-05-001=W-06-013 & W-06-016)
Bridge Replacement Project
USCG Request for Advanced Approval

BRIDGE PLANS

BSC GROUP



KEY PLAN
SCALE: 1" = 40'



LOCUS
SCALE: 1" = 2000'

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS FOR HL-93 LOADING.

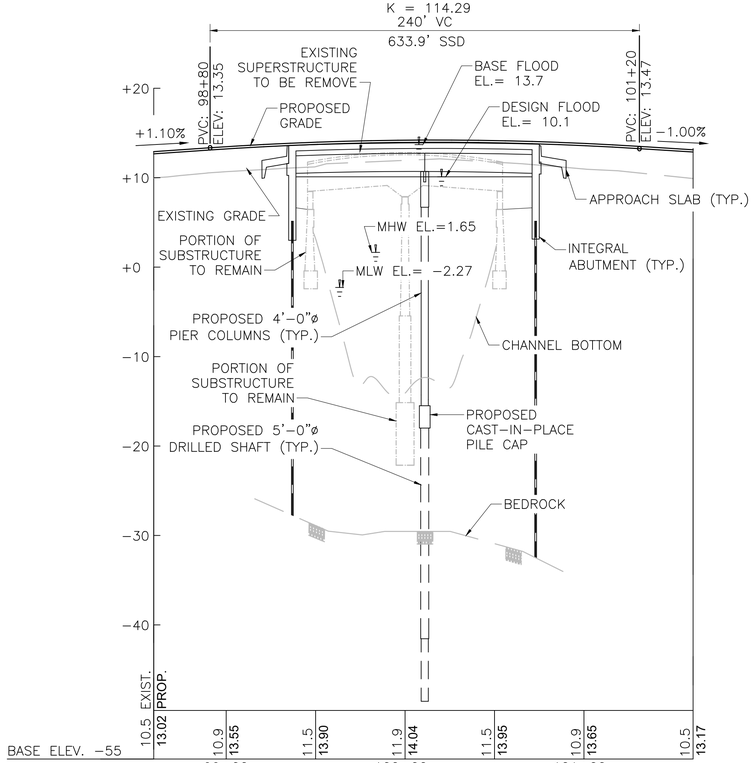
NOTES:

1. APPROVAL DOES NOT INCLUDE STRUCTURAL ANALYSIS.
2. DIMENSIONS OF STRUCTURAL MEMBERS ARE APPROXIMATE, AND WILL BE FINALIZED DURING THE FINAL DESIGN PHASE.
3. SEE GEOTECHNICAL REPORT, DATED DECEMBER 21, 2021 AND CAUSEWAY REPORT DATED DECEMBER 20, 2021.
4. SEE PRELIMINARY HYDRAULIC ANALYSIS, DATED JULY 3, 2019
5. NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.

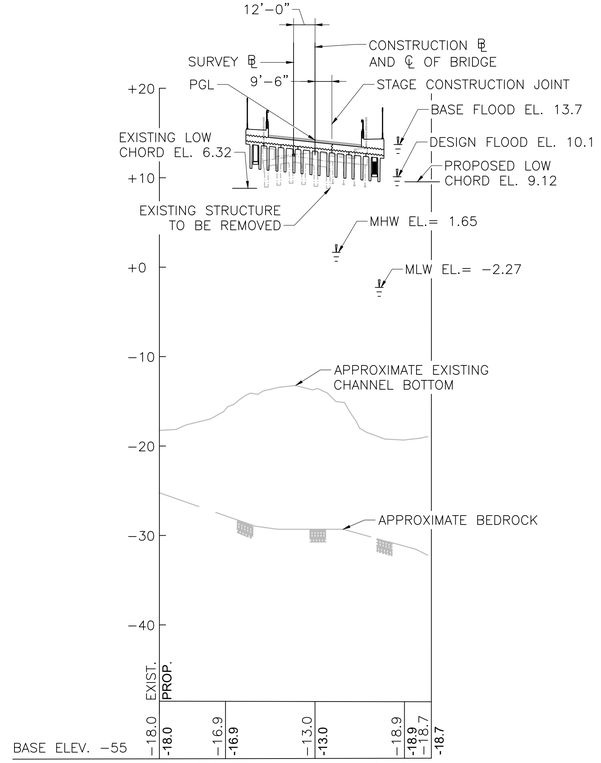
TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2044	N/A
AVERAGE DAILY TRAFFIC – PRESENT	9,559	N/A
AVERAGE DAILY TRAFFIC – DESIGN YEAR	10,302	N/A
DESIGN HOURLY VOLUME	907	N/A
DIRECTIONAL DISTRIBUTION	DIST	N/A
TRUCK PERCENTAGE – AVERAGE DAY	2.3%	N/A
TRUCK PERCENTAGE – PEAK HOUR	2.45%	N/A
DESIGN SPEED	55 MPH	N/A
DIRECTIONAL DESIGN HOURLY VOLUME	439	N/A

SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YEARS
DESIGN SPECTRA	
As	0.138
SDs	0.29
SD1	0.112
SITE CLASS	E
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA		
DRAINAGE AREA:	N/A	SQ. MILES
DESIGN FLOOD DISCHARGE:	N/A	C.F.S.
DESIGN FLOOD FREQUENCY	25	YEARS
DESIGN FLOOD VELOCITY:	N/A	F.P.S.
DESIGN FLOOD ELEVATION:	10.1	FEET, NAVD
BASE (100-YEAR) FLOOD DATA		
BASE FLOOD DISCHARGE:	N/A	C.F.S.
BASE FLOOD ELEVATION:	13.7	FEET, NAVD
DESIGN AND CHECK SCOUR DATA		
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY:	50	YEARS
DESIGN FLOOD ABUTMENT SCOUR DEPTH:	3.3	FEET
DESIGN FLOOD PIER SCOUR DEPTH:	10.0	FEET
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY:	100	YEARS
CHECK FLOOD ABUTMENT SCOUR DEPTH:	7.1	FEET
CHECK FLOOD PIER SCOUR DEPTH:	12.0	FEET
FLOOD OF RECORD		
DISCHARGE:	N/A	C.F.S.
FREQUENCY (IF KNOWN):	N/A	YEARS
MAXIMUM ELEVATION:	N/A	FEET, NAVD
DATE:	N/A	MONTH, YEAR
HISTORY OF ICE FLOES:	N/A	N.A.
EVIDENCE OF SCOUR AND EROSION:	N/A	N.A.



PROFILE ALONG WAREHAM ROAD (US 6)
HORIZONTAL 1" = 40'
VERTICAL 1" = 8'



CHANNEL PROFILE (LOOKING UPSTATION)
HORIZONTAL 1" = 40'
VERTICAL 1" = 8'

PROJECT INFORMATION			
PROJECT FILE NO.: 605311			
PROJECT DESCRIPTION: PROPOSED BRIDGE			
BRIDGE DESIGN LOADING: HL-93			
SURVEY: ELECTRONIC SURVEY BY SURVEY AND MAPPING CONSULTANTS (SMC)			
ELEVATION REFERENCE: NAVD OF 1988			
BENCH MARK:			
BENCHMARK	N 2730951.302	E 862244.338	8.513
BM	N 2731012.918	E 862341.519	9.915
BM	N 2729975.537	E 861297.506	15.758
BM	N 2730619.515	E 861833.717	17.320
POINT 1550	N 2729590.234	E 861126.664	17.719
BENCHMK	N 2730776.727	E 861969.623	11.500

PARSONS
100 HIGH STREET
BOSTON, MA 02110

MassDOT Massachusetts Department of Transportation Highway Division

SKETCH PLANS OF PROPOSED BRIDGE

MARION-WAREHAM

US 6 (WAREHAM ROAD)
OVER WEWEANTIC RIVER

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

APPROVED BY _____ DATE _____

STRUCTURAL ELEMENTS:

TITLE:

HIGHWAY ELEMENTS:

TITLE:

605311_SK01_BRM(M05001-W06013).DWG Plotted on 12-Dec-2023 11:11 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

TEST BORING REPORT

Boring No. BB-1

Project BRIDGE W-06-013 = M-05-001, WAREHAM ST (US 6), MARION & WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 3
Start 29 December 2017
Finish 2 January 2018
Driller C. Bierholm
H&A Rep. D. Palleiko/D. Warren
Elevation 10.8
Datum NAVD 1988
Location Northing: 2730242.0
Easting: 861522.0

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW/NW	S	NX	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4/3	1 3/8	2.0	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	Spin/140	140	-	Casing: PW Spin 20', HW Drive 39', NW Spin 44'
Hammer Fall (in.)	30	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					9.8	-ASPHALT/MACADAM ROADWAY-										
					1.0	-COARSE GRANULAR FILL-										
	6 17 15 16	S1 18	1.5 3.5	SP	9.3 1.5	Dense light brown poorly graded SAND (SP), trace gravel, mps 1.5 in., no structure, no odor, dry	5	5			90					
5	17 20 18 10	S2 10	4.0 6.0	SW		Dense brown well graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, moist	20	25	35	15	5					
10	8 9 4 2	S3 9	9.0 11.0	SP		Medium dense brown poorly graded SAND with gravel (SP), mps 1.5 in., no structure, no odor, wet	5	10	5	10	70					
						-FILL-										
15	11 6 4 11	S4 15	14.0 16.0	SM		Loose tan silty SAND (SM), trace gravel, mps 1.5 in., no structure, no odor, wet	5	5			75	15				
						Note: Drill action indicates dense sand and gravel with cobbles from approximately 17.0-19.0 ft.										
					-8.2											
20	9 5	S5 12	19.0 21.0	OL/ OH	19.0	Stiff brown sandy ORGANIC SILT (OL/OH), mps < 1mm, no structure, organic odor, moist					30	70				

EL. 0.96
OBSERVED JAN. 2, 2018

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
1/2/18	0920	80+	34.0	34.0	9.84

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary

Overburden (ft)	44.0
Rock Cored (ft)	15.0
Samples	9S, 3C

Boring No. BB-1

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-09 REV 1\H&A LIB09-BOS-REV\GLIB H&A-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18

BORING BB–1

TEST BORING REPORT

Boring No. BB-1
File No. 40991-005
Sheet No. 2 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	4 5				-11.7 22.5	-ORGANIC DEPOSITS-										
25	6 9 10 18	S6 14	24.0 26.0	ML	-15.2 26.0	Medium dense light gray-brown SILT (ML), mps < 1mm, no structure, no odor, wet -GLACIOLACUSTRINE DEPOSITS-						100				
30	24 21 32 20	S7 15	29.0 31.0	SM		Very dense gray-brown silty SAND with gravel (SM), mps 1.5 in., moderately well bonded in-situ, wet, with cobbles -GLACIAL TILL- (Ablation Till)	10	10	10	10	45	15				
35	16 14 14 21	S8 16	34.0 36.0	SW- SM		Medium dense mottled orange brown to gray well graded SAND with silt and gravel (SW-SM), mps 1.5 in., no structure, no odor, wet, with cobbles cobbles	10	15	20	15	30	10				
						Note: Cobbles from 38.0-38.6 ft.										
40	82 100/0"	S9 6	39.0 39.5	SW	-28.7 39.5	Very dense orange brown well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, wet TOP OF BEDROCK Note: Split spoon refusal at 39.5 ft. Advance roller bit to 44.0 ft through soft to moderately hard, highly to moderately weathered rock. Start rock core at 44.0 ft. SEE CORE BORING REPORT FOR ROCK DETAILS	10	15	20	20	30	5				
45																

APPROX. BOT. OF PILE TIPS AND TOP OF BEDROCK
EL. –28.7

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-1

H&A-TEST BORING-09 REV 1\H&A LIB09-BOS-REV\GLIB H&A-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 18 Jun 18

BORING BB–1

BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: ◔
2. BORINGS ARE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1 3/8" I.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30".
5. BORING SAMPLES ARE STORED AT A STORAGE FACILITY LOCATED ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.
6. BB–1 TO BB–6 BORINGS WERE MADE IN DECEMBER, 2017 THROUGH MARCH, 2018. BORINGS BB–14 TO BB–25 WERE MADE IN DECEMBER 2020 THROUGH FEBRUARY 2021
7. BORINGS WERE MADE BY NORTHERN DRILL SERVICE, INC.
8. THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.

GROUND WATER:

THE WATER LEVELS RECORDED IN THE TABLE ARE THOSE MEASURED ON THE DATES GIVEN AND DO NOT NECESSARILY REPRESENT GROUND WATER LEVEL AT TIME OF CONSTRUCTION.

605311_SK02-17_BRM(M05001-W06013).DWG Plotted on 12-Dec-2023 11:28 AM

605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

CORE BORING REPORT

Boring No. BB-1
File No. 40991-005
Sheet No. 3 of 3

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery in.	Recovery %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
						High		Note: Set 3.0-in. casing to 42.5 ft. Clean out and advance bit to 44.0 ft to start C1. Drill action indicates moderately to highly weathered rock.
45	5	C1	44.0 49.0	60 42	100 70	Fresh		C1: Very hard, fresh, gray and pink mottled, medium to very coarse-grained GRANITIC GNEISS. Massive. Primary joints low angle, moderately close to very close, rough, planar, discolored with manganese and/or iron staining, occasionally disintegrated, tight. Secondary joints moderately dipping to high angle, close to moderately close, smooth, planar, discolored with manganese and/or iron staining, occasionally disintegrated, tight.
	4							
	4							
	4							
	5							-BEDROCK-
	4	C2	49.0 54.0	60 44	100 73			
50	3					Moder- ate		C2: Medium hard to soft, black/gray and pink mottled, moderately weathered, medium to coarse grained, altered GRANITIC GNEISS. Primary joints low angle, close to very closely spaced, rough, planar to undulating, disintegrated to decomposed, commonly iron stained, tight. Secondary joints moderate to high angle, close to moderately close, rough, planar, decomposed to disintegrated, commonly iron stained, tight, solid core pieces can be broken by hand.
	3							
	3							
	3							
	3	C3	54.0 59.0	60 47	100 78			
55	3					Fresh		C3: Very hard, fresh, gray and pink mottled, medium to very coarse grained GRANITIC GNEISS. Massive. Primary joints low angle, close to moderately close, smooth to rough, planar, discolored with manganese staining, tight. Secondary joints moderate to high angle, close to moderately close, smooth, planar, discolored with manganese, tight.
	5							
	5							
	5						-48.2 59.0	BOTTOM OF EXPLORATION 59.0 FT
60								
65								
70								
75								

H:\HA_CORE+WELL-09\HA-LIB09-BOS-REV\GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18

BORING BB–1

TEST BORING REPORT

Boring No. BB-2

Project BRIDGE W-06-013 = M-05-001, WAREHAM ST (US 6), MARION & WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 2
Start 3 January 2018
Finish 3 January 2018
Driller C. Bierholm
H&A Rep. D. Palleiko
Elevation 10.9
Datum NAVD 1988
Location Northing: 2730218.3
Easting: 861548.2

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW	S	-	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4	1 3/8	-	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	Spin/300	140	-	Casing: PW Spin 29', HW Drive 39'
Hammer Fall (in.)	24	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					10.1 0.8	-BITUMINOUS CONCRETE-										
				GP	9.5 1.0	-COARSE GRAVEL BASE-										
	6 51 22 18	S1 12	1.0 3.0	SP		Very dense gray brown to light brown poorly graded SAND (SP), mps 0.8 in., no structure, no odor, frozen		10		5	80	5				
	7 6 5 4	S2 7	4.0 6.0	SP		Medium dense light gray brown poorly graded SAND (SP), mps 0.8 in., no structure, no odor, moist		10		5	80	5				
5						-FILL-										
	7 6 3 3	S3 5	9.0 11.0	SP		Loose tan poorly graded SAND (SP), mps 0.8 in., no structure, no odor, wet		10	5	5	75	5				
	9 25 20 18	S4 6	14.0 16.0	SP		Dense gray brown poorly graded SAND with gravel (SP), mps 1.0 in., no structure, no odor, wet	5	15	5	5	65	5				
15					-7.6 18.5	Note: Drill action and wash water change at 18.5 ft.										
	7 1	S5 5	19.0 21.0	OL/ OH		Soft dark brown to black ORGANIC SILT (OL/OH), mps 0.05 in., no structure, moderate hydrogen sulfide odor, wet						5	95	N	L	N
20																

EL. 1.58
OBSERVED JAN. 2, 2018

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
1/2/18	1415	0.25	--	13.2	9.32*
		*Water level not stabilized			

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 43.5
Rock Cored (ft) --
Samples 9S
Boring No. BB-2

Field Tests: Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H:\HA-TEST BORING-09 REV HA-LIB09-BOS-REV\GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18

BORING BB–2

605311_SK02-17_BRM05001-W06013).DWG Plotted on 12-Dec-2023 11:11 AM
605311 Sketch Plan Submittal (SP3) 21-DECEMBER-2021

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

TEST BORING REPORT

Boring No. BB-2
File No. 40991-005
Sheet No. 2 of2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	2 2					-ORGANIC DEPOSITS-										
	2 10 12 10	S6 15	24.0 26.0	OL/ OH / ML	-13.6 24.5	S6, 24.0-24.5 ft: Similar to above S6, 24.5-26.0 ft: Medium dense light gray SILT (ML), mps 0.05 in., no structure, no odor, wet						100	R	L	N
25						-GLACIOLACUSTRINE DEPOSITS-										
					-17.1 28.0	Note: Drill action indicates occasional cobbles.										
	24 18 18 20	S7 11	29.0 31.0	SM		Dense gray silty SAND with gravel (SM), mps 0.8 in., no structure, no odor, wet		15	5	10	55	15				
30						-GLACIOFLUVIAL DEPOSITS-										
						Note: Drill action indicates occasional cobbles.										
	26 62 (20/2"	S8 10	34.0 35.1		-23.6 34.5	Very dense gray and red brown mottled silty SAND with gravel (SM), mps 0.8 in., relic bedrock structure, no odor, wet		15	15	25	25	20				
35						-COMPLETELY WEATHERED BEDROCK-										
						Note: 1.2-ft cobble.										
	13 17 21 100/0"	S9 10	39.0 40.5	SM		Dense gray and red brown silty SAND with gravel (SM), mps 0.8 in., relic bedrock structure, no odor, wet		15	15	25	25	20				
40						Note: Advance roller bit to 43.5 ft with consistent drill action and cuttings.										
					-32.6 43.5	BOTTOM OF EXPLORATION 43.5 FT										

APPROX. BOT. OF PILE TIPS AND TOP OF BEDROCK
EL. -28.7

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-2

BORING BB-2

TEST BORING REPORT

Boring No. BB-3

Project BRIDGE W-06-013 = M-05-001, WAREHAM ST (US 6), MARION & WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW/NW	S	--	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	4/3	1 3/8	--	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	Spin/300	140	-	Casing: HW Drive 8', NW Spin 12.5'
Hammer Fall (in.)	24	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

File No. 40991-005
Sheet No. 1 of 2
Start 28 March 2018
Finish 30 March 2018
Driller J. Bierholm
H&A Rep. D. Palleiko
Elevation -17.3
Datum NAVD 1988
Location Northing: 2730283.8
Easting: 861548.2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	14 18 17 17	S1* 14	0.0 2.0	SM		Note: 29.0 ft bridge deck to river bottom. Dense black fading to tan poorly graded silty SAND with gravel (SM), mps 1.2 in., no structure, no odor, wet		15	12	22	28	23				
	19 89 19 17	S2 11	2.0 4.0	SP		Very dense tan to slight brown poorly graded SAND with gravel (SP), mps 1.2 in., no structure, no odor, wet	5	15		20	55	5				
						-FLUVIAL DEPOSITS-										
5	34 18 13 13	S3* 16	4.0 6.0	SM		Dense tan to light brown poorly graded silty SAND with gravel (SM), mps 1.2 in., no structure, no odor, wet	11	16	10	16	21	25				
	22 100/1"	S4 7	6.0 8.0	SP	-23.9 6.6	Very dense light brown poorly graded SAND (SP) with gravel, mps 1.2 in., no structure, no odor, wet	5	15		20	55	5				
						TOP OF WEATHERED BEDROCK										
					-25.3 8.0	Cobble from 6.6-8.0 ft.										
	17 18 65 92	S5* 16	8.0 10.0	SM		Very dense red brown to brown silty SAND with gravel (SM), mps 1.2 in., occasional pocket showing relic bedrock structure, no odor, wet		24	13	19	23	21				
10						-COMPLETELY WEATHERED BEDROCK-										
	100/3"	S6 3	10.0 10.3			Completely weathered bedrock above 10.3 ft. Apparent moderately weathered bedrock below 10.3 ft.	15	15	20	25	20	5				
						Note: Set 3-in. casing to 12.5 ft.										
					-29.8 12.5	SEE CORE BORING REPORT FOR ROCK DETAILS										
15																
20																

APPROX. TOP OF BEDROCK
EL. -28.9

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
3/29/18	0915	18	41.5	53.5	10.25
3/30/18	0915	18	52.0	57.0	8.94
3/30/18	1200	0.25	57.0	67.0	12.4

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary	
Overburden (ft)	12.5
Rock Cored (ft)	25.5
Samples	6S, 6C
Boring No.	BB-3

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Note: ** indicates sample and stratum depths measured relative to the mudline. Water level data depths, however, are measured with respect to the bridge deck. Water level is tidal. Bridge deck is at El. 11.7; river bottom is at -17.3.

BORING BB-3

H&A-TEST BORING.GDT REV H4A-LIB09-BOS-REV GLB H4A-TB+CORE+WELL-.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18
H&A-TEST BORING.GDT REV H4A-LIB09-BOS-REV GLB H4A-TB+CORE+WELL-.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18
605311_SK02-17_BRM(M05001-W06013).DWG Plotted on 12-Dec-2023 11:11 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

CORE BORING REPORT

Boring No. BB-3
File No. 40991-005
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weath-ering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
	7	C1	12.5 15.5	27 6	75 17	Slight	-29.8 12.5	C1 and C2: Very hard, slightly weathered gray and red brown, aphanitic to very coarse grained, rehealed QUARTZ BRECCIA. Massive. Primary joints low angle, close to very close, rough, planar to slightly undulating, discolored with iron staining, tight. Secondary joints high angle, close to very close, rough, planar to undulating, discolored with iron staining, tight. Breccia clasts prone to break free of quartz matrix causing frequent core jams, frequent vugs and pits up to 3/4" across, with iron staining, total water loss while coring.
	NR							
15	NR							
	4	C2	15.5 19.5	47 30	98 63	Slight		-BEDROCK- (FAULT ZONE BRECCIA)
	5							
	4							
	4							
	Jam	C3	19.5 24.5	41 17	68 28	Slight		C3: Very hard to hard, gray to red brown, slightly weathered, aphanitic to very coarse grained QUARTZ BRECCIA. Massive. Primary joints low angle, very close, rough, undulating, discolored with iron staining, tight. Secondary joints high angle, close to very close, rough, undulating, discolored with iron staining, tight.
20	2							
	2							
	2							
	3							
	3	C4	24.5 28.0	27 10	64 24	Slight to Moder-ate		C4: Very hard to hard, gray, slightly weathered, aphanitic to very coarse grained QUARTZ BRECCIA. Massive. Primary joints low angle, very close to closely spaced, rough, undulating, discolored with iron staining and limonite coating, open to tight. Secondary joints high angle, close to very closely spaced, rough, undulating, iron stained and limonite coated, open to closed. Interconnected vugs and pits create a void space of about 15% in rock core.
25	NR							
	NR							Note: Hole collapsed between core runs. Advanced 3-in. casing to 28.0 ft to resume coring. Total water loss while advancing casing. Advanced roller bit to 28.0 ft to clear out debris from coring advancement.
	NR							
	4	C5	28.0 33.0	53 26	88 43	Slight to Moder-ate		C5: Moderately hard, gray, slightly weathered, aphanitic to fine grained, hydrothermally altered GRANITIC GNEISS/BRECCIA. Primary joints low angle, extremely close to closely spaced, rough, planar to undulating, discolored with iron staining, commonly quartz healed. Secondary joints high angle, closely spaced, rough, undulating, discolored with iron staining and limonite coating, tight to open, highly weathered pockets, quartz veins reduced quantity of recovery.
	4							
30	Jam							
	3							
	4							
	4	C6	33.0 38.0	60 51	100 85	Slight		C6: Moderately hard to hard, mottled gray green and maroon, slightly weathered, aphanitic to very coarse grained, rehealed BRECCIA. Massive. Primary joints low angle very close to moderately close, rough, planar, discolored to disintegrated, iron stained tight. Secondary joints high angle, close, rough, undulating, discolored with iron staining, occasionally limonite coated, tight.
	4							
35	4							
	4							
	4							
	4						-55.3 38.0	BOTTOM OF EXPLORATION 38.0 FT
40								
45								

APPROX. BOT. OF DRILLED SHAFT AND TOP OF ROCK SOCKET
EL. −40.9

APPROX. BOT. OF ROCK SOCKET
EL. −47.9

BORING BB−3

TEST BORING REPORT

Boring No. BB-4

Project BRIDGE W-06-013 = M-05-001, WAREHAM ST (US 6), MARION & WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 2
Start 12 March 2018
Finish 15 March 2018
Driller C. Bierholm
H&A Rep. D. Palleiko
Elevation -18.0
Datum NAVD 1988
Location Northing: 2730277.1
Easting: 861599.9

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW/NW	S	--	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4/3	1 3/8	--	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	300	140	-	Casing: PW Spin 0.8', HW Drive 12.7', NW Spin 15'
Hammer Fall (in.)	24	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	1/12 1 1	S1* 4	0.0 2.0	SW-SM		Note: 29.8 ft bridge deck to river bottom. Very loose black well graded SAND with silt and gravel (SW-SM), mps 1.2 in., no structure, no odor, wet -FLUVIAL DEPOSITS-	5	28	23	32	8	4		2		
	2 12 12 58	S2 12	2.0 4.0	SW	-21.0 3.0	S2: Medium dense black fading to tan well graded SAND with gravel (SW) mps 1.2 in., no structure, no odor, wet	10	15	15	30	20	10				
	26 28 34 25	S3* 14	4.0 6.0	SW		Very dense yellow brown well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, wet -COMPLETELY WEATHERED BEDROCK-	17	22	10	15	20	16				
5	22 20 24 23	S4 14	6.0 8.0	SW		Dense yellow brown well graded SAND with gravel (SW), mps 1.2 in., no odor, wet, granular structure resembles weathered bedrock (grus).	10	15	15	30	20	10				
	33 61 34 26	S5 8	8.0 10.0	SW		Very dense yellow brown well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, wet	10	15	15	30	20	10				
10	28 25 18 100/2	S6* 15	10.0 11.7	SM		Dense yellow brown silty SAND with gravel (SM), mps 1.2 in., no structure, no odor, wet	5	26	11	18	19	21				
					-30.7 12.7	Note: Casing Refusal at 12.7 ft. Drill action indicates top of harder bedrock. Spin casing to 15.0 ft to begin core. -BEDROCK-										
15						SEE CORE BORING REPORT FOR ROCK DETAILS										
20																

APPROX. TOP OF BEDROCK
EL. −28.9

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 15.0 Rock Cored (ft) 14.5 Samples 6S, 3C **Boring No. BB-4**
3/15/18	0945	44	40.5	40.5	21.75*			
3/15/18	1400	0.25	45.0	50.0	13.10			

Field Tests: Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

*Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Note: ** indicates sample and stratum depths measured relative to the mudline. Water level data depths, however, are measured with respect to the bridge deck. Water level is tidal. Bridge deck is at El. 11.8; river bottom is at El. -18.0.

BORING BB−4

H:\HA_CORE+WELL-09\HA-LIB09-BOS-REV\GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18
H:\HA-TEST BORING-09 REV HA-LIB09-BOS-REV\GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18
605311_SK02-17_BRM(M05001-W06013).DWG Plotted on 12-Dec-2023 11:11 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

CORE BORING REPORT

Boring No. BB-4
File No. 40991-005
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
15	4	C1	15.0	59	98	Slight		C1: Hard to moderately hard, slightly weathered, pink white and gray, medium to very coarse grained GRANITIC GNEISS. Massive. Primary joints low angle, close to moderately spaced, rough, planar, discolored with iron staining and disintegrated, tight to open, frequent quartz veins intact along primary joints with vugs and "cocks comb" structure evident up to 3 in. thick, fine grained terminated quartz crystals common in vugs up to 1/2 in. deep. Quartz veins intrude zones of brecciated bedrock. Total water loss while coring.
	3		20.0	45	75			
	3							
	3							
20	2	C2	20.0	54	100	Slight		C2: Similar to above, except quartz veins up to 9 in. thick. Quartz veins intrude zones of brecciated bedrock.
	2		24.5	47	87			
	4							-BEDROCK-
	11							
	10							
25	4	C3	24.5	60	100	Slight		C3: Hard to soft, slightly to completely weathered, pink white and gray, moderate to very coarse grained GRANITIC GNEISS. Massive. Primary joint low angle, close to moderately spaced, rough, planar, discolored to decomposed, tight to open, frequent quartz veins intrude along primary joints up to 7 in. thick, fine grained terminated quartz crystals common in vugs up to 1/2 in. deep, "cocks comb" structure. Quartz veins intrude zones of brecciated bedrock. Total water loss while coring. From 26.7 to 27.5 ft: Zone of highly fractured "grus-like" decomposed GNEISS.
	4		29.5	36	60			
	4					Comp-lete		
	2							
	3					Slight		
	NR						-47.5 29.5	
30								BOTTOM OF EXPLORATION 29.5 FT
								Note: Hole collapsed to 20.0 ft upon removal of core barrel.
35								
40								
45								
50								

APPROX. BOT. OF DRILLED SHAFT AND TOP OF ROCK SOCKET
EL. −40.9

APPROX. BOT. OF ROCK SOCKET
EL. −47.9

H:\A_CORE+WELL-09 HA-LIB09-BOS-REV GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18

BORING BB−4

TEST BORING REPORT

Boring No. BB-5

Project BRIDGE W-06-013 = M-05-001, WAREHAM ST (US 6), MARION & WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 1
Start 26 December 2017
Finish 26 December 2018
Driller T. Tucker
H&A Rep. D. Warren
Elevation 11.0
Datum NAVD 1988
Location Northing: 2730342.7
Easting: 861608.6

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW	S	-	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4	1 3/8	-	Bit Type: Roller Bit Drill Mud:
Hammer Weight (lb)	Spin	140	-	Casing: PW Drive 10', HW Drive 13'
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					10.5	-ASPHALT ROADWAY-										
					0.5	-TAR/GRAVEL MACADAM ROADBASE-										
	26 30 16 12	S1 20	1.0 3.0	SM SP-SM	10.3 0.8 9.8 1.2	Very dense dark brown silty SAND with gravel (SM), mps 1.5 in., no structure, no odor, dry Dense tan poorly graded SAND with silt (SP-SM), mps < 1mm, no structure, no odor, dry	5	10	10	20	40	15				
	12 16 17 10	S2 12	3.0 5.0	SP-SM		Similar to above. Spoon bent on edge of boulder. Drilled through boulder from approximately 3.5-5.0 ft. - FILL - Note: Drilled through edge of boulder from 7.0-9.0 ft.					90	10				
5																
	12 29 10 10	S3 5	8.0 10.0	SW		Dense gray well graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet, with cobbles Note: Casing bent when advanced through numerous boulders in Fill from approximately 3.5-9.0 ft. Cored approximately 12.0 inches of steel infused slag from 12.0-13.0 ft. Casing broke. Abandoned location after retrieving broken pipe. Multiple boulders >/= 2.0 ft noted in open borehole after pulling casing.	15	25	30	20	10					
10					-2.0 13.0	BOTTOM OF EXPLORATION 13.0 FT Note: Moved rig 4.5 ft northeast and advanced boring of record. See log BB-5A.										

