HALEY ALDRICH

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REPORT ON

SUMMARY OF SUBSURFACE EXPLORATIONS, GEOTECHNICAL DESIGN RECOMMENDATIONS AND CONSTRUCTION CONSIDERATIONS
2 HARBOR STREET / 329 NORTHERN AVENUE
BOSTON, MASSACHUSETTS

by
Haley & Aldrich, Inc.
Boston, Massachusetts

for
BCP-CG Harbor Property LLC
Boston, Massachusetts

File No. 0200427-000
May 2021

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File No. 0200427-000

BCP-CHG Harbor Property LLC
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Attention: Mr. Eric Ewer

Subject: Summary of Subsurface Explorations, Geotechnical Design Recommendations and Construction Considerations
2 Harbor Street / 329 Northern Avenue
Boston, Massachusetts

Ladies and Gentlemen:

This report summarizes the subsurface explorations undertaken at the site to date, provides our interpretation of the subsurface data, and includes recommendations for geotechnical design and considerations for construction for the proposed 2 Harbor Street / 329 Northern Avenue Project (the "site") located in Boston, Massachusetts. This report can be provided to the Building Official to satisfy the requirements of the Massachusetts State Building Code (Building Code) 780 CMR Section 1803.1. The work summarized herein was conducted in accordance with our proposal dated 1 December 2020 and your subsequent authorization.

We appreciate the opportunity to serve on your team. Please contact us if you require additional information or wish to discuss any aspect of this report.

Sincerely yours,
HALEY & ALDRICH, INC.

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Enclosures

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1. Introduction

1.1 GENERAL

This report presents the results of the subsurface exploration programs completed at the site and provides geotechnical engineering recommendations and construction considerations for the proposed 2 Harbor Street / 329 Northern Avenue development. The recommendations provided herein are intended to satisfy the requirements of the Massachusetts State Building Code 780 CMR Section 1803.1. The general site location is shown on Figure 1, Project Locus, which is shown in more detail on Figure 2, Site and Subsurface Exploration Location Plan.

The information provided herein supersedes and replaces information previously transmitted in the report titled "Subsurface Data Report, South Boston innovation Campus, 2 Harbor Street/329 Northern Avenue, Boston, Massachusetts," prepared by Haley & Aldrich, Inc. (Haley & Aldrich) and dated 30 September 2019.

We have coordinated our work with the following project team members:

- Owner/Developer: BCP-CHG Harbor Property LLC
- Architect: Handel Architects, LLP
- Structural Engineer: DeSimone Consulting Engineers
- Civil Engineer: Nitsch Engineering, Inc.

1.2 ELEVATION AND DATUM

Elevations in this report are in feet and refer to Boston City Base datum (BCB), which is 6.46 ft below the North American Vertical Datum of 1988 (NAVD) and 94.35 ft above the Central Artery/Tunnel (CA/T) datum.

1.3 PROPOSED DEVELOPMENT

Our understsanding of the subject development is based on drawings titled, "100% Design Development" prepared by Handel Architects and dated 21 May 2021. This development includes demolition of the existing site building in its entirety followed by construction of a 10-story above grade office/lab/research building (refered to as "Building No. 1") positioned over a one-level below grade parking garage within the southeast portion of the site. The below-grade parking level will have an approximately 66,800 square foot (sq ft) footprint and the parking slab's finished floor elevation (FFE) will be set at about El. 4, which is about 12 ft below current site grades (assumes average existing surface grade of El. 16). Columns and walls for the new building and parking garage are planned to be supported by pile foundations installed to derive their load-carrying capacity in the bedrock underlying the site.

Discussions are also underway related to a second building ("Building No. 2") which is planned to be positioned directly to the southwest of the Building No. 1. We understand that Building No. 2 would also have a single below-grade parking level that is connected to the Building No. 1 parking level. At ground level and above, the two buildings would be separated by a courtyard. Building No. 2 would also

be supported on pile foundations. Recommendations provided herein generally apply to both Building No. 1 and Building No. 2.