EL. 1.80
OBSERVED DEC. 15, 2017

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 13.0 Rock Cored (ft) -- Samples 3S **Boring No. BB-5**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-09 REV HA-LIB09-BOS-REV GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18

BORING BB−5

605311_SK02-17_BRM(M05001-W06013).DWG Plotted on 12-Dec-2023 11:12 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

TEST BORING REPORT

Boring No. BB-5A

Project BRIDGE W-06-013 = M-05-001, WAREHAM ST (US 6), MARION & WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 3
Start 27 December 2017
Finish 28 December 2017
Driller T. Tucker
H&A Rep. D. Warren
Elevation 11.0
Datum NAVD 1988
Location Northing: 2730342.7
Easting: 861068.6

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW/NW	S	NX	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4/3	1 3/8	2.0	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	Spin/140	140	-	Casing: PW Spin 20', HW Drive 44', NW Spin 48.5'
Hammer Fall (in.)	30	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					10.2	-ROADWAY-										
					0.8	Boring located 4.5 ft northeast of trial refusal hole BB-5. See log BB-5 for overburden details. 0.0-13.0 Drill action indicates coarse granular fill with cobbles. Note: Advanced borehole without sample to depth of exploration in companion hole BB-5.											
5																
10	7 5 3 2	S1 4	13.0 15.0	SW		Loose gray well graded SAND with gravel (SW), mps 1.5 in., no structure, no odor, wet -FILL- Note: Drilled through WOOD from approximately 15.5-16.5 ft. Coarse granular Fill noted below wood from approximately 16.5-17.5 ft.	15	20	40	20	5					
15	10 3 5 2	S2 9	18.0 20.0	SM	-7.0 18.0	Loose brown (organic) silty SAND (SM), mps < 1mm, no structure, organic odor, wet -ORGANIC DEPOSITS-					85	15				
20																

EL. 1.20
OBSERVED DEC. 28, 2017

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
12/28/17	0930	*Trapped	44.0	44.6	9.8*

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe; Screen; Filter Sand; Cuttings; Grout; Concrete; Bentonite Seal

Summary

Overburden (ft)	48.5
Rock Cored (ft)	5.0
Samples	7S, 1C
Boring No.	**BB-5A**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB-5A

TEST BORING REPORT

Boring No. BB-5A
File No. 40991-005
Sheet No. 2 of3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20					-11.0 22.0	-ORGANIC DEPOSITS-										
25	4 8 10 11	S3	24.0 26.0	SP		Medium dense light gray to brown poorly graded SAND (SP), mps 0.25 in., no structure, no odor, wet -MARINE/GLACOFLUVIAL DEPOSITS-			5	20	75					
30	21 20 19 18	S4 8	29.0 31.0	SW	-17.0 28.0	Dense brown well graded SAND (SW), trace gravel, mps 1.0 in., no structure, no odor, wet	5	5	20	40	30					
35	19 28 18 13	S5 9	34.0 36.0	SP		Dense brown poorly graded SAND with gravel (SP), mps 1.5 in., no structure, no odor, wet -GLACIOFLUVIAL DEPOSITS-	5	10	5	5	75					
40	21 15 13 13	S6 8	39.0 41.0	GW	-32.5 43.5	Dense brown well graded GRAVEL with sand (GW), mps 1.5 in., no structure, no odor, wet TOP OF BEDROCK 43.5 FT	25	30	20	10	15					
45	47 60/1"	S7 7	44.0 44.6	SW-SM		Very dense light gray well graded SAND with silt and gravel (SW-SM), mps 0.5 in., distinct granitic bedrock structure, wet. Sample consists of severely weathered, decomposed GRANITE -WEATHERED BEDROCK / GRUS- Advanced borehole with button bit to 48.0 ft. Drill action and cuttings observed indicate weathered GRANITE to approximately 47.0 ft, harder bedrock at approximately 47.0 ft.										
	50/0"	NR	48.0 48.0		-37.5 48.5	Attempted spoon sample of weathered rock at 48.0 ft. Spoon refusal, no recovery. Spun NW casing to 48.5 ft.										

APPROX. BOT. OF PILE TIPS AND TOP OF BEDROCK EL. -33.4

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-5A

BORING BB-5A

H&A-TEST BORING.GDT REV 11Apr18 BOS-REV GLB HA-TB+CORE+WELL-GW W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18
605311_SK02-17_BRM05001-W06013).DWG Plotted on 12-Dec-2023 11:12 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

CORE BORING REPORT

Boring No. BB-5A
File No. 40991-005
Sheet No. 3 of 3

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
50	3	C1	48.5 53.5	58 40	97 67	Slight to Moderate	-37.5 48.5	C1: Hard, slightly to moderately weathered, pink-gray to brown, coarse to fine-grained GRANITE. Weak foliation dipping at high angles. Joints horizontal to dipping at high angles, occasionally vertical. Joints very close to moderately close, rough, planar, discolored and oxidized to decomposed, tight to open, with frequent silt infillings.
	3							
	3							
	3							
	3							-BEDROCK-
							-42.5 53.5	BOTTOM OF EXPLORATION 53.5 FT
55								
60								
65								
70								
75								
80								

H:\A_CORE+WELL-09 HA-LIB09-BOS-REV GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18

BORING BB–5A

TEST BORING REPORT

Boring No. BB-6

Project BRIDGE W-06-013 = M-05-001, WAREHAM ST (US 6), MARION & WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 3
Start 18 December 2017
Finish 19 December 2017
Driller C. Bierholm
H&A Rep. D. Palleiko
Elevation 10.9
Datum NAVD 1988
Location Northing: 2730319.3
Easting: 861635.4

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW/NW	S	NX	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4/3	1 3/8	2.0	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	Spin	140	-	Casing: PW Spin 39', HW Spin 44', NW Spin 47'
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					10.1 0.8	-BITUMINOUS CONCRETE PAVING-										
	21 75/3"	S1 8	1.0 1.8	SP		Very dense light brown poorly graded SAND (SP), mps 0.8 in., no structure Note: Concrete encountered at 1.6 ft, moved 2 ft east. Rebar noted by drill action.		10		35	50	5				
5	3 4 3 3	S2 5	4.0 6.0	SW		Loose light brown well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, wet -FILL-	10	10	20	25	35					
10	5 7 6 4	S3 6	9.0 11.0	SW		Medium dense light brown well graded SAND (SW), mps 0.8 in., no structure, no odor, wet Note: Cobbles from 11.0 to 14.0 ft.	10	10	35	30	15					
15	17 29 23 23	S4 8	14.0 16.0	SW		Very dense light brown well graded SAND (SW), mps 1.0 in., structure, no odor, wet	10	10	35	30	15					
20	13 17	S5 12	19.0 21.0	SP		Medium dense light brown poorly graded SAND with gravel (SP), mps 0.8 in., no structure, no odor, wet	10	20	45	15	10					

EL. 1.19
OBSERVED DEC. 19, 2017

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
12/19/17	0900	18	40.5	40.0	9.71

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 47.0
Rock Cored (ft) 10.0
Samples 9S, 2C

Boring No. BB-6

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-05-09 REV HA-LIB09-BOS-REV GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18

BORING BB–6

605311_SK02-17_BRM05001-W06013).DWG Plotted on 12-Dec-2023 11:12 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

Boring No. BB-6
File No. 40991-005
Sheet No. 2 of3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	13 7					-FILL-										
						Note: Cobble/Boulder encountered from 22.5 to 23.8 ft.										
	9 11 8 6	S6 10	24.0 26.0	SP	-12.9 23.8	Medium dense light gray with black bands poorly graded SAND (SP), mps 0.05 in., frequent interbeds of organic silty SAND up to 0.5 in. thick -ORGANIC / ESTUARINE DEPOSITS- Note: Wash water color change at 26.0 ft, very weak hydrogen sulfide odor				5	90	5				
25					-15.1 26.0	-ORGANIC DEPOSITS-										
	1 1 1 1	S7* 12	29.0 31.0	OL/ OH		Very soft brown ORGANIC SILT with sand (OL/OH), mps 0.01 in., increasing fine sand with depth, no odor, wet, organic content = 3.1%				1	2	20	77	S	L	N
30					-22.6 33.5	Note: Drill action change at 33.5 ft.										
	37 26 19 18	S8 1	34.0 36.0	SW		Dense light brown well graded SAND (SW), mps 0.5 in., no structure, no odor, wet			5	20	30	40	5			
35						-GLACIOFLUVIAL DEPOSITS-										
	25 18 17 11	S9 6	39.0 41.0	GP		Dense light brown poorly graded GRAVEL with sand (GP), mps 0.8 in., no structure, no odor, wet	70	15	10	5						
40						Note: Drill action change at 44.3 ft. TOP OF BEDROCK SEE CORE BORING REPORT FOR ROCK DETAILS										
	130/4"	NR 0	44.0 44.3		-33.4 44.3	Note: * indicates sample gradation and organic content based on geotechnical laboratory index testing.										
45																

APPROX. BOT. OF PILE TIPS AND TOP OF BEDROCK EL. −33.4

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-6

H&A-TEST BORING-09 REV H&A-1809-BOS-REV GLB HA-TB+CORE-WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18

BORING BB−6

CORE BORING REPORT

Boring No. BB-6
File No. 40991-005
Sheet No. 3 of 3

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weath-ering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
						Fresh	-33.4 44.3	TOP OF BEDROCK 44.3 FT
45	5	C1	47.0 52.0	60 53	100 88	Fresh		C1: Very hard, fresh, pink and gray, medium to very coarse grained GRANITIC GNEISS. Primary joints low angle, closely to moderately spaced, rough, planar to slightly undulating, iron stained to disintegrated/decomposed, tight. Secondary joints moderate angle, moderately spaced, smooth, planar, fresh, tight to quartz healed, occasionally epidote coated and vuggy.
	5							
	6							-BEDROCK-
50	6							
	5							
	6	C2	52.0 57.0	56 38	93 63	Fresh		C2: Very hard to moderately hard, fresh to slightly weathered, pink and gray, medium to very coarse grained GRANITIC GNEISS. Primary joints low angle, close to moderately spaced, rough, planar, discolored to disintegrated, tight, commonly quartz lined occasionally healed, iron stained halos extending 1.0 to 2.0 in. into adjacent rock mass. Secondary joints high angle to vertical, moderately spaced, smooth, planar, discolored with iron staining to disintegrated, commonly quartz lined with micaceous appearing sheets of quartz.
	6							
	3					Slight		
55	3							
	6					Fresh		
							-46.1 57.0	BOTTOM OF EXPLORATION 57.0 FT
60								
65								
70								
75								

H+A_CORE-WELL-09 H&A-1809-BOS-REV GLB HA-TB+CORE-WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB.GPJ 13 Jun 18

BORING BB−6

Plotted on 12-Dec-2023 11:12 AM
605311_SK02-17_BRM(M05001-W06013).DWG

605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

TEST BORING REPORT

Boring No. BB-14

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 2
Start 1 February 2021
Finish 3 February 2021
Driller P. Schofield
H&A Rep. D. Warren
Elevation 10.0
Datum NAVD88
Location Northing: 2730446.3
Easting: 861698.5

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: B48 Mobile Drill
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to
				Hoist/Hammer: Winch / Automatic hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					9.5	-ASPHALT ROADWAY-										
	20	S1	1.0	SP-SM	0.5	Very dense light brown poorly graded SAND with silt and gravel (SP-SM), mps 0.75 in., no odor		15	5	5	65	10				
	60/1"	6	1.6	SP-SM	8.5											
					1.5	- FILL -		5	5		80	10				
					8.2											
					1.8	- MACADAM ROADWAY -										
5	15	S2	4.0			Medium dense light brown to orange poorly graded SAND with silt (SP-SM), mps 1.0 in., no odor, moist										
	17	15	6.0													
	13															
	11				2.5	- FILL -										
				SM	7.5	Very loose brown silty SAND with gravel (SM), mps 1.0 in., no odor, wet		5	10	15	10	45	15			
10	4	S3	9.0			- FILL -										
	2	6	11.0													
	1															
	1				-2.5											
				SW-SM	12.5	Medium dense brown well graded SAND with silt and gravel (SW-SM), mps 1.0 in., no odor, wet		10	15	15	15	35	10			
						- FILL -										
15	14	S4	14.0													
	10	5	16.0													
	6				-6.5											
	12			OL/OH	16.5	Soft dark brown ORGANIC SILT (OL/OH), mps 0.01 in., organic odor, wet		5			30	65				
	2	S5**	17.0													
	2	6	19.0			Atterberg Limits test results: Sample is non-plastic.										
	1				-9.0											
	2	S6	19.0	SM	19.0	- ORGANIC ESTUARINE DEPOSITS -					80	20				
20	5	10	21.0			NOTE: Tube refusal at 19 ft.										
	4					Loose brown silty SAND (SM), mps 0.1 in., organic odor, wet, (Organic) silty SAND										
	2				-12.5											
	3				22.5	- ESTUARINE DEPOSITS -										
	7	S7	24.0	SP		Medium dense gray poorly graded SAND (SP), mps 0.25 in., wet			5	50	40	5				
25	8	16	26.0			- MARINE DEPOSITS -										
	9															
	10				-17.0											
					27.0											
	4	S8	29.0	ML		Very stiff gray to brown SILT (ML), mps 0.01 in., laminae, no odor, wet,						100				
30																

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
02/03/21	13:53 at completion	0.5	44.0	46.0 not stabilized	8.5

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe; Screen; Filter Sand; Cuttings; Grout; Concrete; Bentonite Seal

Summary	
Overburden (ft)	46
Rock Cored (ft)	
Samples	S11
Boring No.	**BB-14**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-09 REV H4-L809-BOS - COPY2 GLB HA-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21

BORING BB–14

TEST BORING REPORT

Boring No. BB-14
File No. 40991-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
30	9	17	31.0			laminated										
	12															
	10					- GLACIOLACUSTRINE DEPOSITS -										
					-22.5											
					32.5	NOTE: Drill action suggests coarse grained deposits at 32.5 ft.										
35	16	S9	34.0	SM		Medium dense light brown silty SAND (SM), mps 0.5 in., no odor, wet, ablation till		5	5	10	65	15				
	11	15	36.0													
	10					- GLACIAL TILL -										
	12															
40	14	S10	39.0	SM		Loose light brown silty SAND (SM), mps 0.5 in., no odor, wet, ablation till		5	5	10	65	15				
	5	12	41.0													
	5															
	6															
45	14	S11	44.0	SM		Medium dense brown silty SAND with gravel (SM), mps 1.0 in., no odor	5	10	5	10	55	15				
	13	8	45.6													
	11				-35.5											
	00/1"				45.5	TOP OF PROBABLE BEDROCK										
					-36.0	Roller bit refusal at 46.0 ft. Drill action suggests hard fresh ROCK										
					46.0											
						- PROBABLE BEDROCK -										
						BOTTOM OF EXPLORATION 46.0 FT										

PROBABLE TOP OF BEDROCK
EL. −35.5

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-14

H&A-TEST BORING-09 REV H4-L809-BOS - COPY2 GLB HA-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21

BORING BB–14

Plotted on 12-Dec-2023 11:12 AM
605311_SK02-17_BRM05001-W06013).DWG
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

TEST BORING REPORT

Boring No. BB-16

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 2
Start 26 January 2021
Finish 27 January 2021
Driller P. Schofield
H&A Rep. D. Warren
Elevation 10.0
Datum NAVD88
Location Northing: 2730410.1
Easting: 861714.6

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: B48 Mobile Drill
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 44.0 ft.
				Hoist/Hammer: Winch / Automatic hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					9.5	-ASPHALT-										
					9.0	2 in. gravel below asphalt										
	14 17 17 20	S1 13	1.0 3.0	SW		Dense well-graded brown SAND with gravel (SW)		15	20	40	20	5				
5	12 8 9 80/3"	S2 5	4.0 6.0	SM		Medium dense brown silty SAND (SM)		10	30	30	15	15				
						Note: Obstruction at 5.8 ft. depth.										
10	16 12 4 4	S3 3	9.0 11.0	SW-SM		Medium dense brown well graded SAND with silt (SW-SM)	5	5	30	30	20	10				
						-FILL-										
15	120/5"	S4 4	14.0 14.4	SW		Very dense brown well graded SAND with gravel (SW)	20	10	30	20	15	5				
					-6.3 16.3	Top 3 in. S5: Same as above					2	71	27			
	2 2 2 2	S5** 24	16.0 18.0	SM		Bottom 21 in. S5: Very loose dark gray silty SAND, strong organic odor, occasional fibers, non-plastic, 3.2% organics, gradation test run					2	73	25			
	P U S H	U1** 24	18.0 20.0	SM		**See lab test data on undisturbed tube samples Top U1: Silty SAND (SM)										
20					-10.0 21.5	Bottom U1: Organic SOIL (OL/OH)										
	P U S H	U2** 21.8	20.0 22.0	OL/ OH	-11.5 21.5	TOP U2: Organic SOIL (OL/OH). **See lab test data on undisturbed tube samples Bottom U2: Brown SAND (SP)										
						-ORGANIC ESTUARINE DEPOSITS-										
25	2 7 6 4	S6 14	24.0 26.0	SP PT	-17.0 27.0	Bottom 6 in. of push had more resistance Top 5 in. (Jar S6A): Medium dense dark gray SAND (SP) interbedded with organic SILT and pockets of PEAT (PT) and wood fragments Bottom 9 in. (Jar S6B): Medium dense gray SAND (SP)			2	5	5	73	15			
						-ESTUARINE DEPOSITS-										
30	11	S7	29.0	SM		Medium dense gray silty SAND (SM), mps 0.1 in., no odor, wet						75	25			

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
01/27/21	14:10	0.25 not stabilized,	0.0 hole coll	14.0 apsed	12.0

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary
Overburden (ft) 44.1
Rock Cored (ft)
Samples S10
Boring No. BB-16

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB–16

TEST BORING REPORT

Boring No. BB-16
File No. 40991-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
30	12 9 14	16	31.0	ML	-20.0 30.0	- MARINE DEPOSITS - Very stiff brown SILT with sand (ML), mps 0.1 in., laminae, no odor, wet, laminated						15	85			
35	5 7 15 14	S8 18	34.0 36.0	ML		Very stiff light brown to tan SILT (ML), mps 0.01 in., laminae, no odor, wet, laminated							100			
					-27.0 37.0	-GLACIOLACUSTRINE DEPOSITS-										
40	11 14 7 7	S9 6	39.0 41.0	SW		Medium dense brown well graded SAND with gravel (SW), mps 1.5 in., no odor, wet	10	20	35	20	15					
					-31.5 41.5	- GLACIOFLUVIAL DEPOSITS -										
	22 17 100/1"	S10 9	43.0 44.1	SM	-34.1 44.1	Dense light brown silty SAND with gravel (SM), mps 1.5 in., no odor, wet, - GLACIAL TILL - TOP OF PROBABLE BEDROCK BOTTOM OF EXPLORATION 44.1 FT	5	10	5	5	55	20				

PROBABLE TOP OF BEDROCK
EL. –34.1

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-16

BORING BB–16

H&A-TEST BORING-00 REV. H&A_B808-BOS - COPY2 GLB H&A-TBI-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TBI.GPJ 21-Jun-21
Plotted on 12-Dec-2023 11:12 AM
605311_SK02-17_BRM(M05001-W06013).DWG
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

TEST BORING REPORT

Boring No. BB-17

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 1
Start 4 January 2021
Finish 4 January 2021
Driller S. Cooley
H&A Rep. S. Shay
Elevation -10.2
Datum NAVD88
Location Northing: 2730274.3
Easting: 861468.0

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 14.0 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2 4 7 9	S1 18	0.0 2.0	OL/OH ML		S1, top 6 in.: Soft ORGANIC SOIL with sand (OL/OH) S1, bottom 12 in.: Medium dense light gray SILT with sand (ML) mps 1mm, frequent partings, slight organic odor, wet, trace fibers	10	5	5	5 10	15 10	60 80				
	100	S2 6	2.0 2.5	ML	-12.7 2.5	Very dense yellow brown SILT with sand (ML) mps 1mm, frequent partings, no odor, wet -GLACIOLACUSTRINE DEPOSITS-				5	10	85				
5	27 13 11 19	S3 13	4.0 6.0	SM		Note: Probable large cobble at 2.5 ft. Medium dense olive gray silty SAND with gravel (SM) mps 2.5 cm, no structure, no odor, wet -GLACIOFLUVIAL DEPOSITS-	5	10	15	20	35	15				
10	34 22 20 36	S4 13	9.0 11.0	SM		Dense olive gray silty SAND with gravel (SM) mps 2.2cm, no structure, no odor, wet Note: Difficult casing advancement at 14.0 ft. and unable to drive deeper. Advanced borehole with button bit to 15.0 ft. with angular sand-sized material observed in screened drill wash.	5	10	15	20	35	15				
15	100	S 0	15.0 15.0		-25.2 15.0	No recovery Split spoon refusal at 15.0 ft. BOTTOM OF EXPLORATION 15.0 FT.										

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 15 Rock Cored (ft) Samples S4 **Boring No. BB-17**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB–17

TEST BORING REPORT

Boring No. BB-18

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 1
Start 29 December 2020
Finish 29 December 2020
Driller S. Cooley
H&A Rep. S. Shay
Elevation -11.6
Datum NAVD88
Location Northing: 2730377.4
Easting: 861565.4

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 23.0 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	WOH/24in	S1 12	0.0 2.0	OL/OH		Very soft black ORGANIC SOIL (OL/OH) mps 2 mm, no structure, organic odor, wet, trace shell fragments -ORGANIC ESTUARINE DEPOSITS-	5			5	5	85				
	1 3 8 7	S2 15	2.0 4.0	OL/OH SW	-14.6 3.0	S2, top 6 in.: Similar to above except sandy ORGANIC SOIL					30	70				
	1/12in	S3 9	4.0 6.0	SP-SM	-15.6 4.0	S2, bottom 9 in.: Medium dense light gray well-graded SAND (SP) mps 1 cm as trace gravel, no structure, slight organic odor, wet -LITTORAL DEPOSITS-			30	30	35	5				
5	1/12in				-17.1 5.5	Very loose olive brown poorly-graded SAND with silt (SP-SM) mps 3mm, no structure, organic odor, wet, trace shell fragments -ESTUARINE DEPOSITS-			10	10	70	10				
	1 2 5 8	S4 15	6.0 8.0	ML	-20.1 8.5	Loose orange brown SILT (ML) mps 0.1mm, no structure, no odor, wet -GLACIOLACUSTRINE DEPOSITS-					5	95	R	L	L	L
10	18 13 15 20	S5 14	10.0 12.0	SM		Medium dense olive brown silty SAND with gravel (SM) mps 2cm, no structure, no odor, wet	5	10	15	20	30	20				
15	24 14 12 12	S6 13	15.0 17.0	SM		Medium dense olive brown silty SAND with gravel (SM) mps 2.5 cm, no structure, no odor, wet -GLACIOFLUVIAL DEPOSITS-	5	10	15	20	30	20				
20	20/4in	S7 4	20.0 20.3	SM	-31.6 20.0	Very dense light beige silty SAND with gravel (SM) mps 3 cm, no structure, no odor, wet, possible highly weathered rock Note: Inconsistent drilling effort 20.0 to 23.0 ft. indicates possible cobbles or weathered rock	10	10	15	15	35	15				
					-35.6 24.0	POSSIBLE TOP OF BEDROCK										
	100/1ft	S 0	24.0 24.1		-35.7 24.1	No recovery Split spoon refusal at 24.1 ft. -BOTTOM OF EXPLORATION 24.1 FT.- Note: BSC Group/Paul Mancuso received two composite zip-lock bags of soil (S1-S4 and S5-S6) for environmental purposes										

POSSIBLE TOP OF BEDROCK
EL. –35.6

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 24.1 Rock Cored (ft) Samples S7 **Boring No. BB-18**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB–18

H&A-TEST BORING-09 REV H&A-B808-BOS - COPYZ GLB H&A-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21
H&A-TEST BORING-09 REV H&A-B808-BOS - COPYZ GLB H&A-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21
605311_SK02-17_BRM05001-W06013).DWG Plotted on 12-Dec-2023 11:12 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

TEST BORING REPORT

Boring No. BB-19

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 2
Start 28 December 2020
Finish 28 December 2020
Driller S. Cooley
H&A Rep. S. Shay
Elevation -5.0
Datum NAVD88
Location Northing: 2730475.3
Easting: 861651.5

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 31.0 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	WOH/24 in.	S1 8	0.0 2.0	OL/OH		Very soft black ORGANIC SOIL with gravel (OL/OH) mps 1cm, no structure, organic odor, wet, trace shell fragments			25	10	5	60				
	WOH/24 in.	S2 12	2.0 4.0	OL/OH		Very soft dark olive brown sandy ORGANIC SOIL (OL/OH) mps 1mm, occasional gray fine sand seams, strong organic odor, wet					5	40	55				
					-9.0	-ORGANIC ESTUARINE DEPOSITS-										
5	1 1 2 4	S3 10	4.0 6.0	SP	4.0	Very loose gray poorly-graded SAND (SP) mps 1mm, frequent brown sandy organic soil interbedding, organic odor, wet					20	75	5			
	2 3 3 3	S4 18	6.0 8.0	SP		Loose gray poorly-graded SAND (SP) mps 1mm, well stratified, organic odor, wet, trace organic fibers throughout, trace decayed wood					20	75	5			
					-14.0	-ESTUARINE DEPOSITS-										
10	4 4 5 6	S5 13	10.0 12.0	SW	9.0	Loose light gray well-graded SAND (SW) mps 4mm, weakly stratified, no odor, wet				30	35	35				
					-18.5	-LITTORAL DEPOSITS-										
15	4 5 5 7	S6 16	15.0 17.0	ML	13.5	Stiff olive gray SILT (ML) mps 0.1mm, frequent partings, no odor, wet						10	90	R	L	L	L
					-24.5	-GLACIOLACUSTRINE DEPOSITS-										
20					19.5	Note: Change in drilling effort at 19.5 ft.										
	100/2 in	S7 2	20.7 20.9	GP	-26.0	Very dense olive brown poorly-graded GRAVEL (GP) mps 1.5cm, no structure, no odor, wet	100									
	11 10 11 12	S8 12	22.5 24.5	SP-SM	21.0	Note: Advanced borehole with button bit to 21.5 ft. Advanced borehole with core barrel from 21.5 ft. to indicate probable boulder (approximately 1.6-foot dia.) from 20.9 to 22.5 ft. Medium dense olive brown poorly-graded SAND with silt and gravel (SP-SM) mps 1.2cm, no structure, no odor, wet			30	15	15	30	10			
25						-GLACIOFLUVIAL DEPOSITS-										
	14 9 6	S9 4	28.0 30.0	SP-SM		Medium dense olive brown poorly-graded SAND with silt and gravel (SP-SM) mps 1.5cm, no structure, no odor, wet			40	10	15	25	10			
30																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary

Overburden (ft)	31.7
Rock Cored (ft)	
Samples	S10
Boring No.	**BB-19**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB–19

TEST BORING REPORT

Boring No. BB-19
File No. 40991-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
30	11															
	120/5 in	S10 5	31.0 31.4	SM	-36.0 -31.0 -36.7 31.7	Very dense olive brown silty SAND with gravel (SM) mps 2.2 cm, moderately bonded, no odor, wet	5	10	20	20	30	15				
						-GLACIAL TILL DEPOSITS-										
						BOTTOM OF EXPLORATION 31.7 FT.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc. **Boring No. BB-19**

BORING BB–19

H&A-TEST BORING-09 REV H&A-BOR-BOS - COPY2 GLB H:\A-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21
605311_SK02-17_BRM(M05001-W06013).DWG Plotted on 12-Dec-2023 11:12 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

TEST BORING REPORT

Boring No. BB-23

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 21.0 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

File No. 40991-005
Sheet No. 1 of 1
Start 19 January 2021
Finish 19 January 2021
Driller S. Cooley
H&A Rep. S. Shay
Elevation -6.1
Datum NAVD88
Location Northing: 2730157.6
Easting: 861566.7

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	Free fall		0.0 2.0			No recovery										
	WOH/24 in.	S1 16	2.0 4.0	OL/OH		Very soft dark brown sandy ORGANIC SOIL (OL/OH) mps 6mm, no structure, organic odor, wet, trace fibers -ORGANIC ESTUARINE DEPOSITS-		5	5	5	20	65				
					-10.1 4.0											
	33 15 16 20	S2 10	4.0 6.0	SP-SM	-11.1 5.0	S2, top 4 in.: Dense gray poorly-graded SAND (SP-SM) mps 2.8cm, no structure, slight organic odor (from above), wet, trace shell fragments -LITTORAL DEPOSITS-	5	5	15	15	50	10				
5				ML					5	5	5	85				
					-13.6 7.5	S2, bottom 6 in.: Dense light gray with faint yellow brown mottling SILT with sand (ML) mps 3mm, no structure, no odor, wet -GLACIOLACUSTRINE DEPOSITS-										
	18 22 23 23	S3 2	9.0 11.0	GP		Dense red orange poorly-graded GRAVEL with sand (GP) difficult to fully characterize with low recovery, possible cobble fragments	10	65	10	10	5					
10					-18.6 12.5											
	20 14 14 14	S4 9	14.0 16.0	SM		Medium dense olive brown silty SAND with gravel (SM) mps 3cm, no structure, no odor, wet -GLACIOFLUVIAL DEPOSITS-	5	10	10	15	45	15				
15																
	35 21 18 25	S5 13	19.0 21.0	SM		Medium dense olive brown silty SAND as residual soil (SM) mps 3cm, no structure, no odor, wet	5	5	10	15	40	25				
					-27.1 21.0	POSSIBLE TOP OF BEDROCK 21.0 FT.										
20					-28.1 22.0	Note: Abrupt change in effort to drive casing at 21.0 ft. Advanced borehole with button bit to 22.0 ft.										
	100/0 in.	S 0	22.0 22.0			No recovery Split spoon refusal at 22 ft. BOTTOM OF EXPLORATION 22.0 FT.										