Grade raises are planned along the north side of the proposed Building No. 1 through a combination of filling and hardscape/greenscape improvements that will be positioned over MassDOT and BWSC easements for the I-90 EB/WB Ted Williams Tunnel (Tunnel) and a 54-in. diameter storm drain utility (54-in. SD), respectively. In general, grade raises are anticipated to be in the range of no more than about 1 to 4 ft and will transition to existing grades at property boundaries, except for a planned hill (green feature) that gradually rises to about 11 ft above existing grade within the central portion of the final site improvements area.

2. Site Conditions and Proposed Construction

2.1 SITE HISTORY

The site, located in South Boston, historically consisted of mudflats filled in the late 1800s/early 1900s. Bordered by the Massport Haul Road to the northwest, Northern Avenue to the northeast and Harbor Street to the southeast, surface grades across the approximately 190,000 sq ft site are relatively level and generally range from approximately El. 15 to El. 17. To the south are two existing buildings - a nine-story building at 12 Channel Street and a two-story building at 7 Channel Street. Channel Street (a private way) generally bisects the site in a west-to-east direction. Historical maps (dated 1923 to 2002) and aerial photographs taken between 1938 and 2008 depicting conditions and general site uses are included in Appendix A.

2.2 EXISTING SITE CONDITIONS

An approximately 72,000 sq ft vacant, two-story steel and wood framed warehouse building built by the Navy in 1942 occupies much of the southern portion of the site (identified as 329 Northern Avenue). The remainder of the site is comprised of bituminous-paved surface parking. As noted previously, beneath the paved parking areas are easements for the Tunnel and 54-in. SD drain utility.

The existing site building's lowest floor slab was constructed at El. 20 (i.e., about 3 to 4 ft above exterior site grades). Drawings indicate the slab is about 8-in. thick with steel reinforcement in both directions set at the bottom and a welded wire mesh at the top. The building's columns and perimeter walls are pile-supported. The type of pile indicated on the drawings is "Raymond Pile." We believe a uniform tapered Raymond Pile was constructed with the tops of the piles measuring 16-in. diameter and the points tapering to 9-in. diameter. Installation details on the drawings indicated most of the piles were about 60-ft long, although an occasional pile was installed with lengths ranging from 64 to 73 ft; the piles were reportedly rated for "load-carrying capacity" that ranged from approximately 7 to 88 tons. The northern corner of the building was altered in the early 1990s to facilitate construction of the Tunnel. The above grade portion of the building was demolished, and it is presumed the concrete pile caps were removed "to grade" and the concrete piles remain in place. The approximate limits and configuration of the 329 Northern Avenue building is shown on Figure 2.

The portion of the Tunnel adjacent to the site was constructed as a cut-and-cover cast-in-place reinforced concrete box tunnel with east and west roadways separated by a median wall. The open excavation to construct the approximately 125-ft wide by 40-ft high box tunnel is believed to have consisted of steel sheetpiling with external bracing using multiple elevations of tieback anchors; we understand from review of limited archived CA/T files that the steel sheetpiling may have transitioned to concrete slurry wall at approximately Sta. 90+00 (i.e., about 300 ft to the east of the 2 Harbor property limits); refer to Appendix B. As-built drawing records of the temporary earth support system were not reviewed and thus cannot be confirmed at this time. Based on the limited available archived CA/T project records, we believe up to five (5) levels of tiebacks could have been installed and that the tiebacks were likely de-tensioned and abandoned in place. The type of tieback (steel bar or steel tendons), is not known; the length and installation angle for each tieback level cannot be verified but are shown to be about 60 to 100-ft long at an angle of about 30 degrees from the horizontal on a sketch illustrating conditions at Sta. 89+50 (more than 250 ft to the northeast of the project site); refer to Appendix B. We presume that the steel sheetpiling similarly would have been tied back using steel

tendons, and the tendons would have been detensioned and abandoned in place following backfilling around and over the Tunnel. Within the limits of the project site, the bottom of the box tunnel is generally presumed to be bearing on the natural, inorganic Marine Deposits at about El. -28 to El. -31.5. Thickness of cover (overburden soils placed over the roof of the box tunnel) ranges from about 4.4 to 7.9 ft, increasing west-to east across the site. The approximate alignment of the Tunnel is shown on Figure 2.