PROBABLE TOP OF BEDROCK
EL. -27.1

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 22
Rock Cored (ft)
Samples S5
Boring No. BB-23

Field Tests: Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB-23

H:\A-TEST BORING\B-09 REV H\A-LB09-BOS - COPY2 ELB H\A-TB-CORE-WELL-09 W FENCE.GDT 21-Jun-21 09:10 605-TB.GPJ 21 Jun 21
605311_SK02-17_BR\M05001-W06013).DWG Plotted on 12-Dec-2023 11:12 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

TEST BORING REPORT

Boring No. BB-24

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 2
Start 13 January 2021
Finish 13 January 2021
Driller S. Cooley
H&A Rep. S. Shay
Elevation -7.6
Datum NAVD88
Location Northing: 2730307.3
Easting: 861701.4

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 21.0 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sample Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Toughness	Plasticity	Strength
0	WOH/24 in.	S1 10	0.0 2.0	OL/OH		Very soft black sandy ORGANIC SOIL (OL/OH) mps 0.5mm, no structure, organic odor, wet, trace shell fragments					45	55				
	WOH/24 in.	S2 17	2.0 4.0	OL/OH		Very soft dark brown sandy ORGANIC SOIL (OL/OH) mps 0.5mm, no structure, organic odor, wet					50	50				
						-ORGANIC ESTUARINE DEPOSITS-										
5	1 2 2 3	S3 8	4.0 6.0	SW	-11.6 4.0	Very loose light gray well-graded SAND (SW) mps 2.2cm, single-grain structure, no odor, wet	5		35	30	30					
	3 2 1 2	S4 6	6.0 8.0	SP		Very loose light gray poorly-graded SAND (SP) mps 2cm, single-grain structure, no odor, wet	5		15	30	50					
						-LITTORAL DEPOSITS-										
10	1 2 1 2	S5 12	9.0 11.0	SP		Very loose light gray poorly-graded SAND (SP) mps 4mm, weakly stratified, no odor, wet			10	20	70					
					-20.1 12.5	Note: Abrupt change in drilling effort at 12.5 ft.										
15	10 14 13 18	S6 8	14.0 16.0	SM		Medium dense olive brown silty SAND with gravel (SM) mps 2.5cm, moderately bonded, no odor, wet	5	10	15	20	35	15				
						-GLACIOFLUVIAL DEPOSITS-										
					-25.1 17.5											
20	18 10 12 12	S7 6	19.0 21.0	GP		Medium dense olive brown poorly-graded GRAVEL with sand (GP) mps 3cm, no structure, no odor, wet	10	45	10	10	20	5				
					-28.6 21.0	TOP OF BEDROCK 21.0 FT.										
25						Note: Abrupt change in effort to advance casing at 21.0 ft. Advanced borehole with button bit to 22.5 ft. as drilling effort indicated possible weathered rock. SEE CORE BORING REPORT FOR ROCK DETAILS										

APPROX TOP OF BEDROCK
EL. -28.6

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 22.6
Rock Cored (ft) 5.0
Samples S7,C1
Boring No. BB-24

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H:\A_TEST BORING-09 REV HAL-B809-BOS - COPY2 GLB HA-TB+CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB GPJ 21-Jun-21

BORING BB–24

CORE BORING REPORT

Boring No. BB-24
File No. 40991-005
Sheet No. 2 of 2

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
	4	C1	22.5	58	97	Fresh		Very hard, fresh, pink orange, medium-grained GRANITE. Single vertical to near vertical joint top 2 ft. of core, undulating, rough, slight coating of secondary mineralization, tight.
	4		27.5	97	162			-BEDROCK-
25	4							
	4							
	4						-35.1 27.5	BOTTOM OF EXPLORATION 27.5 FT.
30								
35								
40								
45								
50								
55								

H:\A_CORE-WELL-09 HAL-B809-BOS - COPY2 GLB HA-TB+CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB GPJ 21-Jun-21

BORING BB–24

605311_SK02-17_BRM(M05001-W06013).DWG Plotted on 12-Dec-2023 11:12 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023

BORING NOTES:
1. SEE SHEET 02 OF 24 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 24 FOR NOTES.

TEST BORING REPORT

Boring No. BB-25

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 1
Start 12 January 2021
Finish 13 January 2021
Driller S. Cooley
H&A Rep. S. Shay
Elevation -4.5
Datum NAVD88
Location Northing: 2730370.1
Easting: 861751.3

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 27.0 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	WOH/24in.	S1 6	0.0 2.0	OL/OH		Very soft black ORGANIC SOIL (OL/OH) mps 2mm , no structure, strong organic odor, wet, trace shell fragments				5	5	90				
	WOH/24in.	S2 8	2.0 4.0	OL/OH		Very soft black ORGANIC SOIL (OL/OH) mps 1mm, no structure, strong organic odor, wet, trace fibers					5	95				
						Undisturbed tube attempt 4.0-6.0 ft., no recovery										
5						-ORGANIC ESTUARINE DEPOSITS-										
	1/12in.	S3 10	8.0 10.0	OL/OH		Very soft brown sandy ORGANIC SOIL (OL/OH) mps 1mm, interbedded grey fine sand seams mostly at bottom of sample, slight organic odor, wet, trace shell fragments					40	60				
	1 3	S4 6	10.0 12.0	SM	-13.5 9.0	Loose brown silty SAND (SM) mps 1mm, weakly stratified, slight organic odor, wet, up to 20% organic content				5	55	40				
10	3 4 5					-ESTUARINE DEPOSITS-										
	1 2 4 4	S5 7	14.0 16.0	SW	-17.5 13.0	Loose light gray well-graded SAND (SW) mps 4mm, single-grain structure except for silt seam bottom 1" of sample, no odor, wet			30	35	30	5				
15						-LITTORAL DEPOSITS-										
	4 7 12 47	S6 13	19.0 21.0	ML	-21.5 17.0	Very stiff yellow brown SILT (ML) mps 2.8cm as single coarse gravel piece in spoon tip, frequent varves, no odor, wet		5			5	90				
20					-25.5 21.0	-GLACIOLACUSTRINE DEPOSITS-										
						Note: Change in drilling effort at 21.0 ft. Drilling effort indicated probable cobble 6-8 inches diameter plus few others to 24.0 ft.										
	34 22 33 21	S7 12	24.0 26.0	SP		Very dense olive brown poorly-graded SAND (SP) with silt and gravel, mps 2.5cm, no structure, no odor, wet	10	15	15	20	30	10				
25						-GLACIOFLUVIAL DEPOSITS-										
	00/1in.	S 0	27.5 27.6		-32.1 27.6	No recovery Split spoon refusal at 27.6 ft.										
						BOTTOM OF EXPLORATION 27.6 FT.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	27.6
Rock Cored (ft)	
Samples	S7
Boring No.	**BB-25**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Plasticity: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

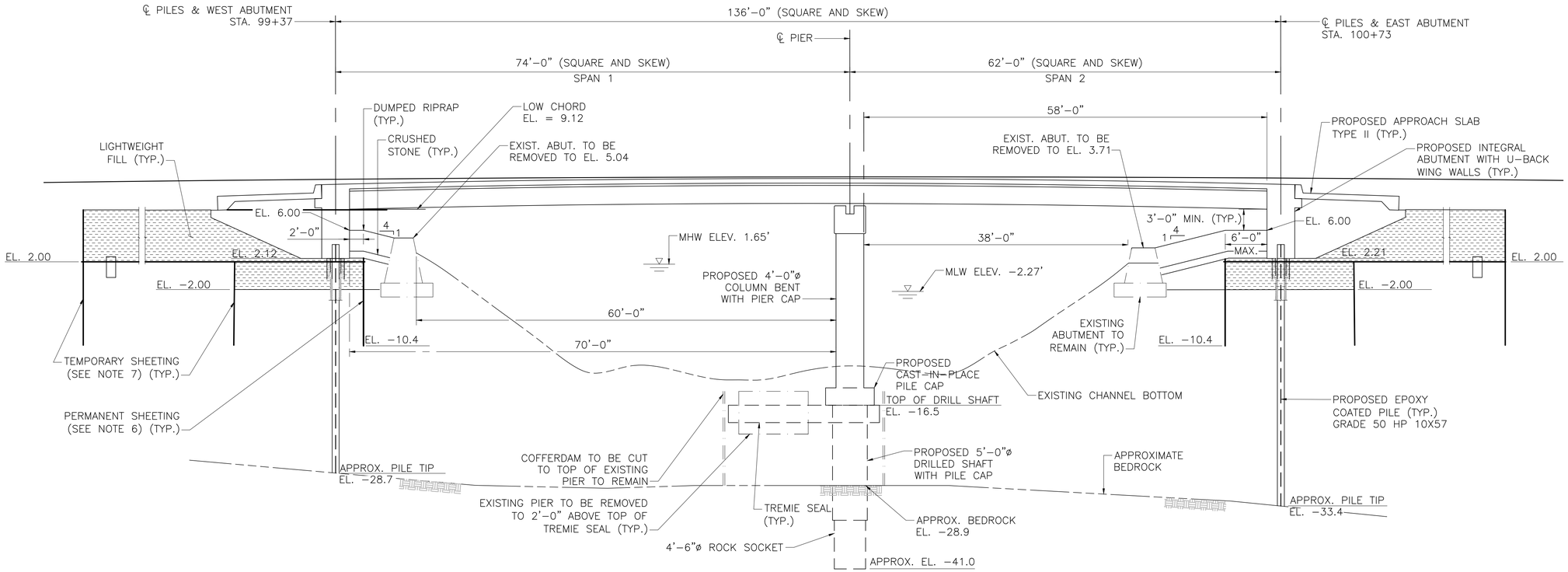
†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-09-REV H&A LIB09-9DS - COPY2 GLB H:\A-TB-CORE-WELL\09 W FENCE.GDT 12/4/09 15:INTCOMBINED\40991-005-TB.GPJ 21-Jun-21

BORING BB–25

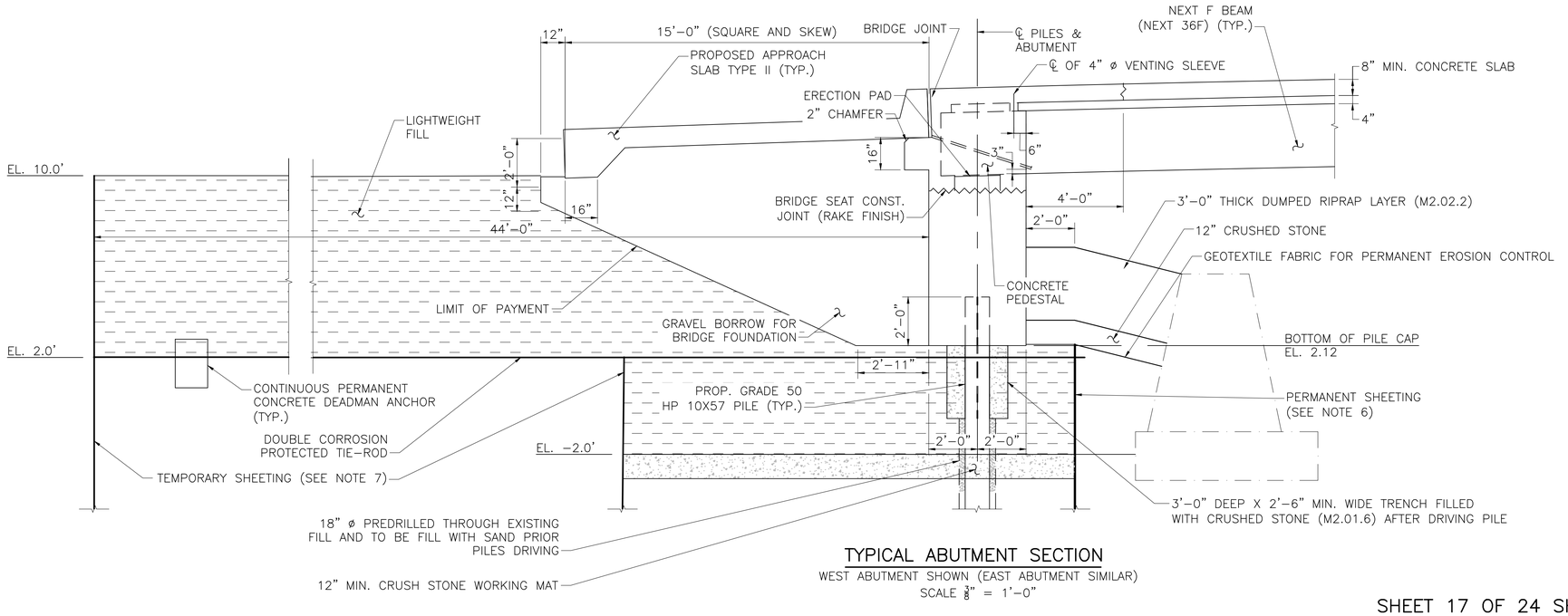
605311_SK02-17_BR\M05001-W06013).DWG Plotted on 12-Dec-2023 11:12 AM

605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023



LONGITUDINAL SECTION

SCALE: $\frac{1}{8}$" = 1'–0"



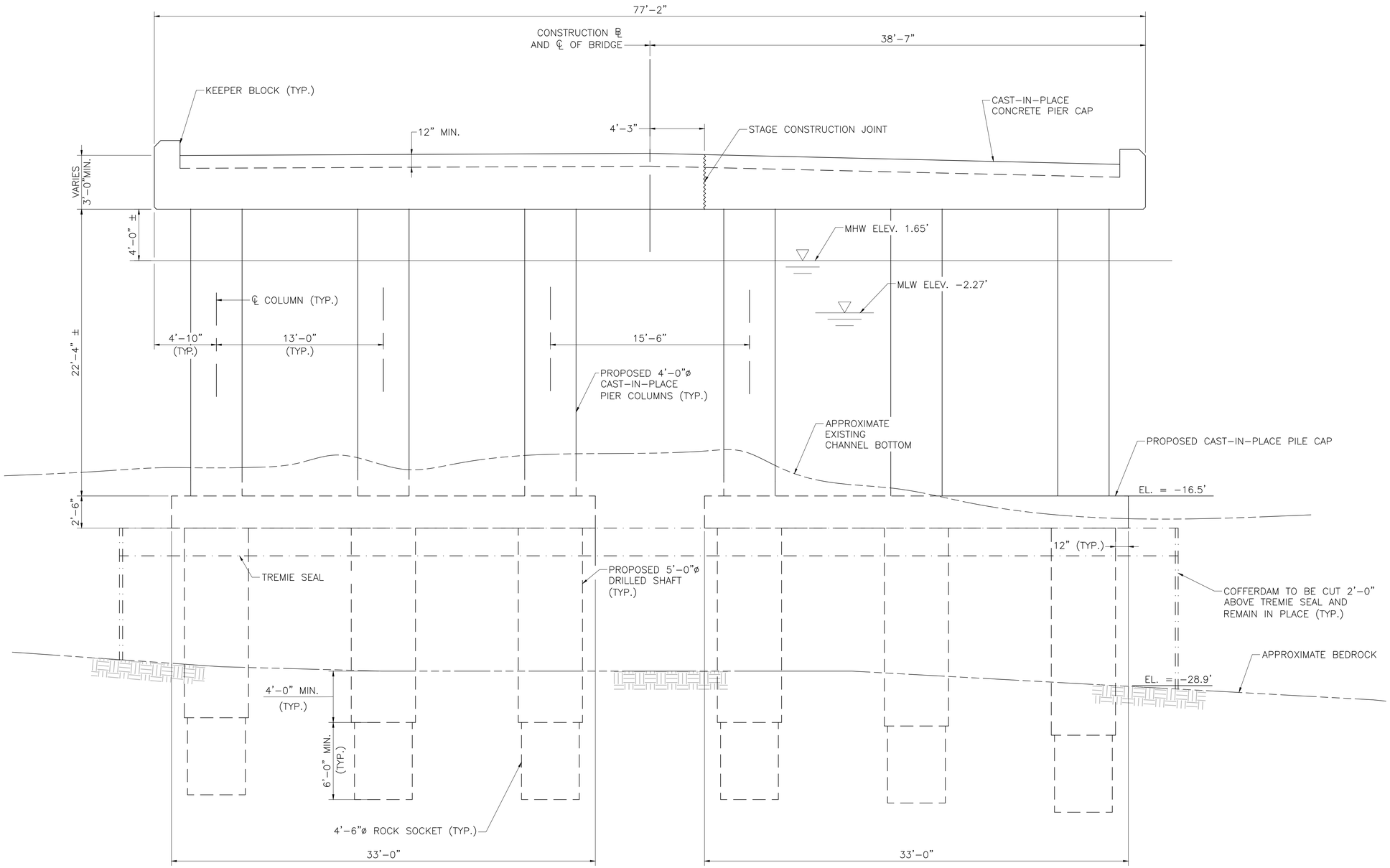
TYPICAL ABUTMENT SECTION

WEST ABUTMENT SHOWN (EAST ABUTMENT SIMILAR)
SCALE $\frac{3}{8}$" = 1'–0"

NOTES:

1. MINIMUM VERTICAL CLEARANCE AT MWH OCCURS AT THE SOUTHERN EXTERIOR GIRDER AT THE WEST END OF THE STRUCTURE. EXISTING VERTICAL CLEARANCE FROM MWH TO THE BOTTOM GIRDER FLANGE IS 4.92', PROPOSED MINIMUM VERTICAL CLEARANCE IS 7.42'.
2. THE FACTORED AXIAL DESIGN LOAD PER PILE IS 290 KIPS FOR WEST ABUTMENT AND 260 KIPS FOR EAST ABUTMENT PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION. THE FACTORED STRUCTURAL RESISTANCE PER PILE IS 417.5 KIPS.
3. THE FACTORED DRILLED SHAFT LOAD IS 1,067 KIPS. THE FACTORED DRILLED SHAFT RESISTANCE IS 5,535 KIPS.
4. THE DESIGN (25 YEAR) FLOOD ELEVATION IS 10.1'. THE BASE (100–YEAR) FLOOD ELEVATION IS 13.7'.
5. THE PRESSURE DESIGN SCOUR DEPTH IS 3.3', PRESSURE CHECK SCOUR DEPTH IS 7.1', PIER DESIGN SCOUR DEPTH IS 10.0', PIER CHECK SCOUR DEPTH IS 12.0'.
6. PERMANENT SHEETING FOR SCOUR PROTECTION, WATER CONTROL AND PLACEMENT OF LIGHTWEIGHT FILL. SHEETING TO BE DESIGNED TO MEET DESIGN SCOUR EVENT FOR PROTECTION OF PROPOSED ABUTMENTS. SEE SHEET 22 FOR PLAN LAYOUT.
7. TEMPORARY SHEETING FOR WATER CONTROL AND PLACEMENT OF LIGHTWEIGHT FILL. SEE SHEET 22 FOR PLAN LAYOUT.

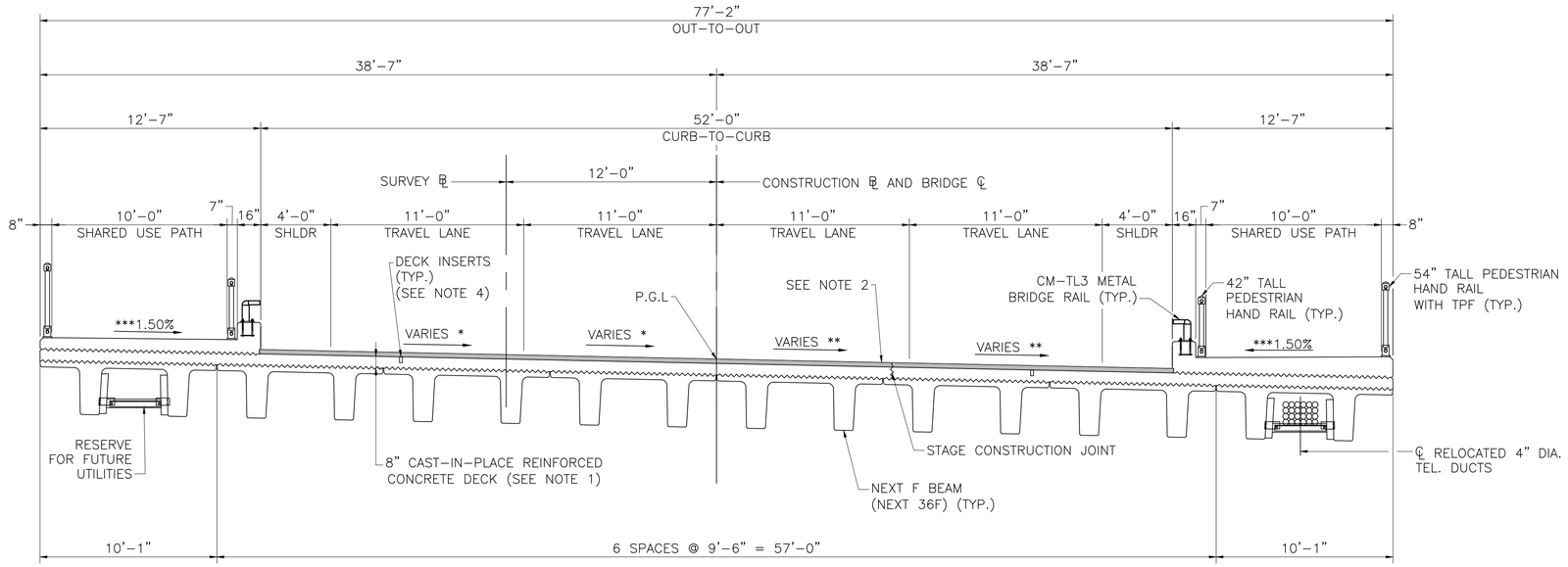
605311_SK18_BR\M05001-W06013).DWG Plotted on 12-Dec-2023 11:13 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023



TRANSVERSE SECTION OF PIER

SCALE: $\frac{1}{4}$" = 1'-0"

605311_SK24_BR(M05001-W06013).DWG Plotted on 12-Dec-2023 11:13 AM
605311 Sketch Plan Submittal (SP2) 10-AUGUST-2022



TRANSVERSE SECTION

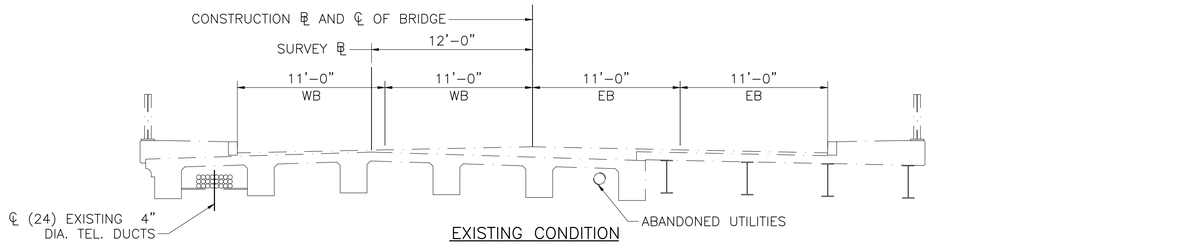
SCALE: $\frac{1}{4}$" = 1'–0"

NOTES:

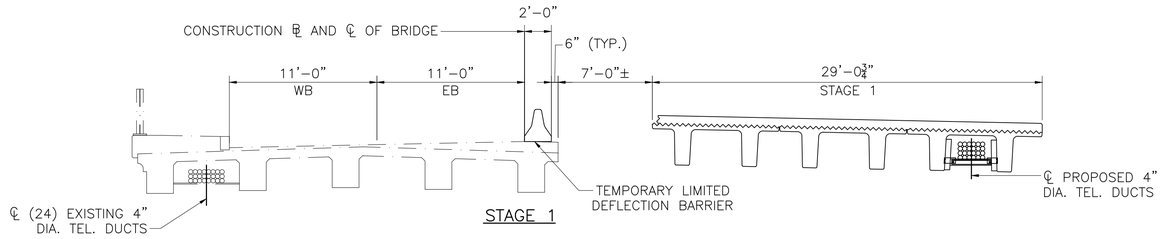
1. DECK THICKNESS VARIES DUE TO SUPPERELEVATION RUNOUT OVER BRIDGE. APPROXIMATE THICKNESS RANGES FROM 8" TO 12".
2. $1\frac{1}{2}$" SUPERPAVE BRIDGE SURFACE COURSE OVER $1\frac{1}{2}$" SUPERPAVE BRIDGE PROTECTIVE COURSE OVER SPRAY APPLIED MEMBRANE WATERPROOFING.
3. * 0.014% AT EAST ABUT.
   0.00% AT PIER
   2.00% AT WEST ABUT.

   ** 2.00% AT EAST ABUT.
   2.00% AT PIER
   2.00% AT WEST ABUT.
4. DECK INSERTS PROVIDED FOR POSSIBLE FUTURE ROAD DIET.
5. ***SLOPES TO MATCH HIGHWAY DRAWINGS.

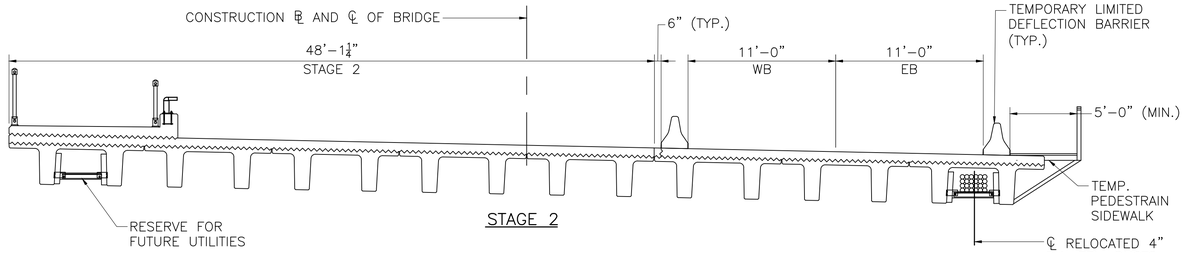
605311_SK19_BR(M05001-W06013).DWG Plotted on 12-Dec-2023 11:13 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023



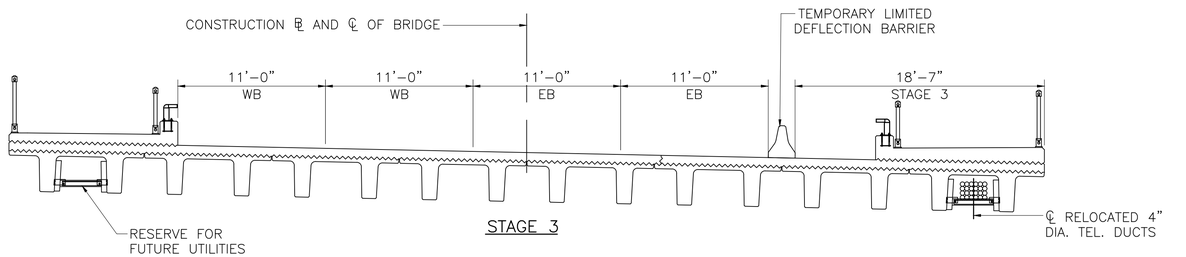
EXISTING CONDITION



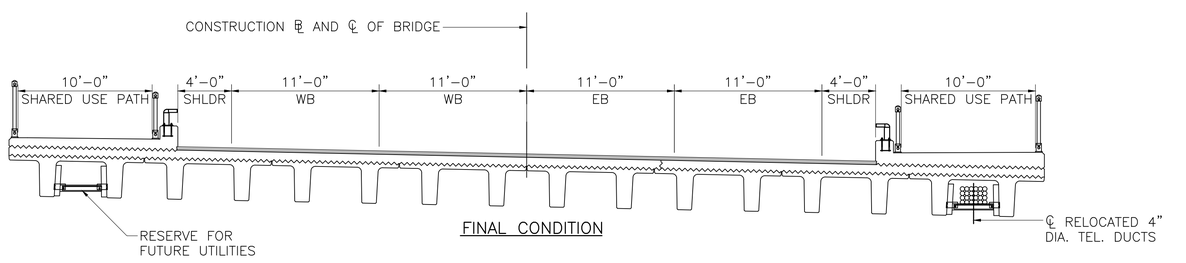
STAGE 1



STAGE 2



STAGE 3



FINAL CONDITION

CONSTRUCTION STAGING

SCALE: $\frac{3}{16}$" = 1'–0"

STAGE 1:

1.1 SHIFT TRAFFIC TO THE NORTH MAINTAINING ONE LANE IN EACH DIRECTION.

1.2 DEMOLISH SOUTHERLY PORTION OF EXISTING STRUCTURE.

1.3 CONSTRUCT PORTION OF NEW STRUCTURE AS SHOWN.

1.4 INSTALL 4" DIAMETER TELECOM DUCTS.

STAGE 2:

2.1 SHIFT TRAFFIC TO SOUTHERLY PORTION OF NEW STRUCTURE MAINTAINING ONE LANE IN EACH DIRECTION.

2.2 CONSTRUCT REMAINDER OF NEW STRUCTURE AS SHOWN.

2.3 CONSTRUCT NORTHERLY SHARED USE PATH AND BRIDGE RAIL.

2.4 RELOCATE FIBER CABLES IN 4" DIAMETER TELECOM DUCTS

STAGE 3:

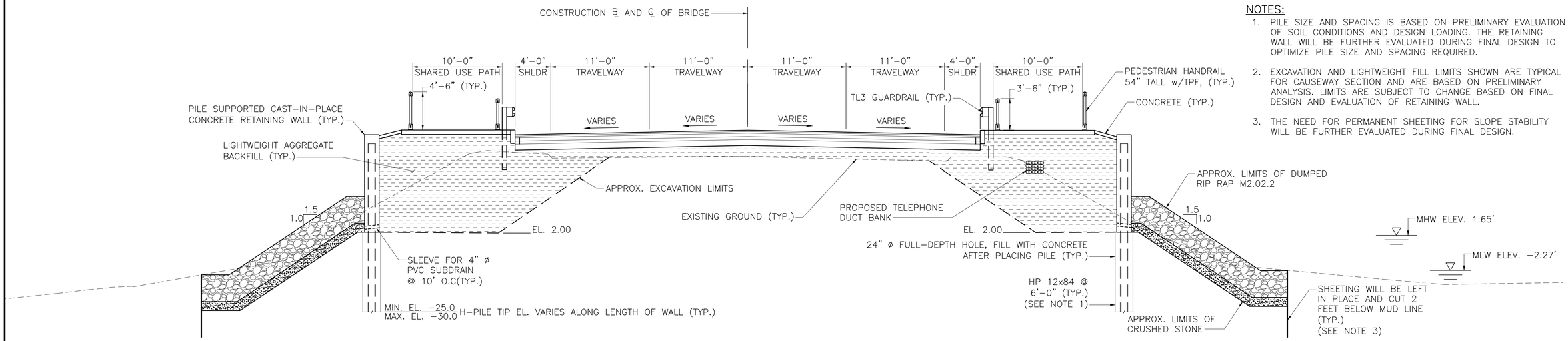
3.1 SHIFT TRAFFIC NORTHERLY MAINTAINING FOUR LANES OF TRAFFIC, TWO IN EACH DIRECTION.

3.2 CONSTRUCT SOUTHERLY SHARED USE PATH AND BRIDGE RAIL

FINAL STAGE:

REMOVE BARRIER AND INSTALL SPRAY APPLIED WATER PROOFING MEMBRANE AND HMA WEARING SURFACE.

605311_SK21_BR(M05001-W06013).DWG Plotted on 12-Dec-2023 11:14 AM
605311 Sketch Plan Submittal (SP2) 10-AUGUST-2022

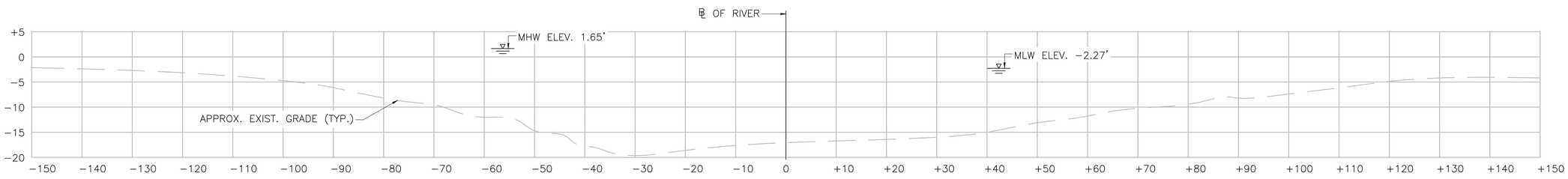


NOTES:

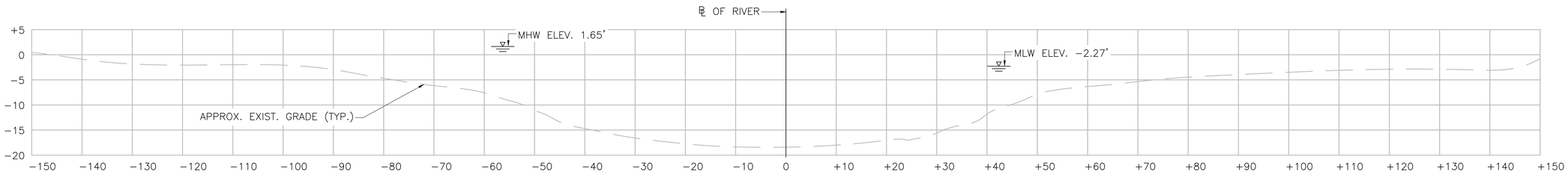
1. PILE SIZE AND SPACING IS BASED ON PRELIMINARY EVALUATION OF SOIL CONDITIONS AND DESIGN LOADING. THE RETAINING WALL WILL BE FURTHER EVALUATED DURING FINAL DESIGN TO OPTIMIZE PILE SIZE AND SPACING REQUIRED.
2. EXCAVATION AND LIGHTWEIGHT FILL LIMITS SHOWN ARE TYPICAL FOR CAUSEWAY SECTION AND ARE BASED ON PRELIMINARY ANALYSIS. LIMITS ARE SUBJECT TO CHANGE BASED ON FINAL DESIGN AND EVALUATION OF RETAINING WALL.
3. THE NEED FOR PERMANENT SHEETING FOR SLOPE STABILITY WILL BE FURTHER EVALUATED DURING FINAL DESIGN.

TYPICAL APPROACH SECTION

SCALE: $\frac{3}{16}$" = 1'-0"



SECTION ACROSS RIVER ℄ AT STA. 101+28

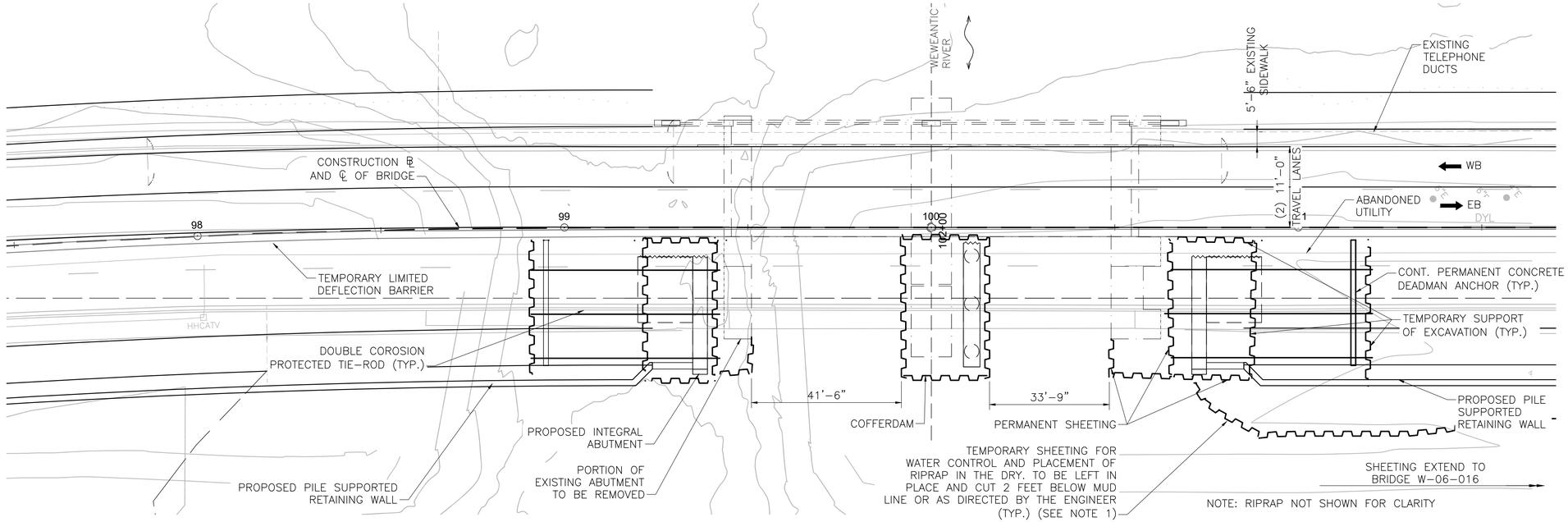


SECTION ACROSS RIVER ℄ AT STA. 102+62

CHANNEL APPROACH SECTIONS (LOOKING NORTHWEST)

SCALE: $\frac{3}{32}$" = 1'-0"

605311_SK20_BRM05001-W06013).DWG Plotted on 12-Dec-2023 11:14 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023



STAGE 1 CONSTRUCTION PLAN

SCALE: $\frac{1}{16}$" = 1'-0"

NOTES:

1. THE NEED FOR PERMANENT SHEETING FOR SLOPE STABILITY WILL BE FURTHER EVALUATED ONCE SUPPLEMENTAL BORINGS/ PROBES HAVE BEEN COMPLETED FOR FINAL DESIGN.

SUGGESTED SEQUENCE OF WATER CONTROL

STAGE 1:

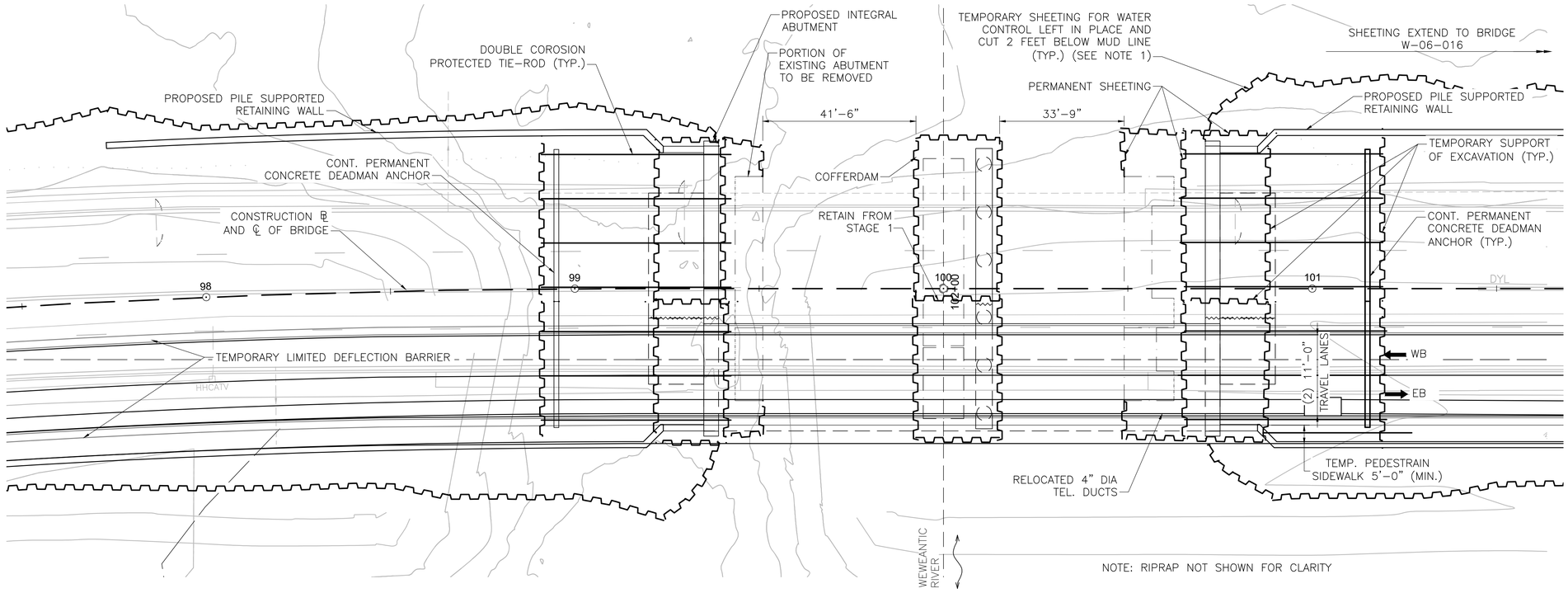
1.1 DEMOLISH SOUTHERLY PORTION OF EXISTING STRUCTURE.

1.2 INSTALL STAGE 1 PIER COFFERDAM AND TEMPORARY SHEETING.

1.3 REMOVE SOUTHERLY PORTION OF PIER AND INTEGRAL ABUTMENTS.

1.4 CONSTRUCT NEW SOUTHERLY PORTION OF PIER AND INTEGRAL ABUTMENTS.

1.5 REMOVE STAGE 1 PIER COFFERDAM AND TEMPORARY SHEETING.



STAGE 2 CONSTRUCTION PLAN

SCALE: $\frac{1}{16}$" = 1'-0"

STAGE 2:

2.1 DEMOLISH NORTHERLY PORTION OF EXISTING SUPERSTRUCTURE.

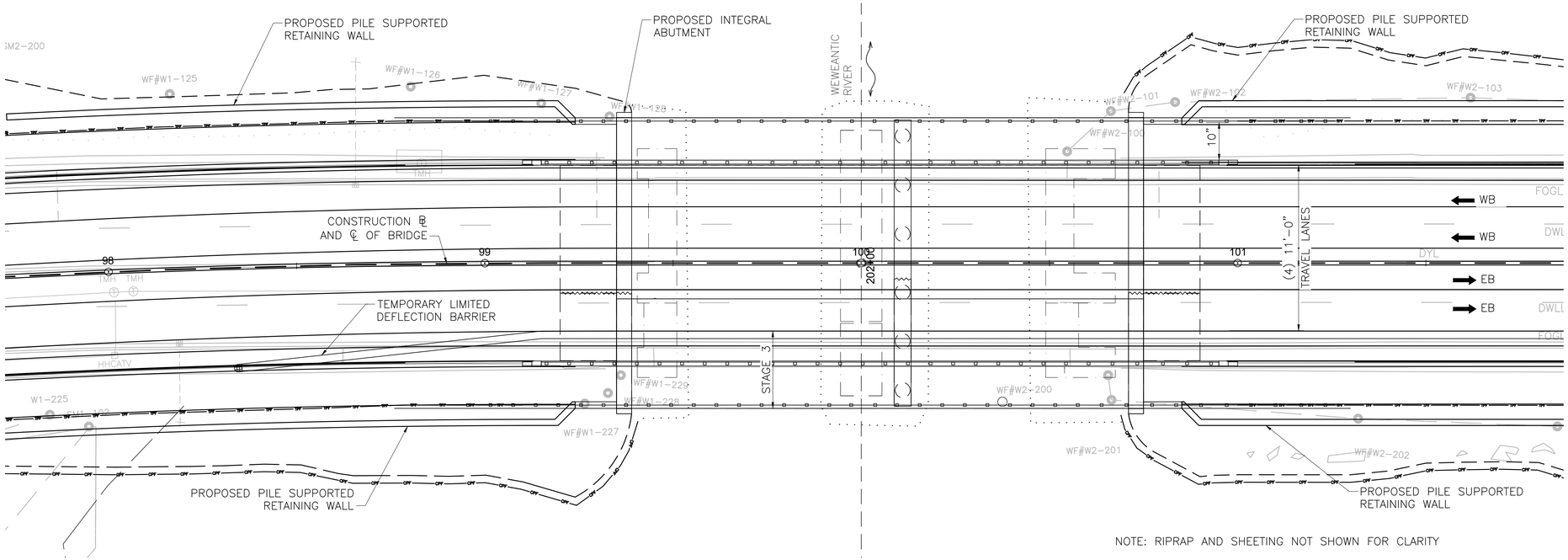
2.2 INSTALL STAGE 2 PIER COFFERDAM AND TEMPORARY SHEETING.

2.3 REMOVE NORTHERLY PORTIONS OF THE EXISTING PIER AND ABUTMENTS TO SPECIFIED LIMITS.

2.4 CONSTRUCT NEW NORTHERLY PORTION OF PIER AND INTEGRAL ABUTMENTS.

2.5 REMOVE STAGE 2 PIER COFFERDAM AND TEMPORARY SHEETING.

605311_SK22_BRM05001-W06013).DWG Plotted on 12-Dec-2023 11:46 AM
605311 Sketch Plan Submittal (SP3) 13-DECEMBER-2023



NOTE: RIPRAP AND SHEETING NOT SHOWN FOR CLARITY

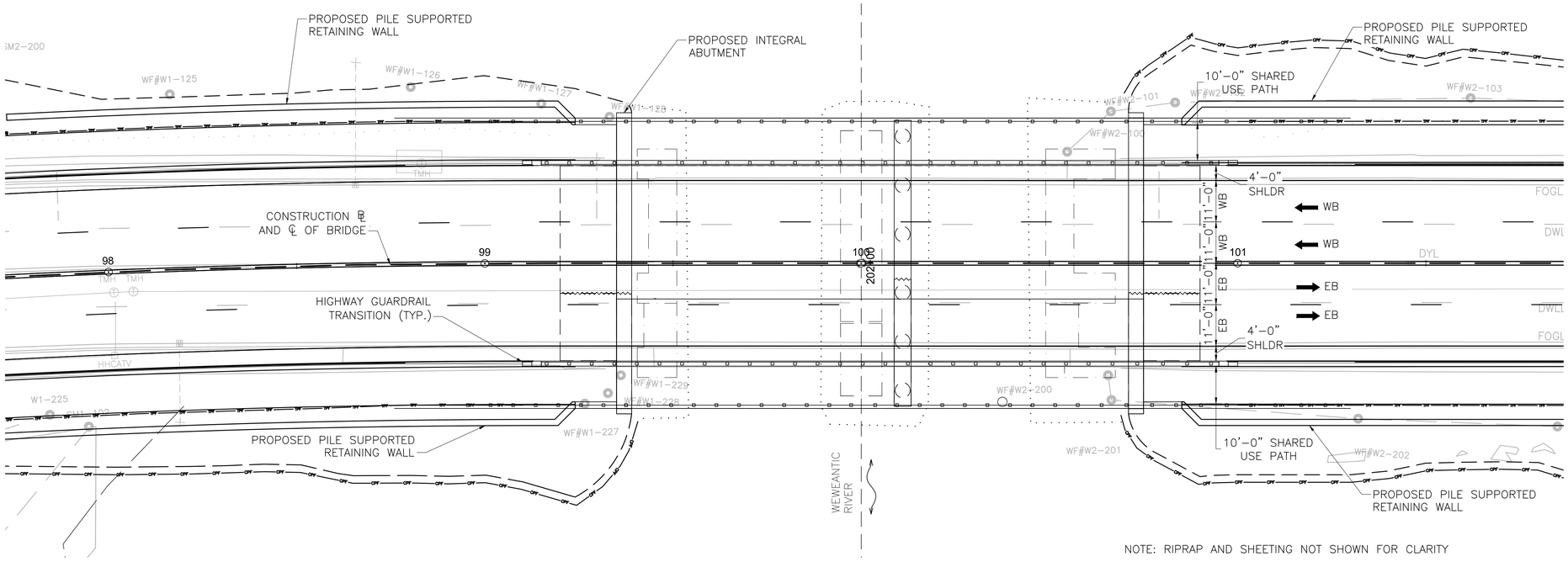
STAGE 3 CONSTRUCTION PLAN

SCALE: $\frac{1}{16}$" = 1'-0"

STAGE 3:

3.1 SHIFT TRAFFIC NORTHERLY MAINTAINING FOUR LANES OF TRAFFIC, TWO IN EACH DIRECTION.

3.2 CONSTRUCT SOUTHERLY SHARED USE PATH AND BRIDGE RAIL.



NOTE: RIPRAP AND SHEETING NOT SHOWN FOR CLARITY

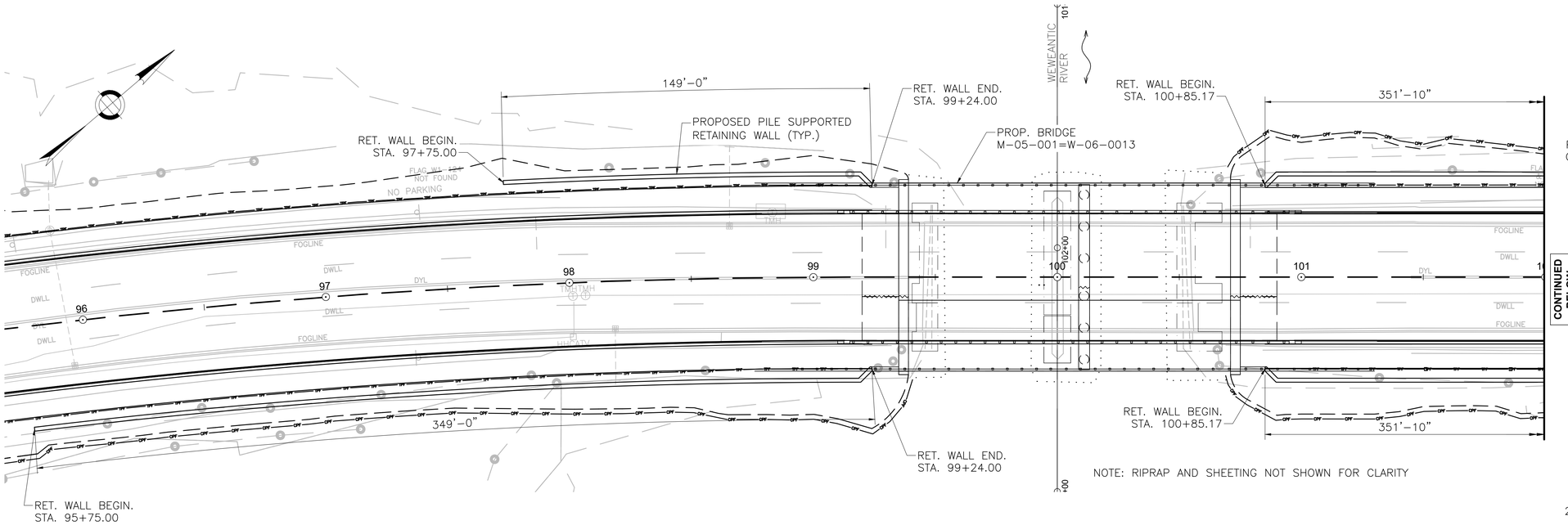
FINAL CONDITION

SCALE: $\frac{1}{16}$" = 1'-0"

FINAL STAGE:

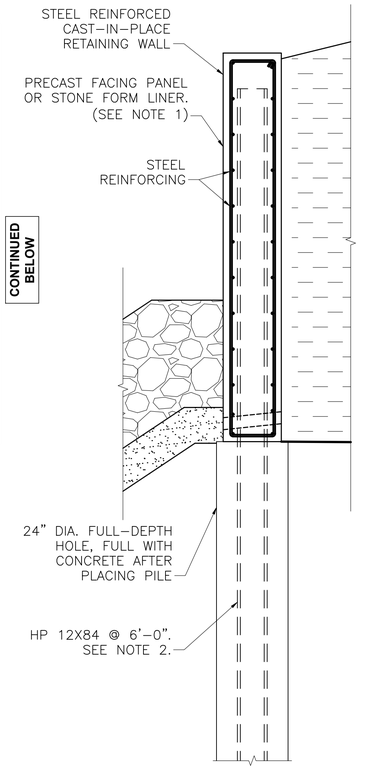
REMOVE BARRIER AND INSTALL SPRAY APPLIED WATER PROOFING MEMBRANE AND HMA WEARING SURFACE.

605311_SK23_BR(M05001-W06013).DWG Plotted on 12-Dec-2023 11:17 AM
605311 Sketch Plan Submittal (SP3) 27-APRIL-2023



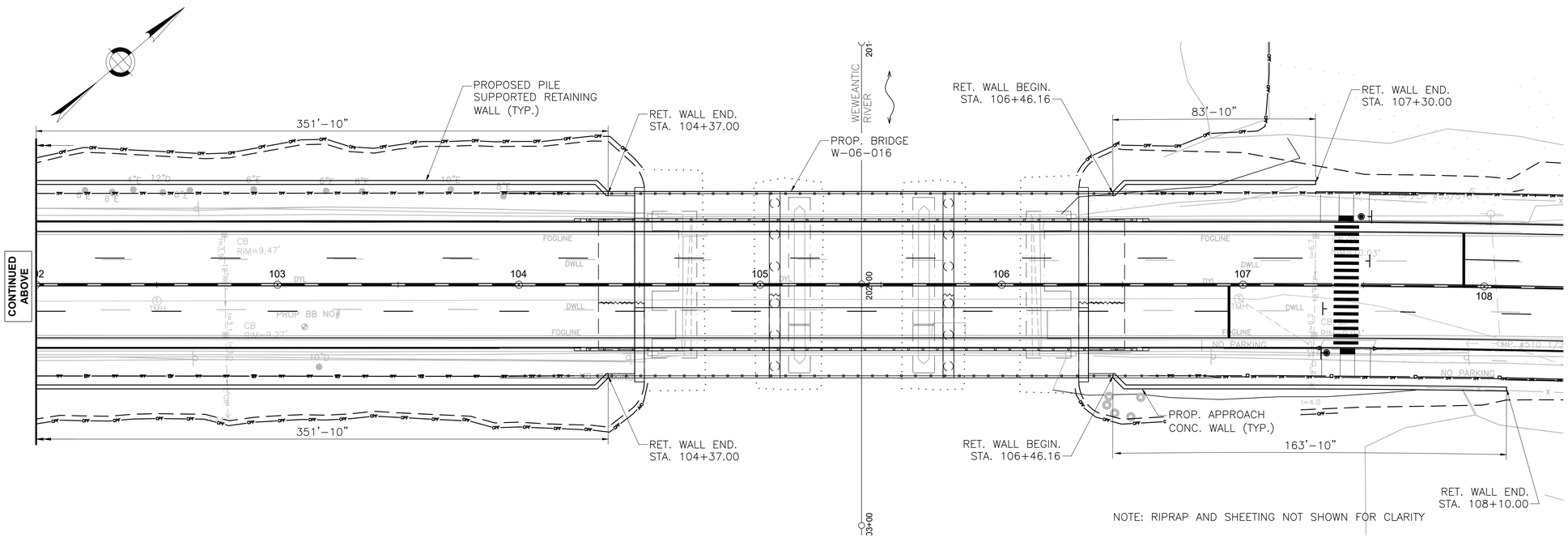
PILE SUPPORTED CONCRETE RETAINING WALL PLAN

NOT TO SCALE



PILE SUPPORTED CONCRETE RETAINING WALL DETAIL

SCALE: $\frac{1}{2}$" = 1'-0"



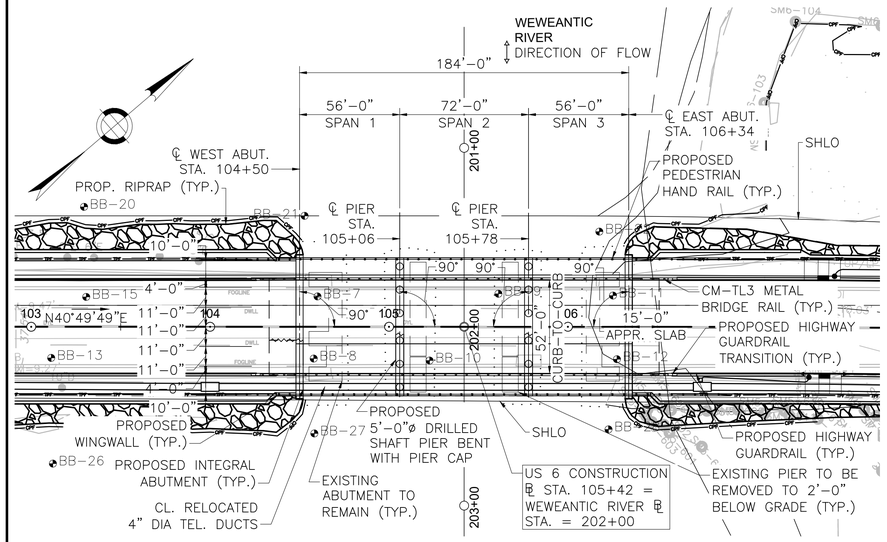
PILE SUPPORTED CONCRETE RETAINING WALL PLAN

NOT TO SCALE

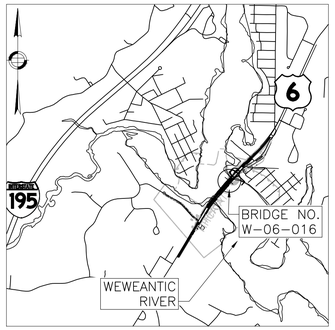
NOTES:

1. PRECAST CONCRETE FACING OR STONE TYPE FORM LINER TO PROVIDE AESTHETIC RETAINING WALL FINISH WILL BE EVALUATED FURTHER DURING FINAL DESIGN.
2. PILE SIZE AND SPACING IS BASED ON PRELIMINARY EVALUATION OF SOIL CONDITIONS AND DESIGN LOADING. THE RETAINING WALL WILL BE FURTHER EVALUATED DURING FINAL DESIGN TO OPTIMIZE PILE AND SPACING REQUIRED.

605311_SK25_BR\M05001-W06013).DWG Plotted on 12-Dec-2023 11:19 AM
605311 Sketch Plan Submittal (SP3) 27-APRIL-2023



KEY PLAN
SCALE: 1" = 40'



LOCUS
SCALE: 1" = 2000'

DESIGN:

IN ACCORDANCE WITH THE 2020 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO) LRFD BRIDGE DESIGN SPECIFICATIONS FOR HL-93 LOADING.

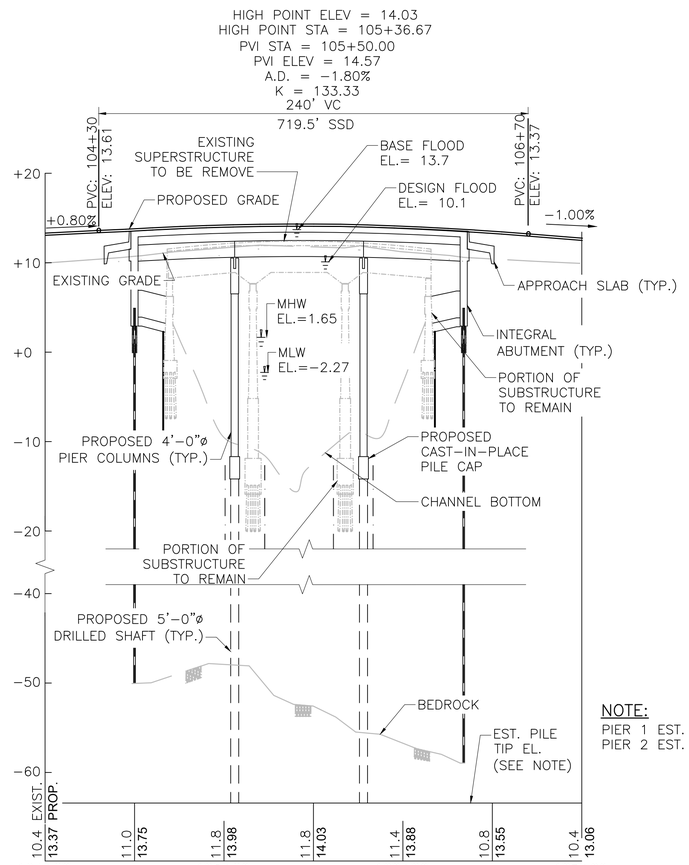
NOTES:

1. APPROVAL DOES NOT INCLUDE STRUCTURAL ANALYSIS.
2. DIMENSIONS OF STRUCTURAL MEMBERS ARE APPROXIMATE, AND WILL BE FINALIZED DURING THE FINAL DESIGN PHASE.
3. SEE GEOTECHNICAL REPORT, DATED DECEMBER 21, 2021 AND CAUSEWAY REPORT, DATED DECEMBER 20, 2021.
4. SEE PRELIMINARY HYDRAULIC REPORT, DATED JULY 3, 2019
5. NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.

TRAFFIC DATA		
	ROADWAY OVER	ROADWAY UNDER
DESIGN YEAR	2044	N/A
AVERAGE DAILY TRAFFIC – PRESENT	9,559	N/A
AVERAGE DAILY TRAFFIC – DESIGN YEAR	10,302	N/A
DESIGN HOURLY VOLUME	907	N/A
DIRECTIONAL DISTRIBUTION	DIST	N/A
TRUCK PERCENTAGE – AVERAGE DAY	2.3%	N/A
TRUCK PERCENTAGE – PEAK HOUR	2.45%	N/A
DESIGN SPEED	55 MPH	N/A
DIRECTIONAL DESIGN HOURLY VOLUME	439	N/A

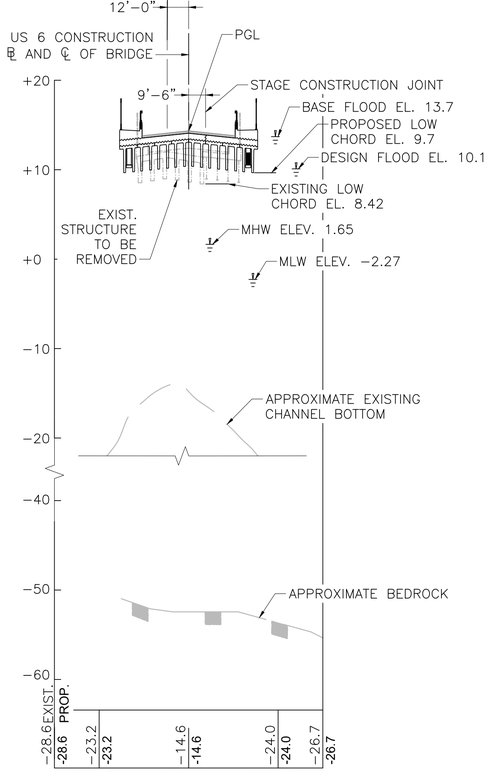
SEISMIC DESIGN CRITERIA	
DESIGN RETURN PERIOD:	1000 YEARS
DESIGN SPECTRA	
As	0.138
SDs	0.290
SD1	0.112
SITE CLASS	E
SEISMIC DESIGN CATEGORY (SDC)	A

HYDRAULIC DESIGN DATA		
DRAINAGE AREA:	N/A	SQ. MILES
DESIGN FLOOD DISCHARGE:	N/A	C.F.S.
DESIGN FLOOD FREQUENCY	25	YEARS
DESIGN FLOOD VELOCITY:	N/A	F.P.S.
DESIGN FLOOD ELEVATION:	10.1	FEET, NAVD
BASE (100-YEAR) FLOOD DATA		
BASE FLOOD DISCHARGE:	N/A	C.F.S.
BASE FLOOD ELEVATION:	13.7	FEET, NAVD
DESIGN AND CHECK SCOUR DATA		
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY:	50	YEARS
DESIGN FLOOD ABUTMENT SCOUR DEPTH:	2.0	FEET
DESIGN FLOOD PIER SCOUR DEPTH:	10.0	FEET
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY:	100	YEARS
CHECK FLOOD ABUTMENT SCOUR DEPTH:	5.5	FEET
CHECK FLOOD PIER SCOUR DEPTH:	12.0	FEET
FLOOD OF RECORD		
DISCHARGE:	N/A	C.F.S.
FREQUENCY (IF KNOWN):	N/A	YEARS
MAXIMUM ELEVATION:	N/A	FEET, NAVD
DATE:	N/A	MONTH, YEAR
HISTORY OF ICE FLOES:	N/A	N.A.
EVIDENCE OF SCOUR AND EROSION:	N/A	N.A.