Parallel with the south side of the Tunnel easement is an approximately 30-ft wide easement (presumably for BWSC infrastructure), within which has been constructed various utilities, including a 54-in. diameter reinforced concrete storm drain (SD) utility. Refer to the project's Site/Civil drawings for additional information regarding the approximate depth and alignment of the 54-in. SD pipe. The invert of the pipe is estimated to be about El. 1 to El. 2.

A compilation of Drawings for the on-site building, Tunnel and 54-in. SD utility obtained through research of our files and other resources, including information made available to the project by MassDOT, are included in Appendix B.

3. Subsurface Soil and Bedrock Conditions

3.1 PREVIOUS EXPLORATIONS BY OTHERS

Previous explorations associated with the design of the Tunnel (SB2-series) and site characterization by the former site owner (B-series), have been conducted at the subject site. The designations and approximate locations of the previous explorations are shown on Figure 2, and the logs of these explorations are provided in Appendix C.

3.1.1 2019 Test Borings

During the period 24 June to 15 July 2019, Geologic-Earth Exploration, Inc. conducted five (5) test borings (designated HA19-B1 through HA19-B5) at the site for geotechnical and environmental purposes. The test borings were advanced to depths ranging from 51 to 119 ft below ground surface (bgs). A groundwater observation well (OW) was installed in completed borehole HA19-B2. Refer to Figure 2 for the designations and approximate locations of the explorations. Logs of the test borings and installation report for the groundwater observation well are provided in Appendix D; photographs of recovered rock core are included in Appendix E.

3.1.2 2019 Test Pits

During the period 22 and 29 July 2019, James W. Flett Co., excavated nine (9) test pits (designated HA19-TP1 through HA19-TP9) at the site to determine the depth to the top of the Tunnel, identify the limits of remnant Support of Excavation (SOE) system(s) abandoned in-place, and assess the composition of the soils placed as backfill above the Tunnel. The test pits were advanced to depths ranging from 4.4 to 8.5 ft bgs. Refer to Figure 2 for the designations and approximate locations of the explorations. Logs and photographs of conditions observed at the test pit locations are provided in Appendix F.

A generalized summary of conditions encountered at each test pit is provided below:

Test Pit ID	Primary Purpose of Test Pit	Observations/Conditions Encountered
HA19-TP1	Identify top of tunnel	Top of tunnel protective slab at 4.4 ft (El. 12.5)
HA19-TP2	Identify remnant SOE	SOE not encountered in test pit, top of ductile iron pipe at 2.7 ft (El. 3.5); top of concrete duct bank at 6.5 ft (El. 9.7)
HA19-TP3	Identify top of tunnel	Top of tunnel protective slab at 7.9 ft (El. 8.4)
HA19-TP4	Identify top of tunnel	Top of tunnel protective slab at 4.8 ft (El. 11.6)
HA19-TP5	Identify top of tunnel	Top of tunnel protective slab at 4.6 ft (El. 12)
HA19-TP6	Identify top of tunnel	SOE not encountered in test pit, top of concrete duct bank at 2.5 ft (El. 13.4); top of pipe at 4.3 ft (El. 11.6)
HA19-TP7	Identify top of tunnel	Top of tunnel not encountered; top of concrete rubble at 3.3 ft (El. 12.9)
HA19-TP8	Identify top of tunnel	Top of tunnel protective slab at 6 to 6.5 ft (El. 10.1 to El. 10.6)
HA19-TP9	Identify top of tunnel	Top of tunnel protective slab at 6.5 to 6.9 ft (El. 9 to El. 9.4); top of concrete rubble at 2 ft (El. 13.9); top of concrete drain pipe at 3.8 ft (El. 12.1)

3.2 SUBSURFACE SOIL AND BEDROCK CONDITIONS

The subsurface explorations generally indicated the following sequence of subsurface units:

Stratum/Subsurface Unit	Top of Stratum Elevation (BCB)	Range in Thickness (ft)
Fill (Miscellaneous and Cohesive)	El. 15 to El. 17	5 to 28
Organic Soils	El. 11 to El. -11	5 to 29
Marine Deposits (Clay)	El. -12 to El. -21	43 to 70
Glacial Deposits	El. -61 to El. -89	2 to 12
Bedrock	El. -71 to El. -94	Depth to bedrock approximately 87 to 111 ft

A summary of subsurface conditions encountered at each exploration location is included as Table I. A generalized description of the soil units encountered is provided below (one or more of the soil units may be absent at specific locations throughout the site):

- **Fill:** encountered at each exploration location ranging from 5 to 28 ft thick. The nature and composition of the Fill materials encountered vary considerably. The Fill soils can generally be described as light brown to black, gray to dark gray, loose to dense, poorly graded SAND with various amounts of silt, clay and gravel. Varying amounts of deleterious materials were encountered throughout the Fill and included ash, cinders, organic materials (peat and silt), shells, wood, fabric, brick, concrete, metal, and other debris.
- **Cohesive Fill:** encountered at location HA19-B5 beneath the Fill at a depth of 9 ft bgs, corresponding to El. 6.5. The Cohesive Fill soil is described as soft to very soft gray to black lean CLAY with trace pockets of poorly graded sands and trace shells.
- **Organic Deposits:** encountered at each test boring location ranging from 5 to 29 ft thick. In general, these materials were described as very soft to stiff ORGANIC SOIL with variable quantities of sand, shells and peat.
- **Marine Deposits:** encountered at each test boring location beneath the Organic Deposits ranging from 43 to 70 ft thick. In general, the Marine Deposits can be described as gray or tan to olive brown, hard to very soft CLAY with varying amounts of sand and gravel.
- **Glacial Deposits:** encountered beneath the Marine Deposits at depths ranging from 77 to 105 ft bgs, corresponding to El. -61 to El. -89. At locations HA19-B1 and HA19-B3, the stratum consisted of Glaciomarine Deposits described as gray, hard CLAY with varying amounts of sand and gravel; a boulder was encountered within the Glaciomarine Deposits at the locations of HA19-B1 at a depth of about 105 ft (El. -88.8). At locations HA19-B2 and HA19-B4, the stratum consisted of Glacial Till described as gray, dense to very dense SAND with varying amounts of clay, silt and gravel.
- **Bedrock:** underlying the site is known as Cambridge ARGILLITE and was encountered at depths ranging from about 87 to 111 ft bgs, which corresponds to about El. -71 to El. -94. Within the upper approximately 2 to 6 ft of bedrock, the driller was generally able to advance the borehole using a roller-bit and split-spoon sampler through what was described as weathered bedrock. Beneath the weathered bedrock, moderately hard to hard and fresh bedrock was encountered. Advance rates measured during coring ranged from about 2 to 4 minutes per foot. Rock core

recovery ranged from 75% to 100%, and the Rock Quality Designation (RQD), which represents the percent of rock pieces recovered greater than 4 in. in length relative to the total length of the core run, ranged from 58% to 82%. In general, the depth to bedrock appears to be greatest towards the northern and northwestern limits of the proposed building footprint.

The lines designating the interface between strata on the logs represent approximate boundaries, which may be gradual and vary between locations. The logs depict subsurface conditions at the specific exploration location and at the time the exploration was conducted. Subsurface conditions at other locations on the site may differ from conditions occurring at these exploration locations.