PROFILE ALONG MARION ROAD (US 6)
HORIZONTAL 1" = 40'
VERTICAL 1" = 8'

NOTE:
PIER 1 EST. TIP EL. -70.70
PIER 2 EST. TIP EL. -78.30



CHANNEL PROFILE (LOOKING UPSTATION)
HORIZONTAL 1" = 40'
VERTICAL 1" = 8'

PROJECT INFORMATION			
PROJECT FILE NO.: 605311			
PROJECT DESCRIPTION: PROPOSED BRIDGE			
BRIDGE DESIGN LOADING: HL-93			
SURVEY: ELECTRONIC SURVEY BY SURVEY AND MAPPING CONSULTANTS (SMC)			
ELEVATION REFERENCE: NAVD OF 1988			
BENCH MARK:			
BENCHMARK	N 2730951.302	E 862244.338	8.513
BM	N 2731012.918	E 862341.519	9.915
BM	N 2729975.537	E 861297.506	15.758
BM	N 2730619.515	E 861833.717	17.320
POINT 1550	N 2729590.234	E 861126.664	17.719
BENCHMK	N 2730776.727	E 861969.623	11.500

100 HIGH STREET
BOSTON, MA 02110

MassDOT Massachusetts Department of Transportation Highway Division

SKETCH PLANS OF PROPOSED BRIDGE

WAREHAM

US 6 (MARION ROAD)
OVER WEWEANTIC RIVER

MASSACHUSETTS DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION

APPROVED BY DATE

STRUCTURAL ELEMENTS:

TITLE:

HIGHWAY ELEMENTS:

TITLE:

605311_SK01_BRW06016).DWG Plotted on 12-Dec-2023 12:39 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

TEST BORING REPORT

Boring No. BB-7

Project BRIDGE W-06-016, WAREHAM ST (US 6), WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 3
Start 12 December 2017
Finish 15 December 2017
Driller C. Bierholm
H&S Rep. D. Palleiko
Elevation 10.8
Datum NAVD 1988
Location Northing: 2730640.2
Easting: 861866.5

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW/NW	S	-	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4/3	1 3/8	-	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	Spin	140	-	Casing: PW Spin 24', HW Spin 44', NW Spin 60.25'
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					10.1	-BITUMINOUS CONCRETE-										
	8 30 20 12	S1 15	1.0 3.0	SW	0.8	Very dense gray fading to light brown then tan well graded SAND (SW), mps 0.8 in., pockets of poorly graded sand, no odor, moist		10	15	30	40	5				
	14 11 10 11	S2 14	4.0 6.0	SP		Medium dense tan poorly graded SAND (SP), mps 0.8 in., no structure, no odor, moist		10		10	75	5				
5						-FILL-										
	6 15 12 6	S3 5	9.0 11.0	SP		Medium dense tan to light brown with gray poorly graded SAND (SP), mps 0.5 in., no structure, no odor, wet		10		10	75	5				
10																
	10 6 10 12	S4 5	14.0 16.0	SW		Medium dense tan well graded SAND (SW), mps 1.0 in., no structure, no odor, wet		10	15	30	40	5				
15																
	5 1/12	S5 5	19.0 21.0		-8.7 19.5	-ORGANIC DEPOSITS-										
20																

EL. 1.80
OBSERVED DEC. 15, 2017

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
12/15/17	1415	0.5	--	11.5	9.0

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary

Overburden (ft)	60.25
Rock Cored (ft)	--
Samples	13S
Boring No.	**BB-7**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB–7

TEST BORING REPORT

Boring No. BB-7
File No. 40991-005
Sheet No. 2 of3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	1			OL/OH	-12.2 23.0	Very soft tan to dark brown ORGANIC SILT (OL/OH), mps 0.5 in., single layer of sandy SILT 6 in. thick, weak to moderate hydrogen sulfide odor, mussel shells			5			5	90	S	L	N
						-ORGANIC DEPOSITS-										
25	5 6 8	S6 6	24.0 26.0	SP	-17.2 28.0	Medium dense gray poorly graded SAND (SP), mps 0.05 in., no structure, no odor, wet					10	90				
						-GLACIOLACUSTRINE DEPOSITS-										
30	7 4 4 7	S7 10	29.0 31.0	ML		Loose tan to light brown SILT with sand (ML), mps 0.05 in., no structure, no odor, wet						15	85	R	L	N
						-GLACIOLACUSTRINE DEPOSITS-										
35	5 8 10 8	S8 11	34.0 36.0	ML		Medium dense tan to light brown SILT with sand (ML), mps 0.05 in., no structure, no odor, weak						20	80	R	L	N
					-27.2 38.0											
40	9 10 12 12	S9 2	39.0 41.0	SM		Medium dense tan to light brown silty SAND with gravel (SM), mps 1.2 in. no structure, no odor, wet Note: Lost 5 ft of HW (4") casing at 40 to 45 ft.	10	15	15	25	20	15				
						-GLACIOFLUVIAL DEPOSITS-										
45	12 10 8 13	S10 3	44.0 46.0	SP		Medium dense tan poorly graded SAND with gravel (SP), mps 0.5 in., no structure, no odor, wet		15	5	25	50	5				
	6	S11	49.0	SW		Loose light brown well graded SAND with gravel (SW), mps 1.0 in., no		15	20	25	35	5				

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-7

BORING BB–7

BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON THE PLAN THUS: ◕
2. BORINGS ARE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF THE MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1 3/8" I.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30".
5. BORING SAMPLES ARE STORED AT A STORAGE FACILITY LOCATED ON ROUTE 114 (219 WINTHROP AVE.) IN LAWRENCE, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE MASSDOT GEOTECHNICAL SECTION AT 10 PARK PLAZA, BOSTON, MA.
6. BB–7 TO BB–13 WERE MADE IN DECEMBER, 2017 THROUGH MARCH, 2018. BORINGS BB–15 TO BB–28A WERE MADE IN DECEMBER 2020 THROUGH JANUARY 2021.
7. BORINGS WERE MADE BY NORTHERN DRILL SERVICE, INC.
8. THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.

GROUND WATER:

THE WATER LEVELS RECORDED IN THE TABLE ARE THOSE MEASURED ON THE DATES GIVEN AND DO NOT NECESSARILY REPRESENT GROUND WATER LEVEL AT TIME OF CONSTRUCTION.

H:\HA-TEST BORING\2-09 REV 1\HA-LIB09-BOS-REV-GLB 9\HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18
605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:39 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-7
File No. 40991-005
Sheet No. 3 of3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50	6 4 3	4	51.0			structure, no odor, wet										
						-GLACIOFLUVIAL DEPOSITS-										
55	6 14 19 43	S12 11	54.0 56.0	SW		Similar to above, except dense, mps 1.2 in.	10	10	20	25	30	5				
						Note: Encountered cobble from 56.5 to 57.0 ft.										
60	32 75 20/3"	S13 10	59.0 60.3	SW	-49.5 60.3	Very dense light brown well graded SAND with gravel (SW), mps 1.0 in., no structure, no odor, wet Note: Spoon refusal at 60.3 ft. Bedrock chips in tip consistent with bedrock observed at BB-8. POSSIBLE TOP OF BEDROCK AT 60.3 FT BOTTOM OF EXPLORATION 60.3 FT	10	10	20	25	30	5				

APPROX. BOT. OF PILE TIPS AND TOP OF BEDROCK EL. −49.8

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-7

HA-TEST BORING-09 REV HA-LIB09-BOS-REV; GLB HA-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18

TEST BORING REPORT

Boring No. BB-8

Project BRIDGE W-06-016, WAREHAM ST (US 6), WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW/NW	S	NX	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4/3	1 3/8	2.0	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	Spin	140	-	Casing: PW Spin 30', HW Spin 51', NW Spin 63'
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

File No. 40991-005
Sheet No. 1 of 4
Start 28 November 2017
Finish 1 December 2017
Driller C. Bierholm
H&A Rep. D. Palleiko
Elevation 11.7
Datum NAVD 1988
Location Northing: 2730615.9
Easting: 861891.4

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					11.0 0.8	-BITUMINOUS CONCRETE PAVEMENT-										
	15 23 60/0"	S1 9	1.0 2.0	SM		Very dense gray fading to light brown silty SAND (SM), mps 0.5 in., no structure, no odor, moist Note: Encountered granite block from 2.0-3.0 ft.		10	5	5	65	15				
5	3 4 4 3	S2 6	4.0 6.0	SW		Loose brown well graded SAND (SW), mps 0.8 in., no structure, no odor, moist	5	5	15	30	40	5				
						-FILL-										
10	11 7 6 9	S3 3	9.0 20.0	GW		Medium dense light brown well graded GRAVEL with sand (GW), mps 1.2 in., no structure, no odor, wet Note: Encountered granite obstruction from 11.5-13.2 ft.	45	25	5	10	15					
15	3 3 4 8	S4 1	14.0 16.0	SW		Loose light brown well graded SAND (SM), mps 0.3 in., no structure, no odor, wet Note: Encountered cobbles from 16.5-17.3 ft. Note: Encountered cobbles from 17.5-18.5 ft.										
20	8 12	S5 9	19.0 21.0	SW		Medium dense light gray to light brown well graded SAND (SM), mps 0.5 in., no structure, no odor, wet	5	5	20	30	35	5				

EL. 6.59 OBSERVED NOV. 30, 2017

EL. 1.20 OBSERVED DEC. 01, 2017

EL. −0.42 OBSERVED DEC. 01, 2017

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
11/30/17	0920	18	51.0	51.0	5.11
12/1/17	0925	18	63.0	68.0	10.5
12/1/17	1210	0.2	63.0	77.0	12.12

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 67.0
Rock Cored (ft) 10.0
Samples 13S, 3C

Boring No. BB-8

Field Tests: Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HA-TEST BORING-09 REV HA-LIB09-BOS-REV; GLB HA-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18

BORING BB−7

BORING BB−8

605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:39 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-8
File No. 40991-005
Sheet No. 2 of4

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	12 14					-FILL-										
					-10.3 22.0	Note: Wash water change at 22.0 ft.										
	5 5 6 3	S6 11	24.0 26.0	SP		Medium dense gray poorly graded SAND (SP), mps 0.10 in., no structure, no odor, wet				5	95					
25						-GLACIOLACUSTRINE DEPOSITS-										
					-16.3 28.0											
	2 5 6 12	S7 12	29.0 31.0	ML		Medium dense gray to olive gray SILT (ML), mps 0.05 in., no structure, no odor, wet						100	R	L	N	
30						-GLACIOLACUSTRINE DEPOSITS-										
	17 9 17 22	S8 1	34.0 36.0	ML		Medium dense olive gray sandy SILT (ML), mps 0.3 in., no structure, no odor, wet		15	5	10	15	55				
35																
	22 17 15 18	S9 10	39.0 41.0	SW		Dense light brown well graded SAND with gravel (SW), mps 1.2 in., frequent fining upward beds with gravel pieces, no odor, wet	10	15	15	25	30	5				
40						Note: Occasional gravel/cobbles.										
					-32.3											
	14 16 126	S10 9	44.0 45.5	ML	44.0	Very dense light brown sandy SILT (ML), mps 1.2 in., weakly bonded, no odor, moist -GLACIAL TILL- (FLOW TILL)					30	70				
45					-36.3 48.0	Note: Occasional cobbles and boulders up to 2.0 ft thick -GLACIOLACUSTRINE DEPOSITS-										
	11	S11	49.0	ML		Medium dense tan sandy SILT (ML), mps 0.05 in., no structure, no odor,					30	70	M	L	N	

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-8

BORING BB–8

TEST BORING REPORT

Boring No. BB-8
File No. 40991-005
Sheet No. 3 of4

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50	16 14 22	13	51.0			wet -GLACIOLACUSTRINE DEPOSITS-										
					-39.3 51.0											
						Note: Occasional cobbles/boulders.										
55	31 121 42 47	S12 15	54.0 56.0	SM		Very dense gray brown to gray silty SAND (SM), mps 1.2 in., weakly bonded, no odor, wet	10			5	70	15				
						-GLACIAL TILL-										
						Note: Occasional cobbles and boulders up to 18.0+ in.										
60	29 41 49 80	S13 14	59.0 61.0	SM		Very dense tan silty SAND (SM), mps 1.0 in., weakly bonded, no odor, moist	10			5	70	15				
						Note: Drill action change. Bit advances hard and smooth. TOP OF BEDROCK AT 61.5 FT										
					-49.8 61.5	Note: Advanced roller bit to 67.0 ft, consistent drill action, set NW casing to 63.0 ft.										
65						SEE CORE BORING REPORT FOR ROCK DETAILS										
70																
75																

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-8

APPROX. BOT. OF PILE TIPS AND TOP OF BEDROCK EL. –49.8

BORING BB–8

H:\HA-TEST BORING.G9 REV H\HA-LIB09-BOS-REV\ GLB HA-TB+CORE+WELL-G9 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18
H:\HA-TEST BORING.G9 REV H\HA-LIB09-BOS-REV\ GLB HA-TB+CORE+WELL-G9 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18
605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:39 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

CORE BORING REPORT

Boring No. BB-8
File No. 40991-005
Sheet No. 4 of 4

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
	5	C1	67.0 68.0	3 0	25 0	Fresh		C1: Core jam at 68.0 ft. Advanced roller bit to 68.0 ft to clear borehole.
	4	C2	68.0 72.0	48 46	100 96	Fresh		C1-C2, 67.0-72.0 ft: Very hard, fresh, very coarse to fine grained GRANITIC GNEISS. Massive. Primary joints low angle, moderately close, rough, planar, discolored with iron staining, tight. Secondary joints moderately dipping, moderately spaced, rough, planar, fresh, tight.
70	4							
	5							-BEDROCK- (GRANITIC GNEISS)
	4							
	5	C3	72.0 77.0	44 34	73 57	Fresh		C3: Very hard, fresh, very coarse to fine grained GRANITIC GNEISS. Massive. Primary joints low angle, moderately close to widely spaced, rough, planar, fresh, tight. Secondary joints vertical, widely spaced, rough, planar, fresh, tight.
	6							
	8							
75	21							
	10						-65.3 77.0	BOTTOM OF EXPLORATION 77.0 FT
80								
85								
90								
95								
100								

H:\A_CORE+WELL-09 HA-LIB09-BOS-REV_GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18

BORING BB–8

TEST BORING REPORT

Boring No. BB-9

Project BRIDGE W-06-016, WAREHAM ST (US 6), WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 3
Start 20 March 2018
Finish 27 March 2018
Driller C. Bierholm
H&A Rep. D. Palleiko
Elevation -9.8
Datum NAVD 1988
Location Northing: 2730717.7
Easting: 861931.5

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW/NW	S	NX	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4/3	1 3/8	2.0	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	300	140	-	Casing: PW Spin 8', HW Drive 42.5', NW Spin 46.5'
Hammer Fall (in.)	24	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	12 7 8 14	S1* 10	0.0 2.0	GP-GM		Bridge deck is 0.35 ft Bituminous Pavement and 0.65 ft Concrete. 21.5 ft bridge deck to river bottom. Medium dense black poorly graded GRAVEL with silt and sand (GP-GM), mps 1.2 in., no structure, no odor, wet	31	19	7	14	19	10				
	22 11 9 5	S2 6	2.5 4.5	SM		Medium dense black silty SAND with gravel (SM), mps 1.2 in., no structure, no odor, wet -FLUVIAL DEPOSITS-	10	15	15	20	20	20				
5	1 3 2 5	S3* 8	4.5 6.5	SP-SM		Loose black poorly graded SAND with silt and gravel (SP-SM), mps 1.2 in., no structure, no odor, wet, trace shell fragments		24	14	27	25	10				
	5 3 4 2	S4* 10	6.5 8.5	ML	-16.3 6.5	Loose olive brown SILT (ML), mps 0.1 in., no structure, no odor, wet -GLACIOLACUSTRINE DEPOSITS-					5	95	R	L	N	
	1 2 2 2	S5 7	8.5 10.5	ML		Very loose olive brown SILT (ML), mps 0.05 in., occasional layers of lean clay up to 1/2 in. thick, no odor, wet					10	90	R	L	N	
10	4 2 3 3	S6 8	10.5 12.5	ML		Loose olive brown SILT (ML), mps 0.05 in., no structure, no odor, wet					5	95	R	L	N	
	2 3 4 6	S7* 20	12.5 14.5	ML		Similar to above Note: * indicates sample gradation based on geotechnical laboratory index testing.					3	97	R	L	N	
15						Note: Drill action indicates change at 15.5 ft.										
					-25.3 15.5	Note: Casing advancement slows.										
	24 20 14 10	S8 7	17.5 19.5	SM		Dense light brown to tan silty SAND (SM), mps 1.2 in., no structure, no odor, wet -GLACIOFLUVIAL DEPOSITS-	10		15	20	40	15				
20																

H:\A-TEST BORING-09 REV H+A-LIB09-BOS-REV_GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18

Water Level Data **

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
3/26/18	0930	66	58.25*	58.15*	11.76*
3/27/18	1300	0.25	58.25*	58.25*	12.93*

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary
Overburden (ft) 46.5
Rock Cored (ft) 15.25
Samples 13S, 4C
Boring No. BB-9

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Note: ** indicates sample and stratum depths measured relative to the mudline. Water level data depths, however, are measured with respect to the bridge deck. Water level is tidal. Bridge deck is at El. 11.7; river bottom is at El. -9.8.

EL. −21.56
OBSERVED MAR. 26, 2018
EL. −22.73
OBSERVED MAR. 27, 2017

BORING BB–9

605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:39 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-9
File No. 40991-005
Sheet No. 2 of3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20						-GLACIOFLUVIAL DEPOSITS-										
						Note: Occasional cobble.										
	9 8 5 9	S9 6	22.5 24.5	SW-SM		Medium dense light brown well graded SAND with silt and gravel (SW-SM), mps 1.0 in., no structure, no odor, wet		15	15	20	40	10				
25																
	15 17 20 22	S10 19	27.5 29.5	ML	-37.3 27.5	Dense tan SILT (ML), mps 0.01 in., no structure, no odor, wet					5	95	R	L	N	
						-GLACIOLACUSTRINE DEPOSITS-										
30	16 20 25 24	S11 15	32.5 34.5			Dense tan SILT (ML), mps 0.01 in., no structure, no odor, wet					5	95	R	L	N	
35					-45.8 36.0	Note: Casing advancement slows.										
						Note: Casing advancement slows.										
	100/5"	S12 4	37.5 37.9	SW		Very dense gray well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, wet	5	15	20	25	30	5				
						-GLACIOFLUVIAL DEPOSITS-										
40						Note: Occasional cobble.										
	42 65 100/1"	S13 11	42.5 43.6	SW		Very dense gray well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, wet	5	15	20	25	20	15				
						Note: Drill action change. Rollerbit advances with difficulty for 1.5 ft then completely weathered rock from 45.1-45.6 ft. Rolls hard 45.6-46.5 ft. Set 3-in. casing to 46.5 ft.										
45					-55.3 45.5	TOP OF BEDROCK AT 45.5 FT										
						SEE CORE BORING REPORT FOR ROCK DETAILS										
						Note: To obtain extra samples for environmental testing and scour analysis, a 3-in. sampler was driven over the same interval following SPT sampling with the 2-in. sampler. This was done for the continuous samples in the upper 10.0-15.0 ft.										

APPROX. TOP OF BEDROCK
EL. −55.3

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-9

HA-TEST BORING-09 REV HA-LIB09-BOS-REV GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18

BORING BB−9

CORE BORING REPORT

Boring No. BB-9
File No. 40991-005
Sheet No. 3 of 3

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
	4 6 6 6 7	C1	46.5 51.5	60 51	100 85	Fresh		C1: Very hard, fresh, gray, pink and grey green speckled, medium to coarse grained GRANITIC GNEISS. Massive. Primary joints low angle, moderately close to widely spaced, rough, planar to undulating, tight, iron stained. Secondary joints high angle, moderately close, rough, planar, discolored with iron staining, tight, poorly developed shear/flow structure in rock mass.
50								Note: Frequent core jams from 51.5-54.8 ft.
								-BEDROCK- (GRANITIC GNEISS)
	Jam 4 NR	C2	51.5 54.8	39 35	98 88	Fresh		C2: Very hard fresh, gray, pink and gray green speckled, medium to coarse grained GRANITIC GNEISS. Massive. Primary joints low angle, moderately to widely spaced, rough, planar to undulating, iron stained, tight. Secondary joints high angle, moderately close, rough, planar to undulating, fresh, tight.
55	11 12 11 8 8	C3	54.8 59.8	60 58	100 97	Fresh		C3 and C4: Very hard, fresh, gray, pink and gray green, medium to coarse grained GRANITIC GNEISS. Massive. Primary joints low angle, moderately spaced, rough to occassionally smooth, undulating to planar, discolored with iron staining, tight. Secondary joints high angle, moderately close to very close, rough, undulating, fresh, tight, common calcite or epidote infilled/healed.
60	7 7	C4	59.8 61.8	18 14	75 58	Fresh		
							-71.6 61.8	BOTTOM OF EXPLORATION 61.8 FT
65								
70								
75								
80								

APPROX. BOTTOM OF DRILLED SHAFT AND TOP OF ROCK SOCKET
EL. −71.3

APPROX. BOTTOM OF ROCK SOCKET
EL. −78.3

HA_CORE+WELL-09 HA-LIB09-BOS-REV GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18

BORING BB−9

605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:39 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-10

Project BRIDGE W-06-016, WAREHAM ST (US 6), WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 3
Start 16 March 2018
Finish 20 March 2018
Driller C. Bierholm
H&A Rep. D. Palleiko
Elevation -21.2
Datum NAVD 1988
Location Northing: 2730664.2
Easting: 861934.6

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW/NW	S	NX	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4/3	1 3/8	2.0	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: PW Spin 0.8', HW Drive 26', NW Spin
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	1 8 6 5	S1* 8	0.0 2.0	GW-GM		0.8 ft Concrete/Asphalt Bridge Deck. 33.0 ft bridge deck to river bottom. Medium dense gray well graded GRAVEL with silt and sand (GW-GM), mps 1.2 in., no structure, no odor, wet	6	45	17	16	10	6				
					-23.2	-FLUVIAL DEPOSITS-										
	6 9 13 15	S2 10	2.0 4.0	SP-SM	2.0	Medium dense gray to brown poorly graded sand (SP), mps 1.2 in., no structure, no odor, wet	10			25	55	10				
						-GLACIOLACUSTRINE DEPOSITS-										
	5 7 7 10	S3* 12	4.0 6.0	SM		Medium dense light brown to brown silty SAND with gravel (SM), mps 0.3 in., no structure, no odor, wet	7	10	9	25	33	16				
5	8 14 5 6	S4 12	6.0 8.0	SP		Medium dense gray brown to black poorly graded SAND (SP), mps 0.8 in., no structure, no odor, wet										
					-29.2											
	25 46 41 53	S5* 16	8.0 10.0	GM	8.0	Very dense gray silty GRAVEL with sand (GM), no structure, no odor, moist	21	14	8	12	14	31	R	L	N	
10	29 29 21 26	S6 20	10.0 12.0	SP		Very dense tan poorly graded SAND (SP), mps 0.1 in., no structure, no odor, wet		5	5	5	80	5				
						-GLACIOFLUVIAL DEPOSITS-										
						Note: * indicates sample gradation based on geotechnical laboratory index testing.										
15	19 16 9 9	S7 11	16.0 18.0	SW		Medium dense gray brown well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, wet	10	15	20	20	30	5				
						-GLACIOFLUVIAL DEPOSITS-										
20																

EL. +1.08
OBSERVED MAR. 19, 2018

EL. +0.05
OBSERVED MAR. 20, 2018

Water Level Data**

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
3/19/18	0930	70	26.5	26.5	+22.28
3/20/18	0920	18.5	30.5	45.5	+21.25

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 30.5
Rock Cored (ft) 15.0
Samples 9S, 3C
Boring No. BB-10

Field Tests: Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Note: ** indicates sample and stratum depths measured relative to the mudline. Water level data depths, however, are measured with respec tto the bridge deck. Water level is tidal. Bridge deck is at El. 11.8; river bottom is at El. -21.2.

BORING BB–10

TEST BORING REPORT

Boring No. BB-10
File No. 40991-005
Sheet No. 2 of3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20					-41.7	-GLACIOFLUVIAL DEPOSITS-										
	12 23 19 17	S8 19	21.0 23.0	ML	20.5	Dense light brown SILT with sand (ML), mps 0.05 in., no structure, no odor, wet				5	15	80	R	L	N	
						-GLACIOLACUSTRINE DEPOSITS-										
25	100/5"	S9 5	26.0 26.5	ML	-47.7 26.5	Very dense gray SILT with gravel (ML), mps 1.2 in., no structure, no odor, wet	30				5	65	R	L	N	
						TOP OF BEDROCK AT 26.5 FT										
						Note: Spoon refusal at 26.5 ft. Spin 3-in. casing through completely WEATHERED BEDROCK from 26.5-28.5 ft as indicated by wash. Set 3 3-in. casing at 30.5 ft to start C1.										
					-49.7 28.5	TOP OF HARDER BEDROCK AT 28.5 FT										
30					-51.7 30.5	SEE CORE BORING REPORT FOR ROCK DETAILS										
						Note: To obtain extra samples for environmental testing and scour analysis, a 3-in. sampler was driven over the same interval following SPT sampling with the 2-in. sampler. This was done for the continuous samples in the upper 10.0-15.0 ft.										
35																
40																
45																

APPROX. TOP OF BEDROCK
EL. –47.7

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-10

BORING BB–10

HA-TEST BORING-09 REV HA-LIB09-BOS-REV: GLB HA-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18
HA-TEST BORING-09 REV HA-LIB09-BOS-REV: GLB HA-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18
605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:39 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

CORE BORING REPORT

Boring No. BB-10
File No. 40991-005
Sheet No. 3 of 3

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weathering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
	3	C1	30.5	58	97	Fresh	-51.7	C1: Very hard, fresh, gray black and pink speckled, coarse grained GRANITIC GNEISS. Massive. Primary joints low angle, moderately close to widely spaced, rough, planar to undulating, tight to open, discolored with iron staining. Iron stain halos extend into rock mass. Rock mass shows some shearing of crystal matrix/flow structure poorly developed. Note: To obtain extra sample for environmental testing and scour analysis, a 3-in sampler was driven over hte same interval following SPT sampling with the 2-in simpler. This was done for the continuous samples in the upper 10-15.0 ft.
	3		35.5	55	92		30.5	
	4							-BEDROCK- (GRANITIC GNEISS)
35	3							
	4	C2	35.5	57	95	Fresh		C2: Very hard, fresh, gray black and pink speckled, coarse grained GRANITIC GNEISS. Massive. Primary joints low angle, closely spaced, rough, planar, discolored with iron staining. Iron stain halos extend into rock mass. Rock mass shows shearing and translocation of crystal matrix as poorly developed flow bands.
	3		40.5	38	63			
	4							
	4							
40	4							
	4	C3	40.5	57	95	Fresh		C3: Very hard, fresh, gray black pink and green speckled, coarse grained GRANITIC GNEISS. Massive. Primary joints low angle, closely spaced, rough, planar, discolored with iron staining, tight. Iron stain halos extend into rock mass. Occasional pods and pockets of epidote. Indistinct flow bands, poorly developed.
	NR		45.5	48	80			
	NR							
	NR							
45	NR							
							-66.7	
							45.5	BOTTOM OF EXPLORATION 45.5 FT
50								
55								
60								
65								

APPROX. BOTTOM OF DRILLED SHAFT AND TOP OF ROCK SOCKET
EL. −63.7

APPROX. BOTTOM OF ROCK SOCKET
EL. −70.7

H:\A_CORE+WELL-09\HA-LIB09-BOS-REV\GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13-Jun-18

BORING BB−10

TEST BORING REPORT

Boring No. BB-11

Project BRIDGE W-06-016, WAREHAM ST (US 6), WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 4
Start 6 December 2017
Finish 12 December 2017
Driller C. Bierholm
H&A Rep. D. Palleiko
Elevation 10.8
Datum NAVD 1988
Location Northing: 2730765.5
Easting: 861974.1

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW/NW	S	NX	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4/3	1 3/8	2.0	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	Spin	140	-	Casing: PW Spin 30', HW Spin 69', NW Spin 71'
Hammer Fall (in.)	-	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					10.1	-BITUMINOUS CONCRETE PAVEMENT-										
					0.8											
	10	S1	1.0	SW		Dense light brown well graded SAND (SW), mps 1.0 in., no structure, no odor, moist		10	15	30	40	5				
	28	14	3.0													
	14															
	10															
	4	S2	4.0	SP		Medium dense light brown poorly graded SAND with gravel (SP), mps 1.2 in., no structure, no odor, moist	10	15	5	15	50	5				
5	8	6	6.0													
	8															
	70					Note: Granite obstruction in Fill from 6.5-8.5 ft.										
	4	S3	9.0	SW		Medium dense light brown well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, wet	40		15	20	25					
10	16	3	11.0													
	4					-FILL-										
	5															
	4	S4	14.0	SW		Very loose light brown well graded SAND (SW), mps 0.3 in., no structure, no odor, wet		5	20	30	45					
15	3	5	16.0													
	1															
	1															
					-8.2	Note: Wash water color change.										
	1	S5	19.0	PT	19.0	Very soft dark brown fibrous PEAT (PT), mps 0.10 in., fibrous organic mat, moderate hydrogen sulfide odor, wet						100	N	L	N	
20	1	13	21.0													

EL. 3.00
OBSERVED DEC. 11, 2017

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 71.0 Rock Cored (ft) 10.0 Samples 14S, 3C **Boring No. BB-11**
12/11/17	0930	64.0	49.0	49.0	7.8			

Field Tests: Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H:\A-TEST BORING\09 REV HA-LIB09-BOS-REV\GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18

BORING BB−11

605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:39 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-11
File No. 40991-005
Sheet No. 2 of4

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	1 1					-ORGANIC DEPOSITS-										
					-12.2 23.0	Note: Drill action and wash water color change at 23.0 ft.										
25	7 12 12 17	S6 11	24.0 26.0	SP		Medium dense tan to light brown poorly graded SAND (SP), mps 0.5 in., slight fining-up sequence, no odor, wet				5	15	75	5			
						-GLACIOFLUVIAL DEPOSITS-										
30	29 14 8 12	S7 5	29.0 31.0	SM		Medium dense light gray silty SAND with gravel (SM), mps 1.2 in., no structure, no odor, wet	5	15	10	25	30	15				
						Note: Occasional cobbles.										
35	7 14 13 14	S8 6	34.0 36.0	SW		Medium dense gray well graded SAND with gravel (SW), mps 0.8 in., no structure, no odor, wet	10	15	25	30	20					
					-27.2 38.0											
40	9 22 24 32	S9 15	39.0 41.0	SP-SM		Dense light brown to tan poorly graded SAND with SILT (SP-SM), mps 0.05 in., increasing silt with depth, no odor, wet						90	10	R	L	N
						-GLACIOLACUSTRINE DEPOSITS-										
					-32.2 43.0											
45	13 24 24 30	S10 17	44.0 46.0	ML		Dense tan SILT (ML), mps 0.05 in., no structure, no odor, wet						5	95	R	L	N
						-GLACIOLACUSTRINE DEPOSITS-										
	17	S11	49.0	ML		Dense tan SILT with sand (ML), mps 0.05 in., no structure, no odor, wet						20	80	R	L	N

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-11

H&A-TEST BORING-09 REV H4A-LIB09-BOS-REV GLB H4A-TB+CORE+WELL-09 W FENCE GDT G:\40991\GINT\40991-005-TBCB3-2.GPJ 13 Jun 18 08:39:42 CB-2 GPJ 13 Jun 18