3.3 GROUNDWATER AND FLOOD LEVEL CONDITIONS

Limited measurements obtained from an observation well installed in June 2019 indicated groundwater at depths of approximately 8 to 10 ft below the existing ground surface, corresponding to approximately El. 6 to El. 8. Groundwater levels can fluctuate for numerous reasons, including precipitation, infiltration and exfiltration from utilities, and seasonal variation. The site is near Boston's Harbor's Main Channel, and additional measurements of groundwater levels will be needed to determine if site groundwater levels are tidally influenced.

The site is located within a designated flood zone having a Sea Level Rise – Base Flood Elevation (SLR-BFE) established at El. 19.5 by the City of Boston Planning & Development Agency (BPDA).

4. Geotechnical Design Recommendations

4.1 GENERAL

The following sections provide geotechnical recommendations pertaining to permanent design of the proposed structure, intended primarily for members of the project team responsible for design. The recommendations provided herein are in general accordance with the 9th Edition of the Massachusetts State Building Code (Building Code) which references the 2015 International Building Code (IBC 2015), including applicable Amendments. Guidelines for construction will be provided in the project Contract Documents, which should be reviewed by the Contractor in conjunction with the recommendations provided herein.

4.2 BUILDING FOUNDATIONS

The Fill soils, Organic Soils, and Marine Deposits are not suitable to support the new building loads. We recommend the building be designed to be supported on deep foundations installed through the overburden soils, including the Glacial Deposits, and that derive their support in end bearing in bedrock. While straight shaft caissons (drilled shafts) socketed into the bedrock and precast-prestressed concrete piles and concrete-filled steel pipe piles are technically feasible support options, we recommend steel H-piles be considered to limit excess soil generated from the installations and to minimize impacts to the adjacent Tunnel and utilities resulting from potential ground heave associated with "displacement" piles.

Specific foundation design recommendations follow. Additional details related to the foundation piles will be provided in technical provisions of specifications for the foundations.

- Steel H-piles should consist of HP14x102 piles, driven to end-bearing in bedrock, and constructed of steel conforming to current applicable ASTM and other industry standards.
- Based on structural loads and other considerations, we recommend a design capacity of 400-kip per pile in axial compression. The recommended compression capacity considers a minimum yield strength of steel (fy) = 50 kips per square inch (ksi); an allowable compression stress equal to 21 ksi; and a 1/8 in. allowance for corrosion. Final confirmation of pile compression capacity will require dynamic and possibly static load testing in accordance with the Code.
- Allowable lateral capacity, per pile, is estimated as follows, assuming up to an allowable 0.5-in. of deflection at the top of pile:

Pile Section	Fixed Head Condition		Free Head Condition	
	Weak Axis (y-y)	Strong Axis (x-x)	Weak Axis (y-y)	Strong Axis (x-x)
HP14x102	7 kips	12 kips	2 kips	5 kips

- Maximum allowable uplift capacity of 35 tons (70 kips) per pile.
- The steel H-piles are expected to bear in bedrock. Pile lengths are generally anticipated to be on the order of 90 to 110 ft (if driven from a prepared working grade of no lower than El. 10) and will require splicing if greater than about 90 ft.

- A minimum of three piles should be provided below individual columns unless laterally supported in accordance with the Code (1810.2.2).
- Bottoms of pile caps and grade beams should be constructed at least 4 ft below adjacent ground surfaces that will be exposed to freezing temperatures, unless insulation or other suitable protection is provided.
- It is anticipated that total settlement of structural elements supported on pile foundations as recommended herein will not exceed about 3/4 inch, with differential settlements between adjacent columns not exceeding about 1/4 inch. Most of the settlements will likely occur during construction as structure dead loads are placed on the foundations.
- The Code requires a static load test be performed for pile capacities exceeding 100 kips, unless a waiver is granted by the building official. At a minimum, an indicator pile program will be required, including dynamic testing of indicator piles, to confirm drivability conditions, hammer energy, pile lengths, and for selection of a pile(s) for static load testing (if required).

4.3 DESIGN GROUNDWATER LEVEL AND WATERPROOFING

Based on review of groundwater levels and anticipated future flood level data for the site we recommend a design maximum groundwater level at El. 19.5 be used for evaluating resistance to hydrostatic uplift for the below-grade parking level slab, sumps, pits, and other structures (e.g., sub-slab utility corridors). El. 19.5 is also recommended for calculating permanent lateral pressures on exterior foundation walls. Exterior foundation walls should be waterproofed to no less than El. 19.5.

Surface runoff should be directed away from the building. In general, ground surface within 10 ft immediately around the building should slope downward away from the structure to divert surface runoff.

4.4 RESISTANCE TO HYDROSTATIC UPLIFT

Hydrostatic uplift pressures will act on the bottom of the below grade parking slab. An alternative to designing the parking slab to resist anticipated hydrostatic pressures is to relieve hydrostatic uplift pressures with a subslab pressure relief system installed beneath the parking slab. The subslab pressure relief system should consist of 4-inch diameter perforated pipe embedded in an 8-in. to 12-in. thick layer of 3/4-in. crushed stone placed below the slab and underlain by a geotextile separator layer to reduce potential for migration of fines into the drainage layer. Because the excavation for the parking slab is anticipated to be in the Fill and/or Organic Soils, additional excavation may be needed to provide a stable subgrade on which the subslab pressure relief system can be constructed.

The subslab pressure relief plumbing will transmit water to a dedicated sump/ejector pit that will direct the seepage volume to the project's stormwater storage tank located in the garage, from which it would be pumped to the project's linear recharge gallery positioned outside and around the perimeter of the future Building No. 2 and/or to the storm drain by way of the project's stormwater system overflow connection.

We recommend the ejector pit be sized to contain two sumps (primary and redundant) and that each pump system be designed for a steady-state flow of about 5 gallons per minute (gpm) and a peak flow of about 50 gpm, and be served by a primary and backup source of power. In addition, it is recommended that the ejector pit be fully waterproofed and designed to resist a hydrostatic uplift pressure equal to

the height of water between finished parking slab elevation (El. 4) and design bottom of pit. If it is found that the weight of the ejector pit is not sufficient to resist hydrostatic pressures, the pit may need to be structurally doweled into the slab/foundation wall.

Effective performance of the sub slab pressure relief system requires that an impervious material (i.e., flow fill) plug be placed from the bottom of excavation to no lower than El. 5 in the area between the outside face of the building's foundation wall and inside face of the SOE wall. Subsurface perimeter drainage is not considered necessary.

4.5 LOWEST LEVEL FLOOR

Excavation for the below-grade parking slab is expected to extend down to at least approximately El. 2 and about El. -1 (or deeper) for pile caps and the core mat, which will be about 6 to 9 ft below anticipated "normal" groundwater level and up to 20 ft below "hydrostatic uplift design" groundwater level (El. 20). In addition, the parking slab may be underlain by approximately 15 to 24 ft of Fill and/or Organic soils. Loading of the slab, if left unsupported above the Fill and Organic soils, would be expected to cause undesirable differential settlement. Over-excavation and replacement of the underlying Fill and Organic soils is not considered practical. Accordingly, we recommend that the below-grade parking slab be constructed as a structurally supported slab designed to span between pile-supported columns. Intermediate slab-support piles may need to be considered to reduce the span and thickness of the slab.