BORING BB–11

TEST BORING REPORT

Boring No. BB-11
File No. 40991-005
Sheet No. 3 of4

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50	23 24 18	15	51.0			-GLACIOLACUSTRINE DEPOSITS-										
55	16 23 36 43	S12 11	54.0 56.0	ML		Very dense tan SILT with sand (ML), mps 0.05 in., no structure, no odor, wet						15	85	R	L	N
					-47.2 58.0	Note: Gravel layer.										
60	20 35 42 25	S13 13	59.0 61.0	SM		Very dense tan silty SAND with gravel (SM), mps 0.8 in., no structure, no odor, wet		15	10	15	45	15				
						Note: Drill action indicates cobbles from 61.5-62.2 ft.										
						-GLACIOFLUVIAL DEPOSITS-										
65	28 39 40 48	S14 17	64.0 66.0	SM		Very dense tan silty SAND with gravel (SM), mps 0.8 in., no structure, no odor, wet	5	5	20	15	40	15				
						Note: Drill action indicates top of rock at 69.5 ft.										
						TOP OF BEDROCK AT 69.5 FT										
70					-58.7 69.5	Note: Advance roller bit to 71.0 ft and start C1.										
						SEE CORE BORING REPORT FOR ROCK DETAILS										
75																

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-11

APPROX. BOT. OF PILE TIPS AND TOP OF BEDROCK EL. –58.7

H&A-TEST BORING-09 REV H4A-LIB09-BOS-REV GLB H4A-TB+CORE+WELL-09 W FENCE GDT G:\40991\GINT\40991-005-TBCB3-2.GPJ 13 Jun 18 08:39:42 CB-2 GPJ 13 Jun 18

BORING BB–11

605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:39 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

CORE BORING REPORT

Boring No. BB-11
File No. 40991-005
Sheet No. 4 of 4

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weath-ering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
	6	C1	71.0	48	100	Fresh		C1: Very hard, fresh, pink and gray speckled, medium to very coarse grained GRANITIC GNEISS, occasionally foliated. Primary joints low angle, moderately to widely spaced, rough, planar, iron staining, tight. Secondary joints moderate angle, moderately to closely spaced, rough, planar, iron stained to occasionally disintegrated, tight.
	4		75.0	36	75			-BEDROCK- (GRANITIC GNEISS)
	5							
75	4							
	7	C2	75.0	24	100	Fresh		C2: Very hard, fresh, pink and gray speckled, medium to very coarse grained GRANITIC GNEISS. Massive. Primary joints moderate angle, moderately spaced, smooth, planar to slightly undulating, disintegrated to occasionally iron stained, tight.
	9		77.0	23	96			
	8	C3	77.0	42	88	Fresh to Moder-ate		C3: Very hard, fresh, moderately weathered, pink and gray speckled, medium to coarse grained GRANITIC GNEISS. Primary joints low angle, moderately spaced, smooth to rough, planar to slightly undulating, decomposed to disintegrated, iron stained, tight. Secondary joints moderate angle, moderately spaced, smooth, planar, disintegrated, limonite and epidote coated, tight.
	6		81.0	26	54			
	6							
80	7						-70.2	
							81.0	BOTTOM OF EXPLORATION 81.0 FT
85								
90								
95								
100								
105								

H:\A_CORE+WELL-09\HA-LIB09-BOS-REV\GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\IGNT\40991-005-TBCB-2.GPJ 13 Jun 18

BORING BB–11

TEST BORING REPORT

Boring No. BB-12

Project BRIDGE W-06-016, WAREHAM ST (US 6), WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 4
Start 4 December 2017
Finish 5 December 2017
Driller C. Bierholm
H&A Rep. D. Palleiko/S. Gately
Elevation 10.7
Datum NAVD 1988
Location Northing: 2730743.9
Easting: 862002.5

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW/NW	S	NX	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4/3	1 3/8	2.0	Bit Type: Roller Bit
Hammer Weight (lb)	Spin	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: PW Spin 25', HW Spin 62', NW Spin 64'
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					10.0	-BITUMINOUS CONCRETE PAVEMENT-										
					0.8											
	23 120/2"	S1 8	1.0 1.8	SM		Very dense black fading to brown silty SAND with gravel (SM), mps 1.2 in., no structure, no odor, moist	15	15	10	20	25	15				
						-FILL-										
						Note: Encountered metal obstruction. Moved 2 ft NE.										
5	5 4 2 4	S2 6	4.0 6.0	SW		Loose light brown well graded SAND (SW), mps 0.8 in., no structure, no odor, wet		10	15	30	40	5				
10	6 5 4 3	S3 5	9.0 11.0	SW		Loose light brown to gray well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, wet	10	10	15	25	35	5				
						Note: Drill action change indicates boulders in FILL from 12.0-16.0 ft.										
15	6 13 22 100/11"	S4 9	16.0 17.6	SW		Dense light brown well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, wet	10	15	15	25	35					
						Note: Encountered boulder from 17.6-19.0 ft.										
20	12 6	S5 10	19.0 21.0	SP		Medium dense gray to brown poorly graded SAND (SP), mps 0.10 in., no structure, no odor, wet			5	5	85	5				

EL. 2.55
OBSERVED DEC. 04, 2017

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 62.0 Rock Cored (ft) 5.0 Samples 13S, 1C **Boring No. BB-12**
12/4/17	1300	--	26.0	30.0	8.15			

Field Tests: Dilatancy: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H:\A-TEST BORING\09 REV HA-LIB09-BOS-REV\GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\IGNT\40991-005-TBCB-2.GPJ 13 Jun 18

BORING BB–12

605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:39 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-12
File No. 40991-005
Sheet No. 2 of4

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	10 10					-FILL-										
						Note: Wash water color change to dark brown.										
					-12.3 23.0											
	3 4 00/2"	S6 7	24.0 25.2	SM		Soft dark brown and light gray organic silty SAND (SM), mps 0.5 in., intermixed with gray SILT (ML), moderate hydrogen sulfide odor, wet				5	25	35	35				
25					-14.5 25.2	-ORGANIC DEPOSITS-										
						Note: Encountered boulder 25.2-29.5 ft.										
						-FILL-										
					-18.8 29.5											
30	12 9 12 13	S7 4	30.0 32.0	SM		Medium dense gray silty SAND (SM), mps 0.2 in., no structure, no odor, wet				5	20	40	35				
						Note: Wash water changes color to red brown.										
	5 11 12 14	S8 9	34.0 36.0	SW		Medium dense red brown well graded SAND with gravel (SW), mps 1.0 in., no structure, no odor, wet	5	15	15	30	30	5				
35						-GLACIOFLUVIAL DEPOSITS-										
					-28.3 39.0											
	11 28 14 10	S9 5	39.0 41.0	SP		Dense tan poorly graded SAND (SP), mps 0.8 in., no structure, no odor, wet		5	5		85	5				
40						-GLACIOLACUSTRINE DEPOSITS-										
	20 33 35 41	S10 20	45.0 47.0	SP		Very dense tan poorly graded SAND (SP), mps 0.05 in., no structure, no odor, wet				5	90	5				
45					-37.3 48.0											
	18	S11	49.0	ML		Dense tan SILT with sand (ML), mps 0.05 in., no structure, no odor, wet					15	85	R	L	N	

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-12

BORING BB–12

TEST BORING REPORT

Boring No. BB-12
File No. 40991-005
Sheet No. 3 of4

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50	18 22 16	18	51.0			-GLACIOLACUSTRINE DEPOSITS-										
	13 25 31 35	S12 19	54.0 56.0	ML		Very dense tan SILT with sand (ML), mps 0.05 in., occasional interbeds of silty fine sand up to 6-in. thick, no odor, wet					25	75	R	L	N	
55																
	14 35 28 35	S13 20	59.0 61.0	ML		Very dense tan SILT with sand (ML), mps 0.3 in., occasional layer of silty SAND up to 1/2-in. thick, no odor, wet					15	85	R	L	N	
						Note: Occasional gravel to 62.0 ft.										
60						Note: Drill action change.										
					-51.3 62.0	TOP OF BEDROCK AT 62.0 FT										
						Note: Advanced roller bit to 64.0 ft. Consistent drill action, start C1 at 64.0 ft.										
						SEE CORE BORING REPORT FOR ROCK DETAILS										
65																

APPROX. BOT. OF PILE TIPS AND TOP OF BEDROCK EL. –58.7

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-12

BORING BB–12

H&A-TEST BORING.GDT REV H4A-LIB09-BOS-REV; GLB H4A-TB+CORE+WELL-GDT C:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18
H&A-TEST BORING.GDT REV H4A-LIB09-BOS-REV; GLB H4A-TB+CORE+WELL-GDT C:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18
605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:40 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

CORE BORING REPORT

Boring No. BB-12
File No. 40991-005
Sheet No. 4 of 4

Depth (ft)	Drilling Rate (min./ft)	Run No.	Run Depth (ft)	Recovery/RQD in.	Recovery/RQD %	Weath-ering	Elev./ Depth (ft)	Visual Description and Remarks
								SEE TEST BORING REPORT FOR OVERBURDEN DETAILS
65	3.5	C1	64.0	6	10			C1: Very hard, fresh, very coarse to fine grained GRANITE. Massive, primary joints moderately dipping, rough.
	3.8		69.0	6	10			Note: Poor recovery
	2							-BEDROCK-
	3.3							
	4						-58.3	
70							69.0	BOTTOM OF EXPLORATION 69.0 FT
75								
80								
85								
90								
95								

H:\A_CORE+WELL-09 HA-LIB09-BOS-REV\GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18

BORING BB–12

TEST BORING REPORT

Boring No. BB-13

Project BRIDGE W-06-016, WAREHAM ST (US 6), WAREHAM, MA
Client PARSONS TRANSPORTATION GROUP
Contractor NORTHERN DRILL SERVICE, INC.

File No. 40991-005
Sheet No. 1 of 3
Start 20 December 2017
Finish 21 December 2017
Driller C. Bierholm
H&A Rep. D. Palleiko
Elevation 9.5
Datum NAVD 1988
Location Northing: 2730505.1
Easting: 861795.2

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	PW/HW	S	-	Rig Make & Model: Mobile Drill B57
Inside Diameter (in.)	5/4	1 3/8	-	Bit Type: Roller Bit Drill Mud: None
Hammer Weight (lb)	Spin/300	140	-	Casing: PW Spin 36', HW Drive 52.5'
Hammer Fall (in.)	24	30	-	Hoist/Hammer: Winch Automatic Hammer PID Make & Model: NA

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					8.8	-BITUMINOUS CONCRETE PAVING-										
					0.8											
	6 18 20 19	S1 14	1.0 3.0	SW		Dense light brown well graded SAND with gravel (SW), mps 1.2 in., no structure, no odor, moist	5	15	20	25	30	5				
						-FILL-										
	6 5 4 8	S2 7	4.0 6.0	SP		Loose light brown poorly graded SAND (SP), mps 1.0 in., no structure, no odor, wet		5		15	75	5				
5					3.2 6.3											
						Note: Granite obstructions in Fill.										
					0.7 8.8											
	12 3 5 8	S3 4	9.0 11.0	SW		Loose brown well graded SAND (SW), mps 1.2 in., no structure, no odor, wet		10	20	25	40	5				
10						-FILL-										
					-4.5 14.0	Note: Drill action indicates occasional cobbles.										
	4 1 1 2	S4 5	14.0 16.0	OL/ OH		Very soft black to dark brown ORGANIC SILT with sand (OL/OH), mps 1.0 in., no structure, no odor, 10% wood fragments					15	85	S	L	N	
15						ORGANIC DEPOSITS-										
	3 1	S5 11	19.0 21.0	OL/ OH		Medium stiff dark brown sandy ORGANIC SILT (OL/OH), mps 0.05 in., increasing sand with depth to silty SAND at 20.5 ft, no odor, wet					40	60	R	L	N	
20																

EL. 5.22
OBSERVED DEC. 12, 2017

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
12/21/17	0930	18.5	40.5	40.0	4.28

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe; Screen; Filter Sand; Cuttings; Grout; Concrete; Bentonite Seal

Summary

Overburden (ft)	58.0
Rock Cored (ft)	--
Samples	12S

Boring No. BB-13

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H:\A-TEST BORING-09 REV HA-LIB09-BOS-REV\ GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18

BORING BB–13

605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:40 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-13
File No. 40991-005
Sheet No. 2 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Fines % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	4 9				-11.0											
				SM	20.5	Loose tan to gray poorly graded SAND (SP), mps 0.10 in., no structure, no odor, wet					60	40				
	5 3 3 11	S6 8	24.0 26.0	SP					5	5	90					
25						-GLACIOLACUSTRINE DEPOSITS-											
					-19.5											
	3 5 9 14	S7 5	29.0 31.0	ML	29.0	Medium dense gray to olive gray SILT (ML), mps 0.05 in., occasional laminae of clay up to 0.05 in. thick, no odor, wet					5	95	R	L	N	
30						-GLACIOLACUSTRINE DEPOSITS-											
	5 7 10 10	S8 10	34.0 36.0	ML		Medium dense gray to olive gray SILT (ML), frequent laminae of lean clay up to 1/8 in. thick, (varves), no odor, wet					5	95	R	L	N	
35						Note: Casing advancement slows at 37.5 ft.										
					-28.0 37.5											
	19 26 21 21	S9 7	39.0 41.0	SW		Dense olive brown well graded SAND with gravel (SW), mps 0.9 in., no structure, no odor, wet		15	20	30	35					
40						-GLACIOFLUVIAL DEPOSITS-											
						Note: Cobble at 42.0 ft.										
						Note: Cobble from 43.5 to 44.0 ft.										
	9 12 7 5	S10 8	44.0 46.0	SP		Medium dense tan poorly graded SAND with gravel (SP), mps 1.2 in., no structure, no odor, wet	5	15		10	65	5				
45						Note: Casing refusal at 46.5 ft.										
					-37.0 46.5	Note: Cobble encountered from 46.5 to 47.0 ft.										
					-37.5 47.0											
	8	S11	49.0	SW		Dense brown well graded SAND with gravel (SW), mps 1.0 in., pockets of	5	15	10	20	50					

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-13

BORING BB–13

TEST BORING REPORT

Boring No. BB-13
File No. 40991-005
Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Fines % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50	16 22 35	11	51.0			increased gravel, no odor, wet										
						Note: Occasional gravel/cobbles to 54.0 ft.										
	12 38 75 120/3"	S12 12	54.0 56.0	SP		Very dense tan poorly graded SAND (SP), mps 0.3 in., no structure, no odor, wet				10	90					
55						POSSIBLE TOP OF BEDROCK AT 55.8 FT										
					-46.3 55.8	Note: Split spoon refusal at 55.8 ft. Advance roller bit to 58.0 ft. Consistent hard, smooth drill action. Cuttings consistent with rock l lithology encountered in cores of other borings. -POSSIBLE BEDROCK-										
					-48.5 58.0	BOTTOM OF EXPLORATION 58.0 FT										

POSSIBLE TOP OF BEDROCK
EL. –46.3

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-13

BORING BB–13

H&A-TEST BORING.GDT REV H4A-LIB09-BOS-REV GLB H4A-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18
H&A-TEST BORING.GDT REV H4A-LIB09-BOS-REV GLB H4A-TB+CORE+WELL-09 W FENCE.GDT G:\40991\GINT\40991-005-TBCB-2.GPJ 13 Jun 18
605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:40 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-15

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 2
Start 28 January 2021
Finish 29 January 2021
Driller P. Schofield
H&A Rep. D. Warren
Elevation 10.0
Datum NAVD88
Location Northing: 2730543.7
Easting: 861782.6

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: B48 Mobile Drill
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 49.0 ft.
				Hoist/Hammer: Winch / Automatic hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0					9.5	-ASPHALT ROADWAY-										
					0.5											
					9.0	-GRAVEL SUB BASE-										
					1.0											
	33	S1	1.0	SP-SM	8.5	- FILL -					90	10				
	97/5"	10	1.9		1.0											
					8.1	Very dense orange poorly graded SAND with silt (SP-SM), mps 0.1 in., no odor, moist										
				SP-SM	1.9						90	10				
					6.5	- FILL -										
5	14 14 12 17	S2 12	4.0 6.0		3.5											
					3.0	- MACADAM ROADWAY -										
				SM	7.0	Medium dense orange poorly graded SAND with silt (SP-SM), mps 0.1 in., no odor, moist										
						Loose gray brown to orange silty SAND (SM), mottled, organic odor, wet					10	70	20			
10	11 4 1 1	S3 10	9.0 11.0													
	14 12 9 4	S4 3	14.0 16.0	SW		Medium dense brown well graded SAND with gravel (SW), mps 1.5 in., no odor, wet, poor recovery, pushing cobble	10	20	35	20	10	5				
						- FILL -										
	3 1 1 1	S 0	17.0 19.0		-8.0 18.0	Very soft, woodland stem fragment noted in wash at 18 ft. depth										
		S5**	19.0	OL/OH		Soft brown ORGANIC SILT (OL/OH) mps 0.1 in., organic odor, wet					30	70				
20	3 2 2 3	10	21.0		-11.0 21.0	Atterberg Limits test results: Sample is non-plastic.										
	4 3 8 10	S6 14	21.0 23.0	SM		- ORGANIC ESTUARINE DEPOSITS -					75	25				
	6 9 11 11	S7 15	24.0 26.0	SP	-14.0 24.0	Medium dense gray brown silty SAND (SM), mps 0.1 in., organic odor, wet, (Organic) silty sand				5	5	85	5			
25						- ESTUARINE DEPOSITS -										
						Medium dense gray poorly graded SAND (SP), mps 0.25 in., no odor, wet										
						- MARINE DEPOSITS -										
					-18.5 28.5											
30	5	S8	29.0	ML		Stiff gray brown SILT (ML) mps 0.01 in., laminae, no odor, wet					5	95				

EL. −4.50
OBSERVED JAN. 29, 2021

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
01/29/21	12:42 at completion	0.0 not stabilized	49.0	55.0	14.5

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe; Screen; Filter Sand; Cuttings; Grout; Concrete; Bentonite Seal

Summary

Overburden (ft)	55.3
Rock Cored (ft)	
Samples	S13
Boring No.	**BB-15**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-09 REV H&A-B09-BOS - COPY2.GLB H:\A-TB\-CORE-\WELL-09 IW FENCE.GDT G:\40991\IGN\TC\OMB\NED\40991-005-TB.GPJ 21-Jun-21

BORING BB–15

TEST BORING REPORT

Boring No. BB-15
File No. 40991-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
30	6 6 8	12	31.0													
	4 6 7 8	S9 16	34.0 36.0	ML		Stiff gray brown SILT (ML) mps 0.01 in., laminae, no odor, wet						100				
35						- GLACIOLACUSTRINE DEPOSITS -										
	3 5 8 13	S10	39.0 41.0	ML		Stiff gray brown SILT (ML) mps 0.01 in., laminae, no odor, wet						100				
					-31.5 41.5											
40	14 13 13 12	S11 11	44.0 46.0	SM		Medium dense gray silty SAND with gravel (SM), mps 1.5 in., no odor, wet	5	10	5	5	55	20				
45						- GLACIAL TILL -										
					-37.0 47.0											
	24 34 19 16	S12 8	49.0 51.0	GW		Very dense gray well graded GRAVEL with sand (GW), mps 1.5 in., no odor, wet, ablation till	25	35	25	10	5					
50						- GLACIAL TILL -										
					-42.5 52.5											
	56 55 100/9"	S13 12	54.0 55.3	SM		Very dense gray brown silty SAND with gravel (SM), mps 1.5 in., no odor, wet	10	10	10	5	45	20				
55					-45.3 55.3	- GLACIAL TILL -										
						BOTTOM OF EXPLORATION 55.3 FT										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-15

H&A-TEST BORING-09 REV H&A-B09-BOS - COPY2.GLB H:\A-TB\-CORE-\WELL-09 IW FENCE.GDT G:\40991\IGN\TC\OMB\NED\40991-005-TB.GPJ 21-Jun-21

BORING BB–15

Plotted on 12-Dec-2023 12:40 PM
605311_SK02-20_BR(W06016).DWG

605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-20

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 2
Start 23 December 2020
Finish 23 December 2020
Driller S. Cooley
H&A Rep. S. Shay
Elevation -6.9
Datum NAVD88
Location Northing: 2730581.1
Easting: 861733.7

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 32.0 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	WOH/ 24in.	S1 16	0.0 2.0	OL/ OH		Very soft dark brown sandy ORGANIC SOIL (OL/OH) mps 0.1mm, no structure, organic odor, wet					45	55				
	WOH/ 24in.	S2 18	2.0 4.0	OL/ OH		Very soft dark brown sandy ORGANIC SOIL (OL/OH) mps 0.1mm, no structure, organic odor, wet					45	55				
						- ORGANIC ESTUARINE DEPOSITS-										
5	WOH/ 24in.	S3 14	4.0 6.0	OL/ OH		Very soft dark brown, sandy ORGANIC SOIL (OL/OH) mps 0.1mm, no structure, organic odor, wet, trace shell fragments					45	55				
	WOH/ 24in.	S4** 19	6.0 8.0	SM	-12.9 6.0	** Very loose dark brown organic silty SAND (SM), mps 0.1mm, no structure, organic odor, wet, 3.9% organic conctent, PI = 1.7, LL = 41, PL =39.3, gradation test run				13	52	35				
	1/12in.	S5 18	8.0 10.0			S5, top 9 in.: Very soft decayed red brown wood										
	3 2			SP	-15.9 9.0	S5, bottom 9 in.: Very loose gray poorly-graded SAND (SP) mps 0.2mm, no structure, no odor, wet					95	5				
10	2 5 5 7	S6 20	10.0 12.0	SP		Loose gray poorly-graded SAND (SP) mps 8mm, no structure, no odor, wet		5	10	10	75					
					-19.9 13.0	-LITTORAL DEPOSITS-										
						Note: Change in drilling effort at 13.0 ft.										
15	5 4 5 7	S7 8	14.0 16.0	ML		Stiff gray SILT with sand (ML) mps 4mm, no structure, no odor, wet, sand confined to top 2 in. of sample				5	5	85				
20	3 5 3 4	S8 17	19.0 21.0	ML		Medium stiff olive brown SILT (ML) mps <0.1mm, no structure, no odor, wet						100	R	L	L	L
						-GLACIOLACUSTRINE DEPOSITS-										
25	5 7 8 10	S9 18	24.0 26.0	ML		Stiff olive gray SILT (ML) mps <0.1mm, no structure, no odor, wet						100	R	L	L	L
					-33.9 27.0	Note: Change in drilling effort at 27.0 ft.										
						-GLACIAL TILL DEPOSITS-										
30	112	S10	29.0	SM		Very dense olive gray to light gray silty SAND (SM) with gravel, mps 3cm, no	5	10	30	20	20	15				

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary
Overburden (ft) 34.5
Rock Cored (ft)
Samples S11
Boring No. BB-20

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-09 REV H&A-BOS-BOS - COPY2 GLB H&A-TB-CORE+WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21

BORING BB–20

TEST BORING REPORT

Boring No. BB-20
File No. 40991-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	Sand % Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
30	30 50 64	13	31.0			structure, no odor, wet										
						-GLACIAL TILL DEPOSITS-										
	108 47 20 14	S11 6	32.5 34.5	SP		Note: Unable to drive casing beyond 32.0 ft. Advanced borehole with button bit to 32.5 ft. for S11 Very dense, pink brown poorly-graded SAND with gravel (SP) possibly as weathered bedrock although unable to discern rock fabric, mps 3cm, no structure, no odor, wet		10	60	15	10	5				
					-41.4 34.5	BOTTOM OF EXPLORATION 34.5 FT.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-20

H&A-TEST BORING-09 REV H&A-BOS-BOS - COPY2 GLB H&A-TB-CORE+WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21

BORING BB–20

605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:40 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-21

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 1
Start 22 December 2020
Finish 22 December 2020
Driller S. Cooley
H&A Rep. S. Shay
Elevation -8.5
Datum NAVD88
Location Northing: 2730666.6
Easting: 861821.2

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 23.2 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	WOH 1/18in.	S1 6	0.0 2.0	SM		Very loose black silty SAND (SM) with up to 20% organic content, mps 6mm, no structure, slight organic odor, wet, trace shell fragments - ORGANIC ESTUARINE DEPOSITS-			10	15	50	25				
	3 3 3	S2 8	2.0 4.0	SM	-10.5 2.0	Loose black silty SAND (SM) with up to 20% organic content, mps 6mm, no structure, slight organic odor, wet, trace shell fragments -ESTUARINE DEPOSITS-			10	15	50	25				
	4				-12.5											
	1 3 3 4	S3 5	4.0 6.0	SW	4.0	Loose light gray well-graded SAND (SW) mps 3cm, single-grain structure, no odor, wet -LITTORAL DEPOSITS-	5	5	30	30	30					
5		S4 10	6.0 8.0	ML	-15.0 6.5	Note: Top 2 in., S4 similar to above Medium stiff olive gray SILT (ML) mps <0.1mm, no structure, no odor, wet						100	R	L	L	L
	4 4 3 7	S5 14	8.0 10.0	ML		Soft olive brown SILT (ML) mps <0.1mm, no structure, no odor, wet						100	R	L	L	L
	1 2 2 5	S6 16	10.0 12.0	ML		Medium stiff olive brown SILT (ML) mps <0.1mm, no structure, no odor, wet						100	R	L	L	L
10	3 3 5 6					-GLACIOLACUSTRINE DEPOSITS-										
	4 5 5 6	S7 18	15.0 17.0	ML		Stiff olive brown SILT (ML) mps <0.1mm, occasional varves, no odor, wet						100	R	L	L	L
15					-27.5 19.0	Note: Change in drilling effort at 19.0 ft.										
	14 10 7 6	S8 9	20.0 22.0	SW-SM		Medium dense olive brown well-graded SAND with silt (SW-SM) mps 3cm, no structure, no odor, wet -GLACIOFLUVIAL DEPOSITS-	5	5	30	25	25	10				
20					-31.7 23.2	Note: Abrupt change in effort to advance casing at 23.2 ft. Advanced borehole with button bit to 25.0 ft. Pink and white angular sand-sized rock chips observed in wash water										
					-33.5 25.0	Possible boulder or bedrock from 23.2 ft. BOTTOM OF EXPLORATION 25.0 FT.										
25																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 25
Rock Cored (ft)
Samples S8
Boring No. BB-21

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB–21

TEST BORING REPORT

Boring No. BB-21A

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 1
Start 23 December 2020
Finish 23 December 2020
Driller S. Cooley
H&A Rep. S. Shay
Elevation -6.5
Datum NAVD88
Location Northing: 2730651.2
Easting: 861799.9

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 2.0 ft
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	Push/24 in.	U1** 21	2.0 4.0	SP PT		** Gray SAND (SP) with PEAT (PT) and vlay (visual description of content of tube) GUS sampler used										
					-10.5 4.0	-ESTUARINE DEPOSITS- BOTTOM OF EXPLORATION AT 4.0 FT.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 4
Rock Cored (ft)
Samples U1
Boring No. BB-21A

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†**Note: Maximum particle size is determined by direct observation within the limitations of sampler size.**
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB–21A

H&A-TEST BORING-09 REV H&A-BDS - COPY2 GLB H&A-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21 Jun 21
605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:40 PM
605311 Sketch Plan Submittal (SP3) 06-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-22

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 2
Start 30 December 2020
Finish 30 December 2020
Driller S. Cooley
H&A Rep. S.Shay
Elevation -8.9
Datum NAVD88
Location Northing: 2730813.1
Easting: 861926.9

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 37.0 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	WOH/24 in.	S1 18	0.0 2.0	PT		Very soft black PEAT (PT) mps 1mm, 30% organic fibers, strong organic odor, wet										
	WOH/24 in.	S2 16	2.0 4.0	PT	-11.9 3.0	-SALT MARSH DEPOSITS- Very soft black PEAT (PT) mps 1mm, 30% organic fibers, strong organic odor, wet										
	WOH 6 8 7	S3 22	4.0 6.0	OL/OH	-13.4 4.5	S3, top 6 in.: Very soft dark brown ORGANIC SOIL(OL/OH) mps 0.1mm, no structure, strong organic odor, wet, trace fibers					5	95				
5				SM	-14.9 6.0	- ORGANIC ESTUARINE DEPOSITS- S3, bottom 16 in.: Medium dense olive gray silty SAND (SM) mps 0.5mm, no structure, no odor wet					70	30				
	1 2 3 4	S4** 18	6.0 8.0	SP-SM		Loose olive gray poorly-graded SAND (SP-SM) mps 0.5mm, no structure, no odor, wet					93	7				
					-17.9 9.0	**Gradation test run -LITTORAL DEPOSITS-										
10	2 3 4 4	S5 13	10.0 12.0	ML		Medium stiff gray top 3 in. to yellow brown SILT (ML) mps <0.1mm, no structure, no odor, wet -GLACIOLACUSTRINE DEPOSITS-						100	R	L	L	L
					-22.4 13.5											
15	11 6 5 4	S6 15	15.0 17.0	SP-SM		Medium dense beige poorly-graded SAND with silt (SP-SM) mps 3cm, minor sorting, coarse sand and gravel confined to occasional pockets, no odor, wet -GLACIOFLUVIAL DEPOSITS-	5	5	15	15	50	10				
20	7 6 5 6	S7 12	20.0 22.0	SP-SM		Medium dense beige poorly-graded SAND with silt (SP-SM) mps 3 cm, minor, no structure, no odor, wet	5	5	15	20	45	10				
					-32.4 23.5											
25	2 7 8 13	S8 19	25.0 27.0	ML		Medium dense olive brown SILT with sand (ML) mps 4mm, interbedded sand seams up to 1" wide, no odor, wet -GLACIOLACUSTRINE DEPOSITS-				5	5	10	80			
30																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe; Screen; Filter Sand; Cuttings; Grout; Concrete; Bentonite Seal

Summary

Overburden (ft)	39
Rock Cored (ft)	
Samples	S10
Boring No.	**BB-22**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-09 REV H:\L-B\09-BOS - COPY2 GLB H:\A-TB\-CORE-I-WELL-09 IW FENCE.GDT G:\40991\IGN\TC\OMB\NED\40991-005-TB.GPJ 21-Jun-21

BORING BB–22

TEST BORING REPORT

Boring No. BB-22
File No. 40991-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
30	21 33 40 47	S9 14	30.0 32.0	ML SM	-39.9 31.0	S9, top 7 in.: Very dense olive brown SILT with sand (ML) mps 2mm, no structure, no odor, wet						20 80				
						S9, bottom 7 in.: Very dense olive brown silty SAND with gravel (SM) mps 3cm, no structure, no odor, wet	5	15	15	15	35	15				
						Note: Change in effort to advance casing at 35.0 ft. Advanced borehole with button bit to 35.5 ft. prior to S10										
35	19 21 30 120/4 in.	S10 18	35.5 37.2	SM		Very dense olive brown silty SAND with gravel (SM) mps 3cm, no structure although moderately well-bonded, no odor, wet -GLACIAL TILL-	5	15	15	15	35	15				
						No recovery										
	100/0 in.	S 0	39.0 39.0		-47.9 39.0	Split spoon refusal at 39.0 ft. BOTTOM OF EXPLORATION 39.0 FT.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-22

H&A-TEST BORING-09 REV H:\L-B\09-BOS - COPY2 GLB H:\A-TB\-CORE-I-WELL-09 IW FENCE.GDT G:\40991\IGN\TC\OMB\NED\40991-005-TB.GPJ 21-Jun-21

BORING BB–22

605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:40 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-26

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 2
Start 11 January 2021
Finish 11 January 2021
Driller S. Cooley
H&A Rep. S. Shay
Elevation -3.0
Datum NAVD88
Location Northing: 2730467.4
Easting: 861841.7

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive to 33.0 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	WOH/24 in.	S1 9	0.0 2.0	OL/OH		Very soft dark brown to black ORGANIC SOIL (OL/OH) mps 1mm, no structure, strong organic odor, wet, trace shell fragments, possible amorphous peat				5	5	90				
	WOH/24 in.	S2 10	2.0 4.0	OL/OH		Very soft dark brown to black ORGANIC SOIL (OL/OH) mps 1mm, no structure, strong organic odor, wet, trace shell fragments, possible amorphous peat					5	95				
			4.0 6.0			Undisturbed tube attempt 4.0-6.0 ft., no recovery										
5	WOH/24 in.	S3 21	6.0 8.0	OL/OH		-ORGANIC ESTUARINE DEPOSITS- Very soft dark olive brown ORGANIC SOIL (OL/OH) with sand, mps 1mm, no structure, organic odor, wet, trace fibers					20	80				
	WOH/12 in.	S4 14	8.0 10.0	OL/OH		Very soft dark olive brown sandy ORGANIC SOIL (OL/OH) mps 1mm, frequent interbedded gray sand seams, organic odor, wet, trace fibers					30	70				
10	1 2	S5 12	10.0 12.0	SP-SM	-13.0 10.0	Very loose gray poorly-graded SAND with silt (SP-SM) mps 3mm, frequent interbedded brown organic silt, slight organic odor, wet, most coarse to medium sand confined to bottom 4" of sample -LITTORAL DEPOSITS-			15	20	55	10				
	1 1 1 2				-16.0 13.0											
15	3 4 5 6	S6 12	14.0 16.0	ML		Loose light olive brown SILT (ML) mps 0.1mm, frequent partings, no odor, wet wet -GLACIOLACUSTRINE DEPOSITS-						100	R	L	L	M
20	3 3 6 6	S7 18	19.0 21.0	ML		Loose olive brown SILT (ML) mps 0.1mm, frequent partings, no odor, wet						100	R	L	L	M
					-25.5 22.5	Note: Change in effort to advance casing at 22.5 ft.										
25	11 9 13 28	S8 14	24.0 26.0	SM		Medium dense olive brown silty SAND (SM) mps 2.2cm, no structure, no odor, wet -GLACIOFLUVIAL DEPOSITS-	5	5	15	15	40	20				
30	11	S9	29.0	SM		Medium dense olive brown silty SAND (SM) mps 2.2cm, no structure, no odor,	5	5	15	15	40	20				

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary

Overburden (ft) 33.5
Rock Cored (ft) 4.5 (Not Bedrock)
Samples S9
Boring No. BB-26

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB–26

TEST BORING REPORT

Boring No. BB-26
File No. 40991-005
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
30	7 5 5	8	31.0			wet										
					-36.0 33.0	Note: Abrupt change in effort to advance casing at 33.0 ft. Advanced borehole with button bit to 33.5 ft. prior to core attempt. Advanced borehole with core barrel 33.5 to 38.0 ft. to recover 21" of various lithologies with variable drill rates to indicate presence of common cobbles.										
35		C1 21	33.5 38.0													
					-41.0 38.0	BOTTOM OF EXPLORATION 38.0 FT.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-26

BORING BB–26

H&A-TEST BORING-09 REV H&A-BOR-BOS - COPY2 GLB H:\A-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21
H&A-TEST BORING-09 REV H&A-BOR-BOS - COPY2 GLB H:\A-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21
605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:40 PM

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-27

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 1
Start 15 January 2021
Finish 15 January 2021
Driller S. Cooley
H&A Rep. S. Shay
Elevation -4.0
Datum NAVD88
Location Northing: 2730534.3
Easting: 861889.8

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive 25.0 ft., NW spin
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	Free fall	S1 2	0.0 2.0	OL/OH		Very soft black ORGANIC SOIL with sand (OL/OH) mps 6mm, no structure, no odor, wet, trace shell fragments		5	5	5	80					
	Free fall	S2 4	2.0 4.0	OL/OH		Very soft black ORGANIC SOIL with sand (OL/OH) mps 2mm, no structure, no odor, wet, trace shell fragments			5	5	10	80				
						-ORGANIC ESTUARINE DEPOSITS-										
5	Free fall	S3 4	4.0 6.0	OL/OH		Very soft black ORGANIC SOIL with sand (OL/OH) mps 2mm , no structure, no odor, wet, trace shell fragments			5	5	10	80				
	WOH/24 in.	S4 4	6.0 8.0	OL/OH		Very soft dark olive brown sandy ORGANIC SOIL(OL/OH) mps 1mm, no structure, no odor, wet				5	25	70				
	WOH/12 in.	S5 18	8.0 10.0	OL/OH		S5, top 9 in.: Similar to above with trace fibers										
				SP-SM	-13.0 9.0	S5, bottom 9 in.: Loose gray poorly-graded SAND with silt (SP-SM) mps 0.2mm, no structure, no odor, wet					90	10				
10	5 4					-LITTORAL DEPOSITS-										
					-16.0 12.0											
	3 2 3 6	S6 13	14.0 16.0	ML		Medium stiff olive brown SILT (ML) mps <0.1mm, weakly stratified, no odor, wet						100	R	L	L	L
15																
	4 6 8 9	S7 13	19.0 21.0	ML		Stiff olive brown SILT (ML) mps 0.1mm, frequent well-defined partings, no odor, wet					5	95	R	L	L	L
20						-GLACIOLACUSTRINE DEPOSITS-										
					-28.0 24.0											
	11 120/4 in	S8 6	24.0 24.8	SM		Very dense light olive brown silty SAND with gravel (SM) mps 3cm, no structure, no odor, wet Note: Advanced borehole with button bit and core barrel from 24.8 to 27.5 ft. Recovered 19" granitic boulder material	10	10	15	15	35	15				
25						-GLACIAL TILL DEPOSITS-										
	7 8 10 11	S9 8	27.5 29.5	SM		Medium dense light olive brown silty SAND (SM) mps 1.8cm, no structure, no odor, wet Note: Driller installed NW casing after S9		10	15	15	45	15				
30																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary
Overburden (ft) 38
Rock Cored (ft)
Samples S10

Boring No. BB-27

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB–27

TEST BORING REPORT

Boring No. BB-27
File No. 40991-005
Sheet No. 2 of 1

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
30						Note: Few cobbles indicated by drilling effort 30.0 to 34.5 ft.										
35	27 9 120/5 in	S10 10	34.5 35.9	SM		Very dense light olive brown silty SAND (SM) mps 2.5cm, no structure, no odor, wet	5	5	15	15	45	15				
						-GLACIAL TILL DEPOSITS-										
					-42.0 38.0	Note: Advanced borehole with NW spin casing to 38.0 ft. through cobbles/boulder with sand infilling.										
						BOTTOM OF EXPLORATION AT 38.0 FT.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-27

BORING BB–27

H&A-TEST BORING-09 REV H&A-BOS-8908 - COPY2 GLB H&A-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21
605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:40 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-28

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 1
Start 14 January 2021
Finish 14 January 2021
Driller S. Cooley
H&A Rep. S. Shay
Elevation -0.6
Datum NAVD88
Location Northing: 2730765.0
Easting: 862086.7

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Driver to 10 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions, GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	2 1 1 1/12 in	S1 8	0.0 2.0	SP		S1, Top 4 in. : Loose gray fine sand layer (SP)					100					
					-1.6 1.0	-ESTUARINE DEPOSITS-										
				OL/ OH		S1, bottom 4 in. : Very soft black sandy ORGANIC SOIL (OL/OH) mps 0.1mm, no structure, organic odor, wet			5	10	10	75				
	1 1 1/12 in	S2 10	2.0 4.0	OL/OH		Very soft dark brown to black sandy ORGANIC SOIL (OL/OH) mps 0.1mm, no structure, organic odor, wet					25	75				
5	1 1	S3 10	4.0 6.0	OL/OH		Very soft black to dark olive brown sandy ORGANIC SOIL (OL/OH) mps 0.1mm, no structure, organic odor, wet				5	20	75				
	1 1 1 1	U1 10	6.0 8.0			-ORGANIC ESTUARINE DEPOSITS-										
	Push/24 in	S4*	8.0	OL/OH	-9.1	Note: Top 6 in. of sample similar to above				5	20	75				
	3* 5*	20	10.0		8.5	* Blow counts in soil interval of unsuccessful tube attempt (no recovery, 8.0-10.0). Fine gray sand bottom 14 in. of sample										
10	7* 6*	S5 18	10.0 12.0	SP		Medium dense light gray poorly-graded SAND (SP) mps 1mm, single-grain structure, no odor, wet				5	90	5				
	4 6 11 8				-12.6 12.0	-ESTUARINE DEPOSITS- BOTTOM OF EXPLORATION AT 12.0 FT.										

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 12 Rock Cored (ft) Samples S5, U1 **Boring No. BB-28**

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Plasticity: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.
Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-09 REV: H&A-1809-BOS - COPY2 GLB H&A-TB-CORE-WELL-09 W FENCE.GDT 12/4/09 15:04:17 T:\GINT\COMBINED\40991-005-TB.GPJ 21 Jun 21

BORING BB–28

605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:40 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023

NOTES:
1. SEE SHEET 02 OF 29 FOR NOTES.

GROUND WATER:
1. SEE SHEET 02 OF 29 FOR NOTES.

TEST BORING REPORT

Boring No. BB-28A

Project MARION-WAREHAM CAUSEWAY (ROUTE 6) BRIDGE, MARION/WAREHAM, MA
Client PARSONS
Contractor NEW ENGLAND BORING CONTRACTORS

File No. 40991-005
Sheet No. 1 of 2
Start 20 January 2021
Finish 20 January 2021
Driller S. Cooley
H&A Rep. S. Shay
Elevation -8.9
Datum NAVD88
Location Northing: 2730709.3
Easting: 862032.8

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: CME 45 on barge
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	140	140	-	Drill Mud: None
Hammer Fall (in.)	30	30	-	Casing: HW Drive 42.0, NW Drive 47.0 ft.
				Hoist/Hammer: Winch / Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	WOH/24 in.	S1 12	0.0 2.0	OL/OH		Very soft black sandy ORGANIC SOIL (OL/OH) mps 5mm, no structure, organic odor, wet, trace shell fragments						50	50			
					-10.9	-ORGANIC ESTUARINE DEPOSITS-										
	3 3 7 6	S2 9	2.0 4.0	SP	2.0	Loose dark brown to gray poorly-graded SAND (SP) mps 2.5cm, no structure, slight organic odor, wet		5	30	26	30	9				
5	14 5 3 2	S3 2	4.0 6.0	SP		Loose gray poorly-graded SAND (SP) mps 1cm, no structure, no odor, wet, difficult to fully characterize (low recovery)		5	30	40	20	5				
						-LITTORAL DEPOSITS-										
					-15.9											
10	3 2 4 5	S4 13	9.0 11.0	ML	7.0	Medium stiff olive gray SILT (ML) mps 0.1mm, weakly stratified, no odor, wet						5	95	R	L	L
15	3 4 4 5	S5 16	14.0 16.0	ML		Medium stiff olive gray to olive brown SILT (ML) mps 0.1mm, weakly stratified, no odor, wet						100	R	L	L	L
20	2 2 1 2	S6 18	19.0 21.0	ML		Soft olive brown SILT (ML) mps 0.1mm, weakly stratified, no odor, wet						100	R	L	L	L
25	4 3 5 2	S7 14	24.0 26.0	ML		Medium stiff olive brown SILT with sand (ML) mps 2mm, frequent interbedded sand seams, no odor, wet						15	85	R	L	L
						-GLACIOLACUSTRINE DEPOSITS-										
					-36.4 27.5											
30	7	S8	29.0	SM		Loose olive brown silty SAND (SM) mps 8mm, no structure although minor			5	10	15	50	20			

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID: O - Open End Rod; T - Thin Wall Tube; U - Undisturbed Sample; S - Split Spoon Sample

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

Summary

Overburden (ft) 47.7
Rock Cored (ft)
Samples S12

Boring No. BB-28A

Field Tests: Dilatancy: R - Rapid S - Slow N - None; Toughness: L - Low M - Medium H - High; Plasticity: N - Nonplastic L - Low M - Medium H - High; Dry Strength: N - None L - Low M - Medium H - High V - Very High

†Note: Maximum particle size is determined by direct observation within the limitations of sampler size.

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

BORING BB–28A

TEST BORING REPORT

Boring No. BB-28A
File No. 40991-005
Sheet No. 2 of 2

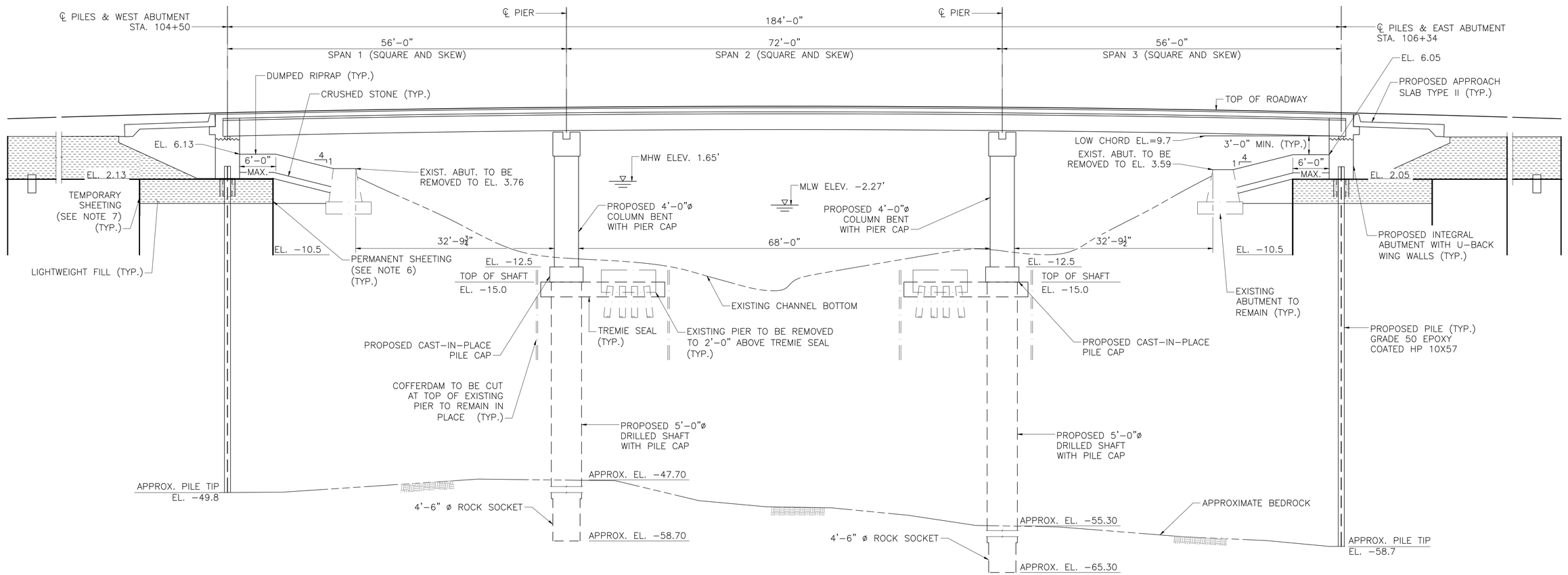
Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size† structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
30	5 3 4	14	31.0			sorting, no odor, wet										
						-GLACIOFLUVIAL DEPOSITS-										
35	1 7 18 29	S9 17	34.0 36.0	SP/SM	-44.9 36.0	Medium dense light olive brown to brown poorly-graded SAND (SP) and silty SAND (SM) mps 6mm, well-defined interbedded stratification and sorting in seams and pockets, no odor, wet		5	10	10	55	20				
						Note: Possible cobble at 37.2 ft. indicated by drilling effort										
						-GLACIOLACUSTRINE DEPOSITS-										
40	13 17 23 21	S10 18	39.0 41.0	ML	-49.9 41.0	Dense beige sandy SILT (ML) mps 2mm, gradational structure, no odor, wet					40	60				
						-GLACIOLACUSTRINE DEPOSITS-										
	24 30 27 19	S11 12	42.0 44.0	SM		Very dense beige silty SAND (SM) mps 5mm, weakly stratified, no odor, wet			10	10	65	15				
45						Note: HW casing driving hard at 42.0 ft. Driller installed NW casing after S11										
						-GLACIOFLUVIAL DEPOSITS-										
	25	S12	47.0	SM	-56.6 47.7	Very dense beige silty SAND (SM) mps 1cm, weakly stratified, no odor, wet	5	10	10	55	20					
	120/2 in	8	47.7			BOTTOM OF EXPLORATION 47.7 FT. Split spoon refusal at 47.7 ft.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. BB-28A

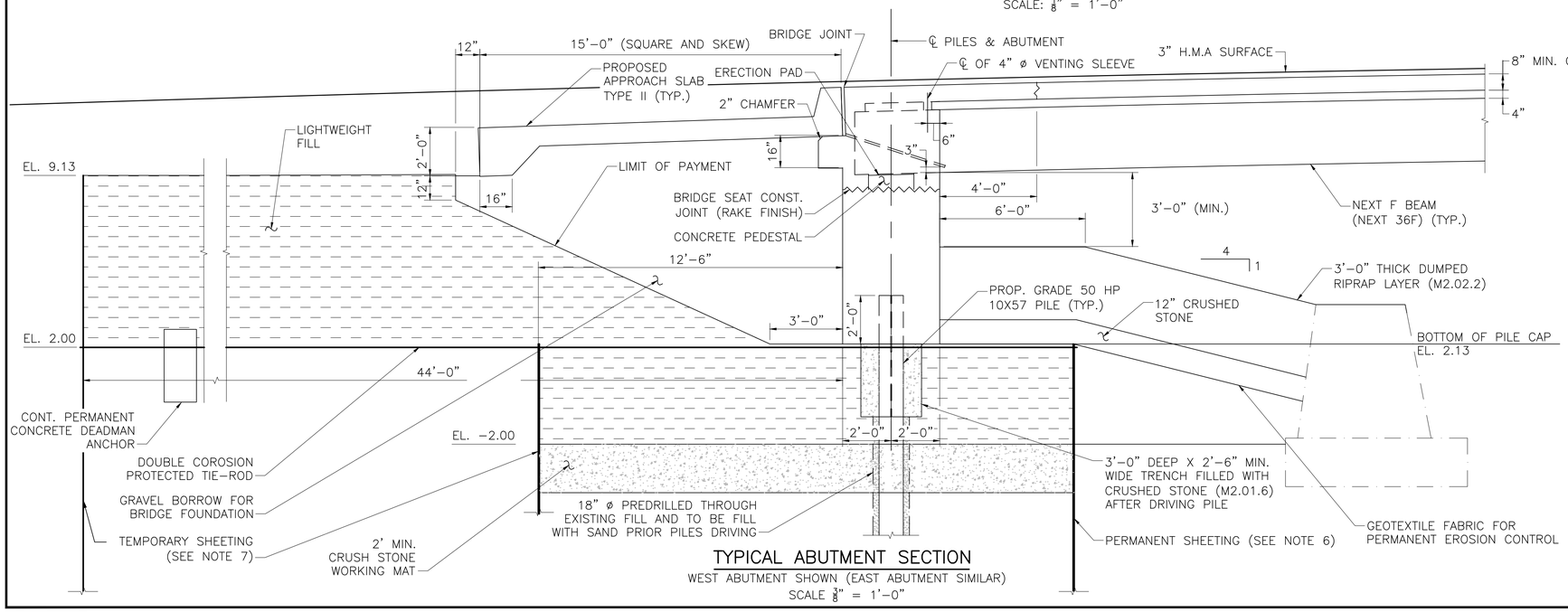
BORING BB–28A

H&A-TEST BORING-09 REV H&A-B808-BOS - COPY2 GLB H:\A-TB-CORE-WELL-09 W FENCE.GDT G:\40991\GINT\COMBINED\40991-005-TB.GPJ 21-Jun-21
605311_SK02-20_BR(W06016).DWG Plotted on 12-Dec-2023 12:40 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023



LONGITUDINAL SECTION

SCALE: ⅛" = 1'–0"



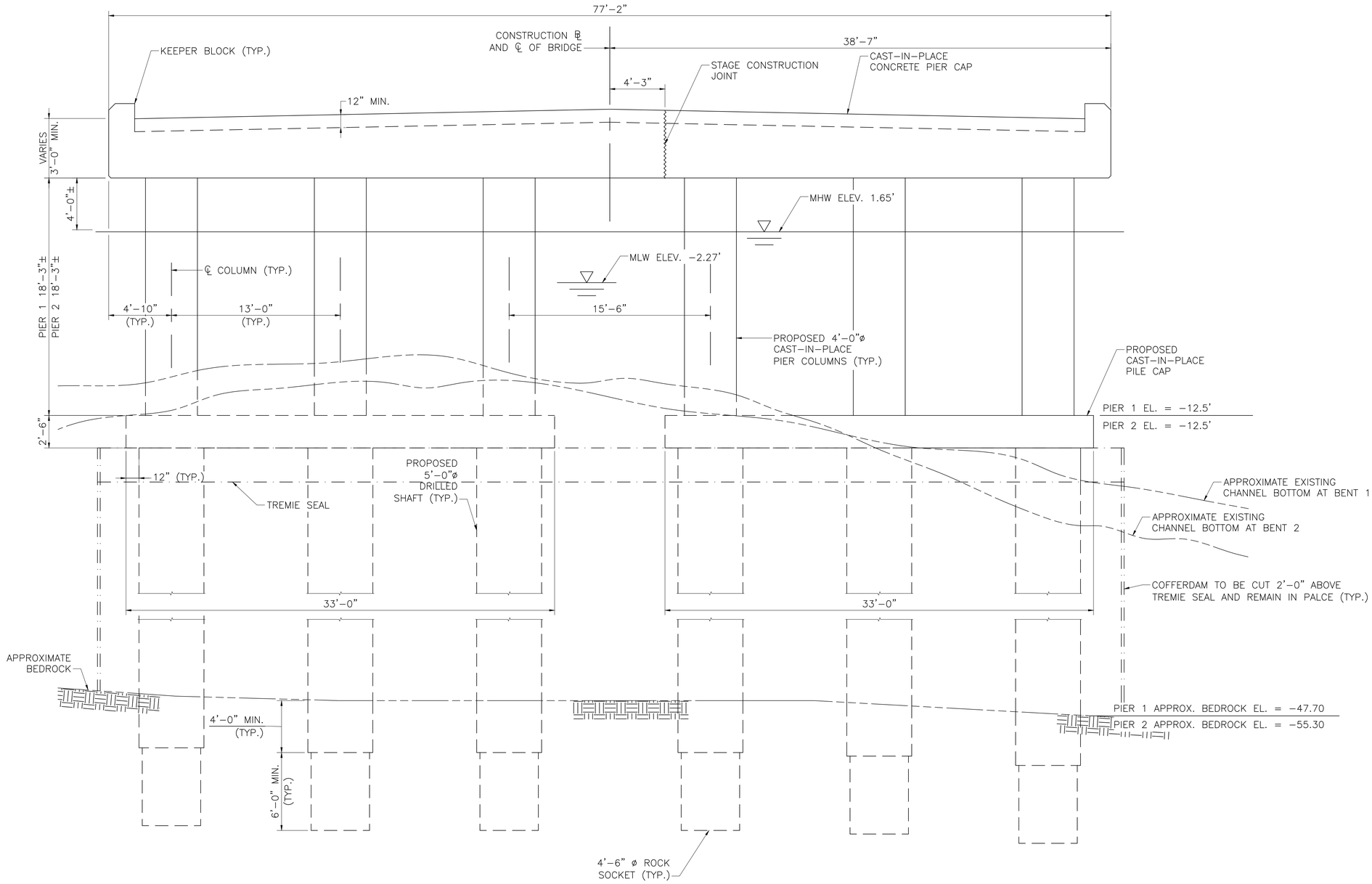
TYPICAL ABUTMENT SECTION

WEST ABUTMENT SHOWN (EAST ABUTMENT SIMILAR)
SCALE ⅜" = 1'–0"

NOTES:

1. MINIMUM VERTICAL CLEARANCE AT MHW OCCURS AT THE SOUTHERN EXTERIOR GIRDER AT THE EAST END OF THE STRUCTURE. EXISTING VERTICAL CLEARANCE FROM MHW TO THE BOTTOM GIRDER FLANGE IS 5.90', PROPOSED MINIMIM VERTICAL CLEARANCE IS 6.05'.
2. THE FACTORED AXIAL DESIGN LOAD PER PILE IS 337.1 KIPS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.
   THE FACTORED STRUCTURAL RESISTANCE PER PILE IS 417.5 KIPS.
3. THE FACTORED DRILLED SHAFT LOAD IS 1,047 KIPS.
   THE FACTORED DRILLED SHAFT RESISTANCE IS 5,535 KIPS.
4. THE DESIGN (25 YEAR) FLOOD ELEVATION IS 10.1'.
   THE BASE (100–YEAR) FLOOD ELEVATION IS 13.7'.
5. THE PRESSURE DESIGN SCOUR DEPTH IS 2.0', PRESSURE CHECK SCOUR DEPTH IS 5.5', PIER DESIGN SCOUR DEPTH IS 10.0', PIER CHECK SCOUR DEPTH IS 12.0'.
6. PERMANENT SHEETING FOR SCOUR PROTECTION, WATER CONTROL AND PLACEMENT OF LIGHTWEIGHT FILL. SHEETING TO BE DESIGNED TO MEET DESIGN SCOUR EVENT FOR PROTECTION OF PROPOSED ABUTMENTS. SEE SHEET 27 FOR PLAN LAYOUT.
7. TEMPORARY SHEETING FOR WATER CONTROL AND PLACEMENT OF LIGHTWEIGHT FILL. SEE SHEET 27 FOR PLAN LAYOUT.

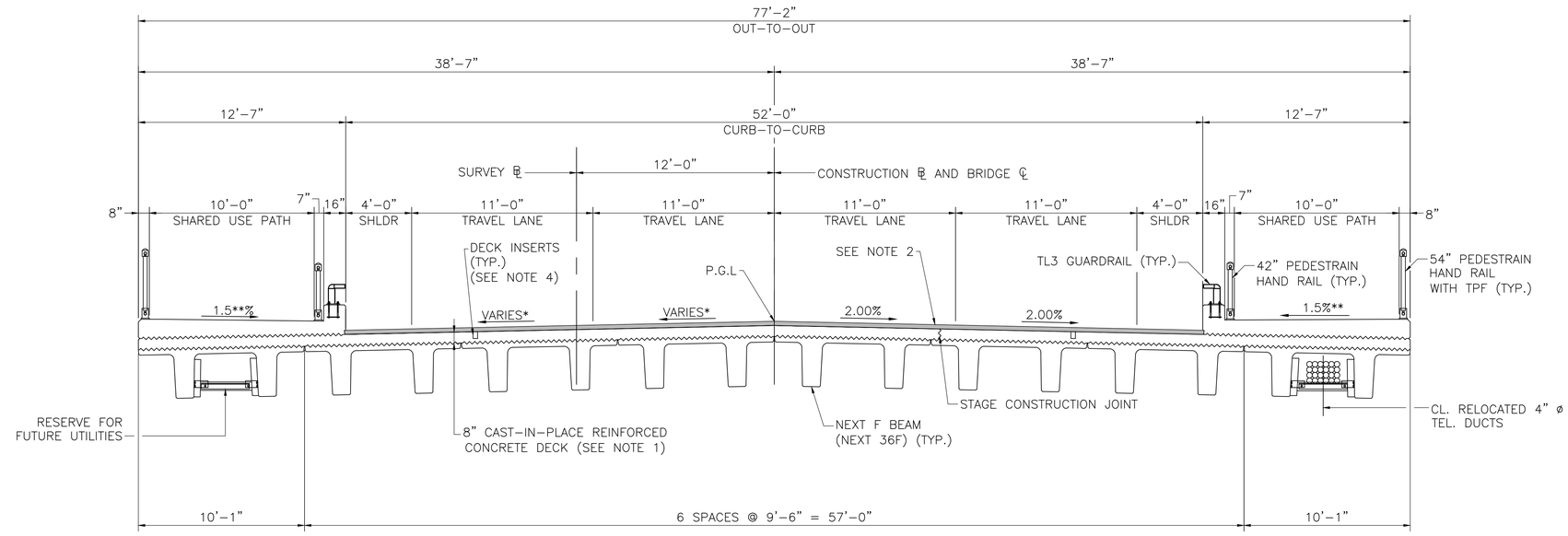
605311_SK21_BRW06016).DWG Plotted on 12-Dec-2023 12:41 PM
605311 Sketch Plan Submittal (SP3) 06-DECEMBER-2023



TRANSVERSE SECTION OF PIER

SCALE: ¼" = 1'-0"

605311_SK27_BR(W06016).DWG Plotted on 12-Dec-2023 12:42 PM
605311 Sketch Plan Submittal (SP2) 10-AUGUST-2022



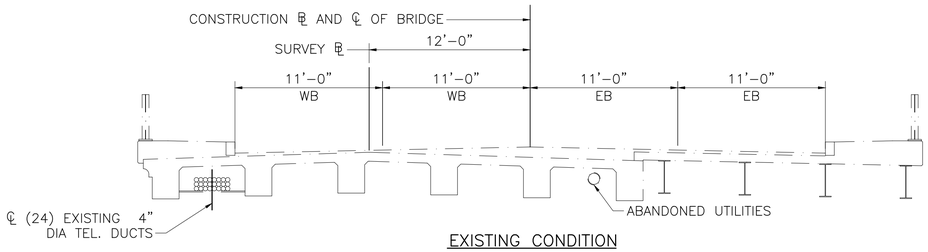
TRANSVERSE SECTION

SCALE: $\frac{1}{4}$" = 1'-0"

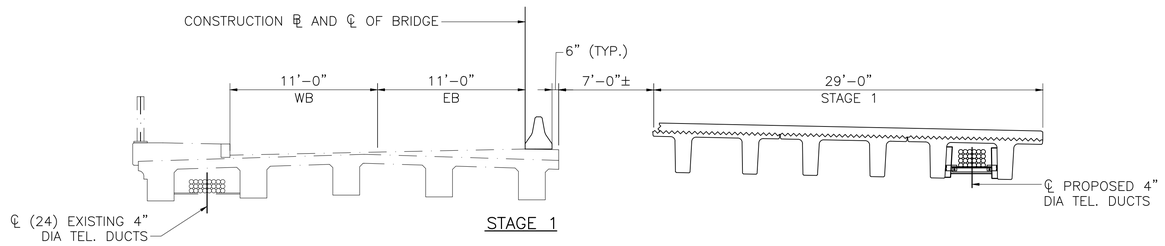
NOTES:

1. DECK THICKNESS VARIES DUE TO SUPPERELEVATION RUNOUT OVER BRIDGE. APPROXIMATE THICKNESS RANGES FROM 8" TO 12".
2. $1\frac{1}{2}$" SUPERPAVE BRIDGE SURFACE COURSE OVER $1\frac{1}{2}$" SUPERPAVE BRIDGE PROTECTIVE COURSE OVER SPRAY APPLIED MEMBRANE WATERPROOFING
3. ROADWAY SLOPES:
   * 0.004% AT EAST ABUTMENT
   * 2.00% AT PIERS 1 AND 2
   * 2.00% AT WEST ABUTMENT
4. DECK INSERTS PROVIDED FOR POSSIBLE FUTURE ROAD DIET
5. **SLOPES TO MATCH HIGHWAY DRAWINGS

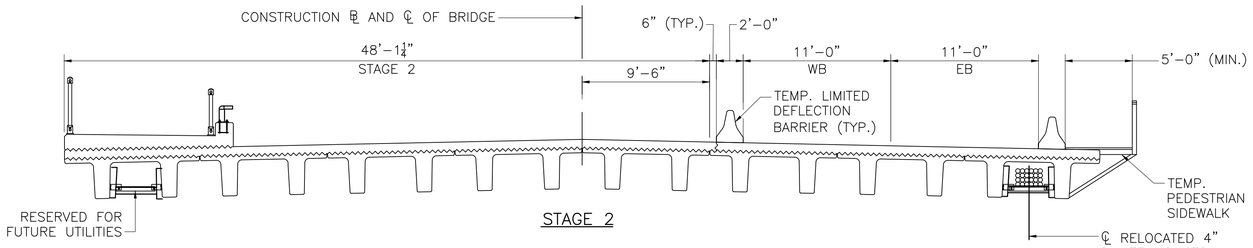
605311_SK22_BR(W06016).DWG Plotted on 12-Dec-2023 12:57 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023



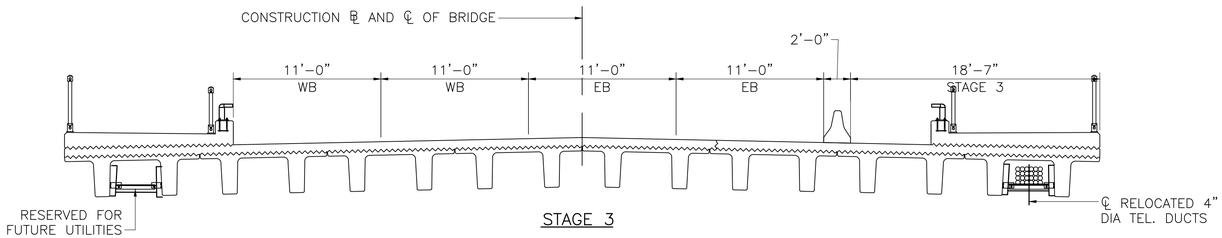
EXISTING CONDITION



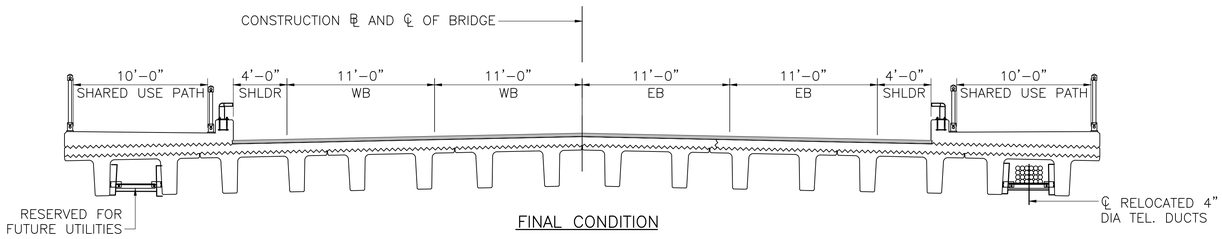
STAGE 1



STAGE 2



STAGE 3



FINAL CONDITION

CONSTRUCTION STAGING

SCALE: $\frac{3}{16}$" = 1'–0"

STAGE 1:

1.1 SHIFT TRAFFIC TO THE NORTH MAINTAINING ONE LANE IN EACH DIRECTION.

1.2 DEMOLISH SOUTHERLY PORTION OF EXISTING STRUCTURE.

1.3 CONSTRUCT PORTION OF NEW STRUCTURE AS SHOWN.

1.4 INSTALL 4" DIAMETER TELECOM DUCTS.

STAGE 2:

2.1 SHIFT TRAFFIC TO SOUTHERLY PORTION OF NEW STRUCTURE MAINTAINING ONE LANE IN EACH DIRECTION.

2.2 DEMOLISH NORTHERLY PORTION OF EXISTING STRUCTURE.

2.3 CONSTRUCT REMAINDER OF NEW STRUCTURE AS SHOWN.

2.4 RELOCATE FIBER CABLES IN 4" DIAMETER TELECOM DUCTS

STAGE 3:

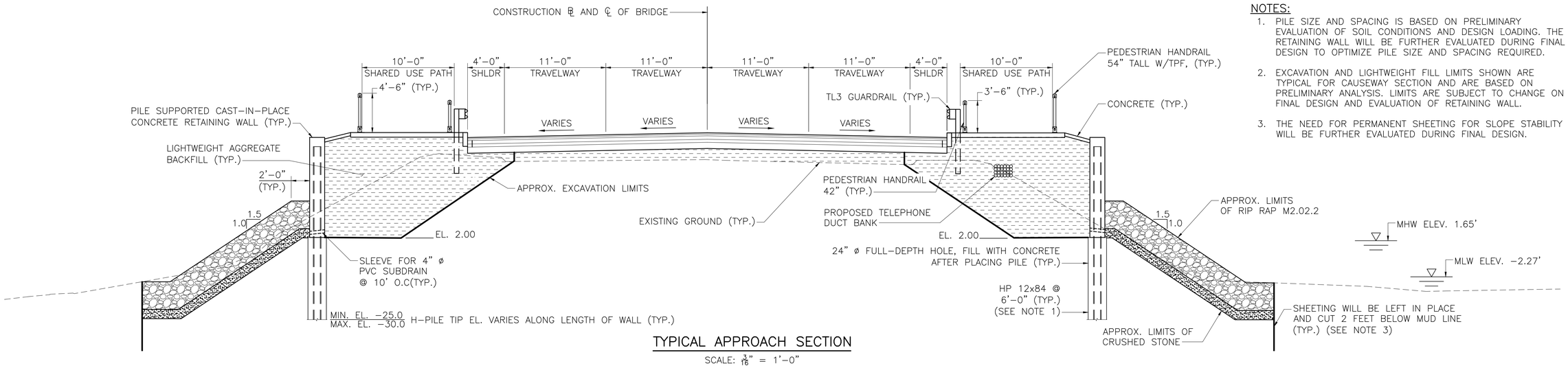
3.1 SHIFT TRAFFIC TRAFFIC NORTHERLY MAINTAINING FOUR LANES OF TRAFFIC, TWO IN EACH DIRECTION.

3.2 CONSTRUCT SOUTHERLY SHARED USE PATH AND BRIDGE RAIL.

FINAL STAGE:

REMOVE TEMPORARY BARRIER AND INSTALL SPRAY APPLIED WATER PROOFING MEMBRANE AND HMA WEARING SURFACE.

605311_SK24_BR(W06016).DWG Plotted on 12-Dec-2023 12:43 PM
605311 Sketch Plan Submittal (SP3) 06-DECEMBER-2023

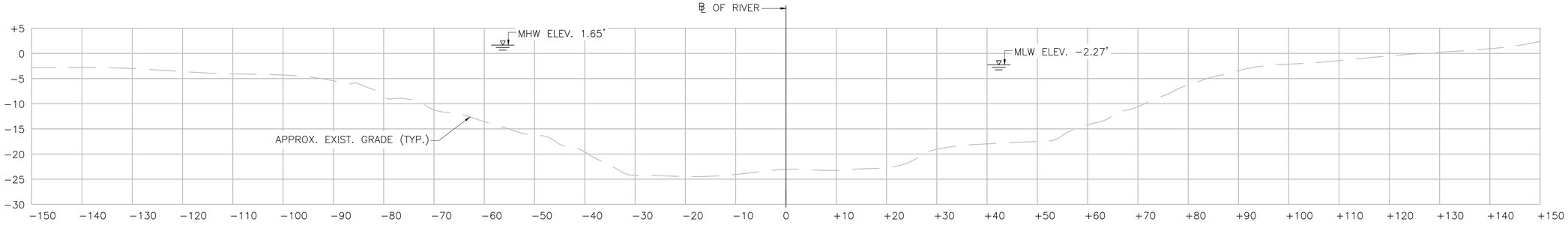


TYPICAL APPROACH SECTION

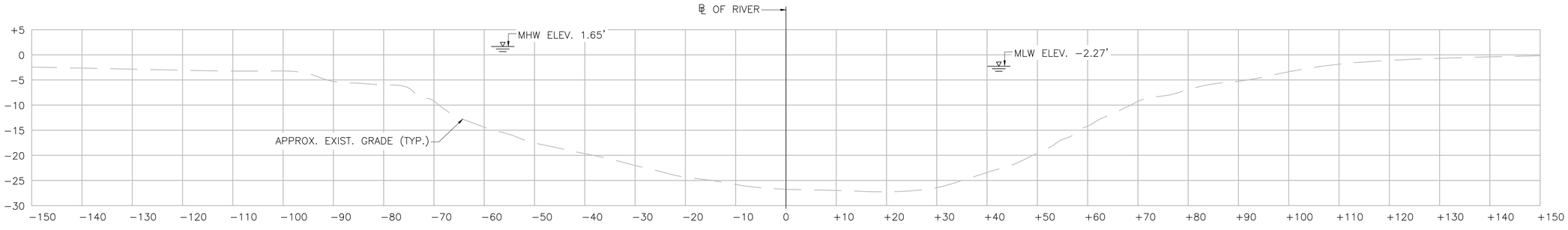
SCALE: $\frac{3}{16}$" = 1'–0"

NOTES:

1. PILE SIZE AND SPACING IS BASED ON PRELIMINARY EVALUATION OF SOIL CONDITIONS AND DESIGN LOADING. THE RETAINING WALL WILL BE FURTHER EVALUATED DURING FINAL DESIGN TO OPTIMIZE PILE SIZE AND SPACING REQUIRED.
2. EXCAVATION AND LIGHTWEIGHT FILL LIMITS SHOWN ARE TYPICAL FOR CAUSEWAY SECTION AND ARE BASED ON PRELIMINARY ANALYSIS. LIMITS ARE SUBJECT TO CHANGE ON FINAL DESIGN AND EVALUATION OF RETAINING WALL.
3. THE NEED FOR PERMANENT SHEETING FOR SLOPE STABILITY WILL BE FURTHER EVALUATED DURING FINAL DESIGN.



SECTION ACROSS RIVER ℄ AT STA. 201+38

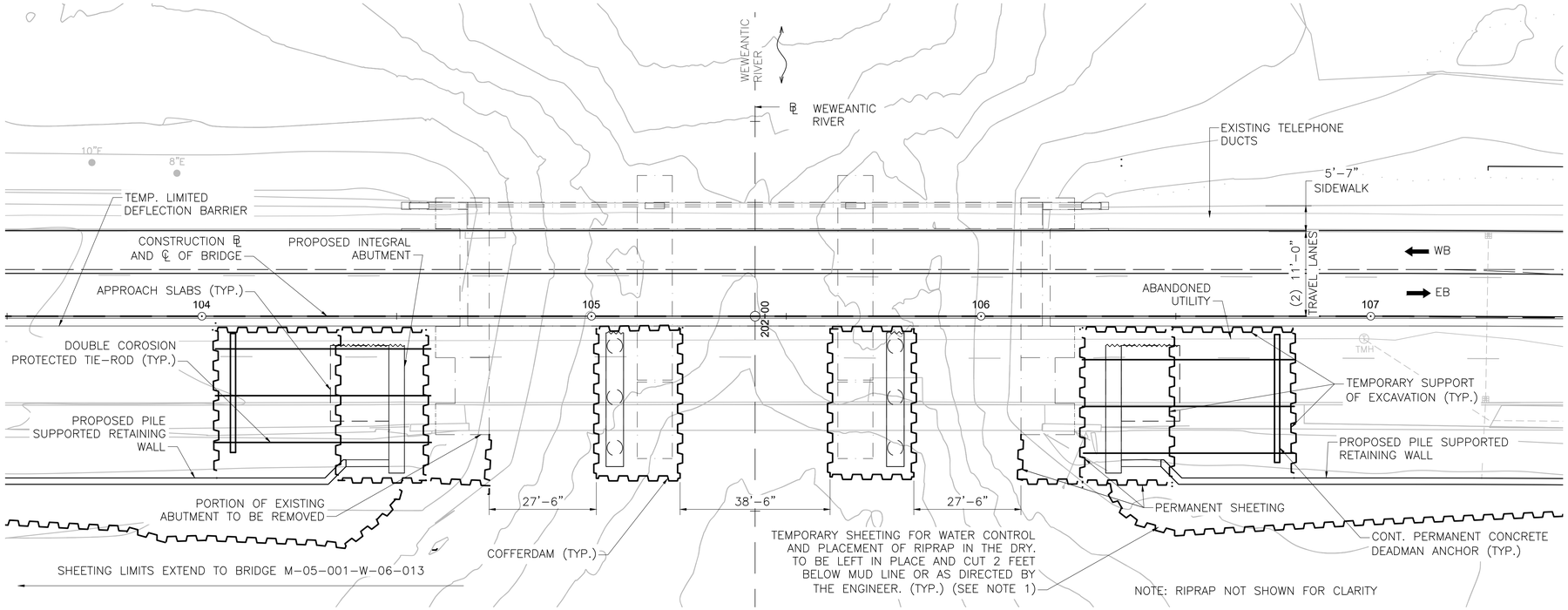


SECTION ACROSS RIVER ℄ AT STA. 202+62

CHANNEL APPROACH SECTIONS (LOOKING NORTHWEST)

SCALE: $\frac{3}{32}$" = 1'–0"

605311_SK23_BR(W06016).DWG Plotted on 12-Dec-2023 12:44 PM
605311 Sketch Plan Submittal (SP3) 10-AUGUST-2022



STAGE 1 CONSTRUCTION PLAN

SCALE: $\frac{1}{16}$" = 1'-0"

SUGGESTED SEQUENCE OF WATER CONTROL

STAGE 1:

1.1 DEMOLISH SOUTHERLY PORTION OF EXISTING STRUCTURE.

1.2 INSTALL STAGE 1 PIER COFFERDAM AND TEMPORARY SHEETING.

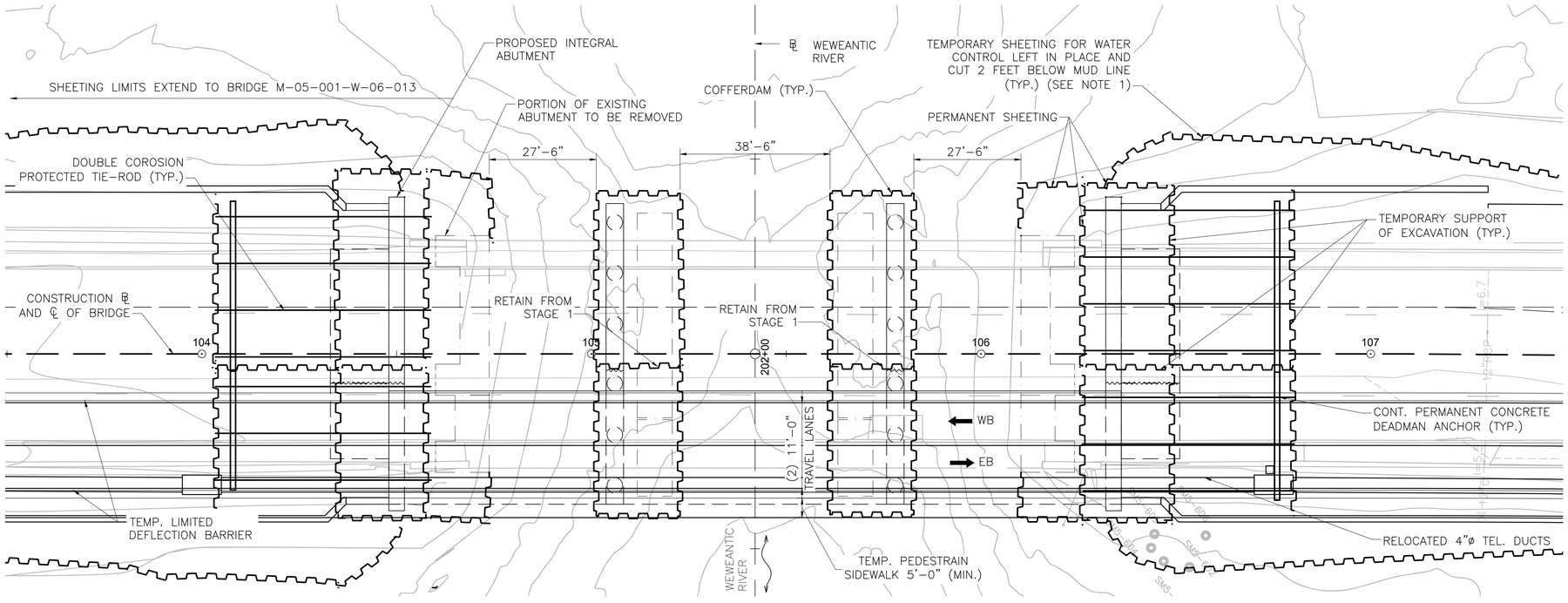
1.3 REMOVE SOUTHERLY PORTION OF PIER AND ABUTMENTS.

1.4 CONSTRUCT NEW SOUTHERLY PORTION OF PIER AND INTEGRAL ABUTMENTS.

1.5 REMOVE STAGE 1 PIER COFFERDAM AND TEMPORARY SHEETING.

NOTES:

1. THE NEED FOR PERMANENT SHEETING FOR SLOPE STABILITY WILL BE FURTHER EVALUATED ONCE SUPPLEMENTAL BORINGS/ PROBES HAVE BEEN COMPLETED FOR FINAL DESIGN.



STAGE 2 CONSTRUCTION PLAN

SCALE: $\frac{1}{16}$" = 1'-0"

NOTE: RIPRAP NOT SHOWN FOR CLARITY

STAGE 2:

2.1 DEMOLISH NORTHERLY PORTION OF EXISTING SUPERSTRUCTURE.

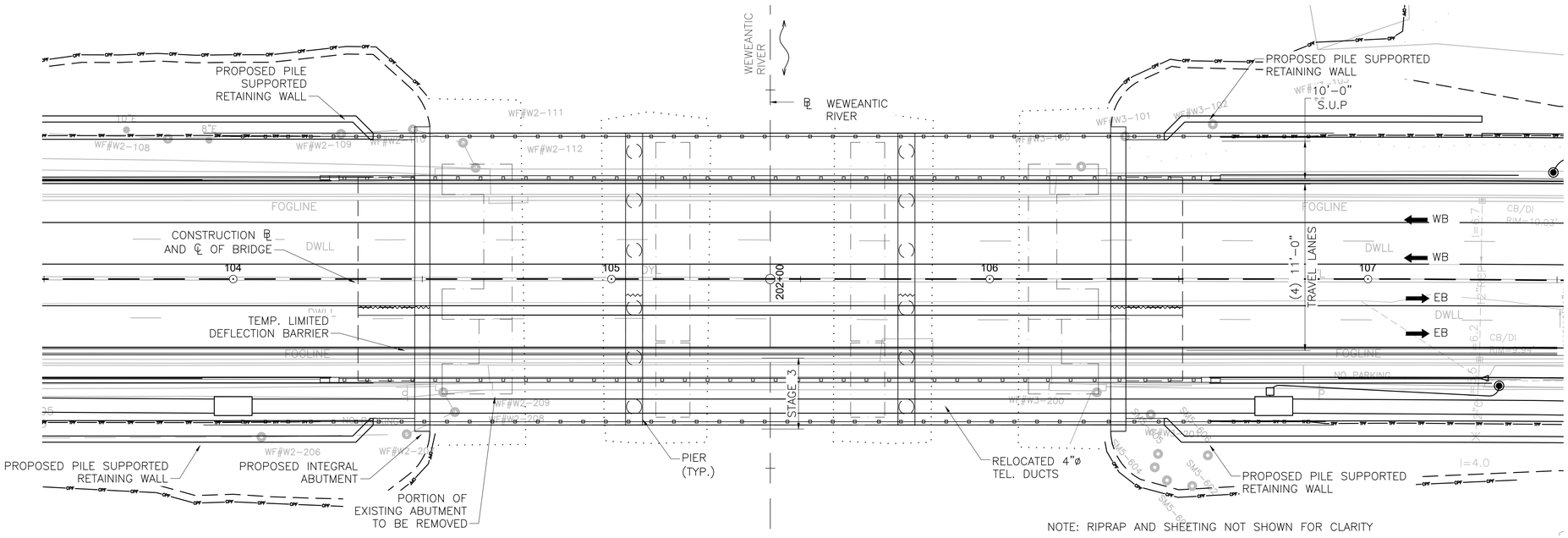
2.2 INSTALL STAGE 2 PIER COFFERDAM AND TEMPORARY SHEETING.

2.3 REMOVE NORTHERLY PORTIONS OF THE EXISTING PIER AND ABUTMENTS TO SPECIFIED LIMITS.

2.4 CONSTRUCT NEW NORTHERLY PORTION OF PIER AND INTEGRAL ABUTMENTS.

2.5 REMOVE STAGE 2 PIER COFFERDAM AND TEMPORARY SHEETING.

605311_SK25_BR(W06016).DWG Plotted on 12-Dec-2023 12:46 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023



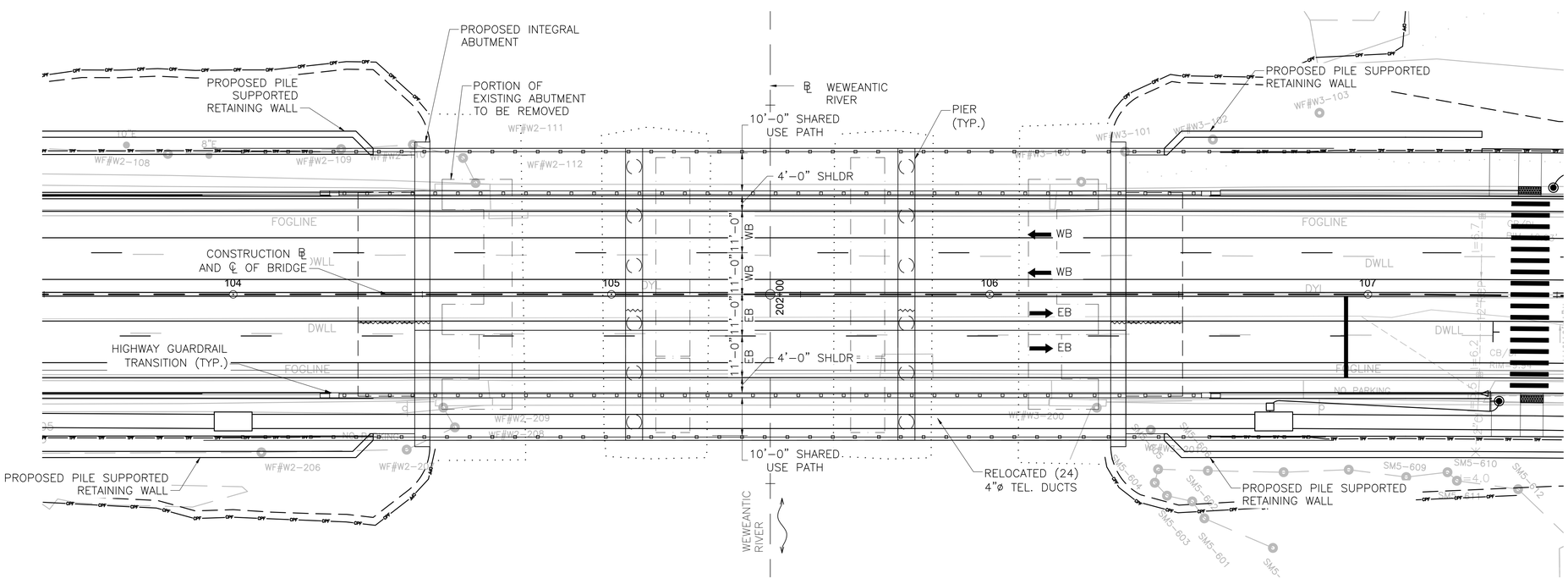
STAGING 3 CONSTRUCTION PLAN

SCALE: $\frac{1}{16}$" = 1'-0"

STAGE 3:

3.1 SHIFT TRAFFIC TRAFFIC NORTHERLY MAINTAINING FOUR LANES OF TRAFFIC, TWO IN EACH DIRECTION.

3.2 CONSTRUCT SOUTHERLY SHARED USE PATH AND BRIDGE RAIL.



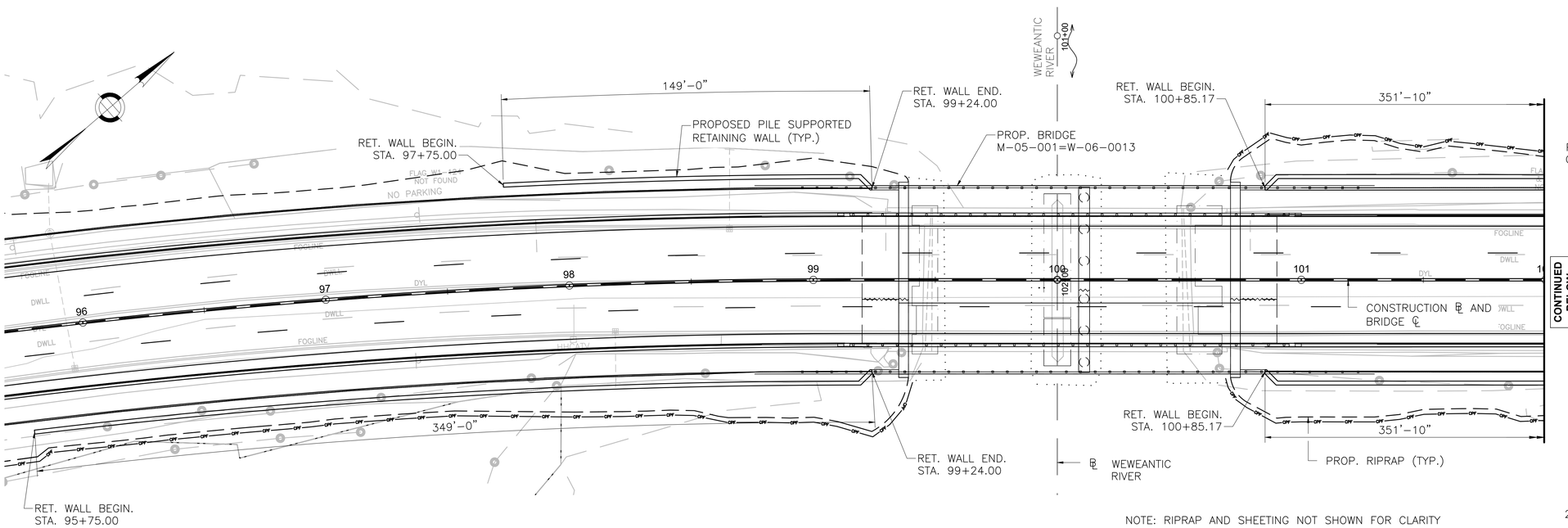
FINAL CONDITION

SCALE: $\frac{1}{16}$" = 1'-0"

FINAL STAGE:

REMOVE BARRIER AND INSTALL SPRAY APPLIED WATER PROOFING MEMBRANE AND HMA WEARING SURFACE.

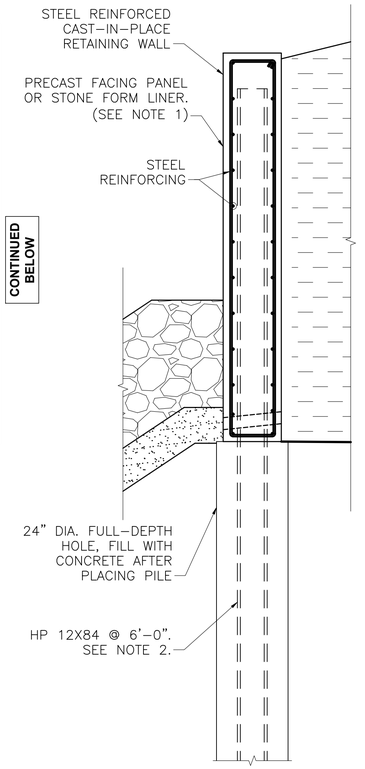
605311_SK26_BR(W06016).DWG Plotted on 12-Dec-2023 12:48 PM
605311 Sketch Plan Submittal (SP3) 27-APRIL-2023



NOTE: RIPRAP AND SHEETING NOT SHOWN FOR CLARITY

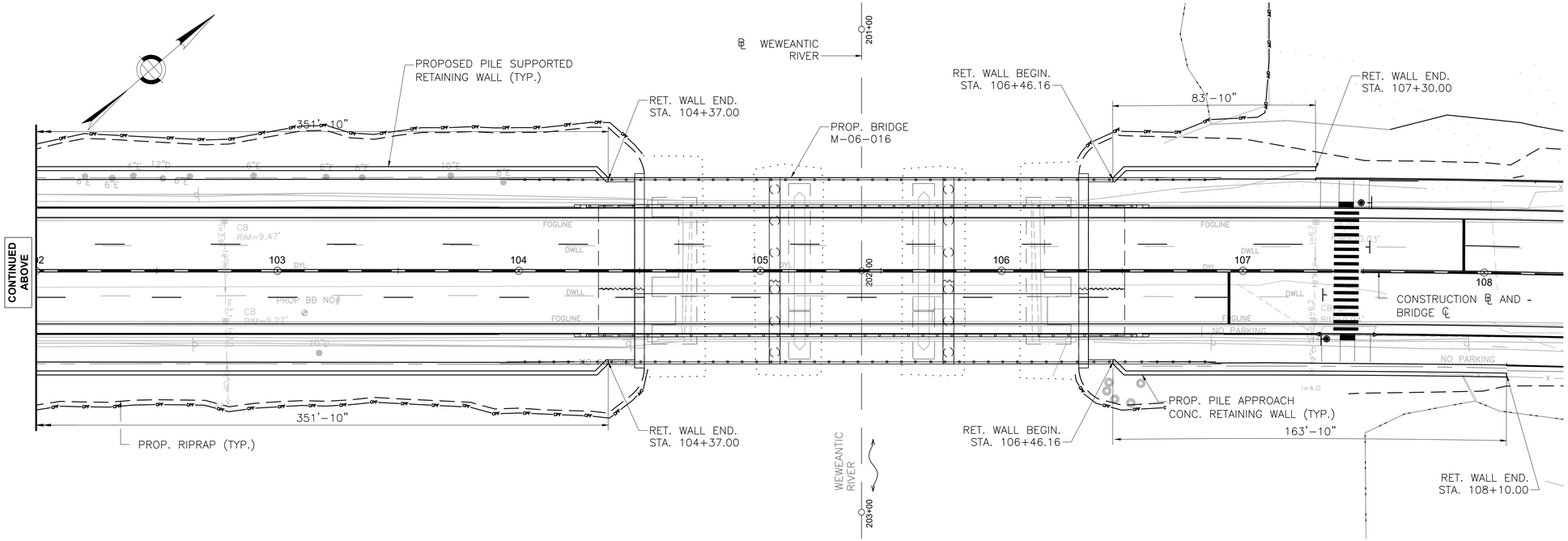
PILE SUPPORTED CONCRETE RETAINING WALL PLAN

NOT TO SCALE



PILE SUPPORTED CONCRETE RETAINING WALL DETAIL

SCALE: $\frac{1}{2}$" = 1'-0"



NOTE: RIPRAP AND SHEETING NOT SHOWN FOR CLARITY

PILE SUPPORTED CONCRETE RETAINING WALL PLAN

NOT TO SCALE

NOTES:

1. PRECAST CONCRETE FACING OR STONE TYPE FORM LINER TO PROVIDE AESTHETIC RETAINING WALL FINISH WILL BE EVALUATED FURTHER DURING FINAL DESIGN.
2. PILE SIZE AND SPACING IS BASED ON PRELIMINARY EVALUATION OF SOIL CONDITIONS AND DESIGN LOADING. THE RETAINING WALL WILL BE FURTHER EVALUATED DURING FINAL DESIGN TO OPTIMIZE PILE AND SPACING REQUIRED.

605311_SK28_BR(W06016).DWG Plotted on 12-Dec-2023 12:49 PM
605311 Sketch Plan Submittal (SP3) 08-DECEMBER-2023