4.6 SEISMIC DESIGN

Under Massachusetts State Building Code 9th Edition, seismic design of structures is to be based on ASCE/SEI 7-05-Minimum Design Loads for Buildings and Other Structures as modified for Massachusetts. The Building Code requires classifying the site (Site Class A through F) depending on the soil profile within 30 meters (100 ft) bgs. After determining the appropriate Site Class and the project location within the State, site-specific design parameters are selected for use in analyses to determine the "Seismic Design Category." Based on review of subsurface data and our analyses, we recommend the following parameters in accordance with the Building Code:

- Site Class = D
- Ss = 0.217 (Note 1)
- S1 = 0.069 (Note 1)
- Fa = 1.6 (Note 2)
- Fv = 2.4 (Note 2)

Notes:

1. Values determined from Table 1604.11 of the Massachusetts State Building Code, 9th Edition.
2. Values determined from Table 1613.3.3(1) and Table 1613.3.3(2) of the International Building Code, 2015.

The soils at the site are not considered susceptible to liquefaction during the design earthquake specified in the Building Code.

4.7 LATERAL PRESSURES

Foundation and basement walls serving as retaining walls and backfilled with soil should be designed to resist at-rest lateral earth pressures as follows:

- Static Earth: use an equivalent fluid unit weight of soil equal to 60 pounds per cubic foot (pcf) to calculate static pressures above El. 19.5 (i.e., design groundwater elevation) and 90 pounds per cubic foot below El. 19.5.
- Surcharges: uniform pressure applied from the elevation of the surcharge to the bottom of the foundation element with a magnitude of 0.5q (psf), where q is the vertical surcharge load (psf), uniformly distributed over the height of the wall for restrained and unrestrained walls, respectively.
- Seismic Earth: calculate in accordance with the Code (Article 1610.2) using a total soil unit weight (γ_t) of 125 pcf.

Site retaining walls should be designed to resist active lateral earth pressures as follows:

- Retained Earth: use an equivalent fluid unit weight of soil equal to 40 pounds per cubic foot (pcf) to calculate static pressures above the design groundwater elevation (El. 19.5) and 80 pounds per cubic foot below the design groundwater elevation.
- Surcharges: uniform pressure applied from the elevation of the surcharge to the bottom of the foundation element with a magnitude of 0.33q (psf), where q is the vertical surcharge load (psf), uniformly distributed over the height of the wall for restrained and unrestrained walls, respectively.
- Seismic Earth: calculate in accordance with the Building Code Article 1610.2 using a total soil unit weight of 125 pcf.

4.8 RESISTANCE TO LATERAL LOADS

Lateral loads may be resisted using a combination of lateral capacity from steel H-piles and passive resistance developed against pile caps and foundation walls, including as follows:

- For site retaining walls and footing foundations supporting landscape improvements, the net allowable lateral resistance (passive minus active) provided by the backfill against the walls/footings can be calculated by using an equivalent fluid unit weight of 150 pcf above the design groundwater level (El. 19.5) and 75 pcf below the design groundwater level (El. 19.5). This value assumes that granular backfill is placed within 3 ft laterally around footings and walls, and systematically compacted in lifts to minimum 95% of maximum dry density. Values should be reduced by 25% if backfill is not systematically placed and compacted. The top of the assumed passive zone should be 6 in. below the top of the adjacent soil or backfill surface.
- A coefficient of friction between cast-in-place concrete footing and the bearing strata beneath equal to 0.45 may be used to calculate ultimate sliding resistance. A minimum factor of safety against sliding equal to 1.5 should be achieved for resistance of permanent lateral loads. The top of the assumed passive zone should be 6 in. below the top of the adjacent soil or backfill surface.

If the combination of net passive earth pressure and frictional forces between the footings and subgrade does not provide adequate lateral resistance, further evaluation of lateral resistance will be necessary.

4.9 STORMWATER STORAGE/RECHARGE DESIGN

A stormwater storage and recharge system is required to comply with storage and infiltration requirements established by the Boston Water and Sewer Commission (BWSC) and goals established by the Leadership in Energy and Environmental Design (LEED).

The system as currently designed by the project's Civil Engineer includes two systems: System 1 consists of 14,500 cf of storage in a tank positioned in the garage and from which water will be pumped to a linear recharge gallery (comprised of stone and slotted piping) positioned outside and around the perimeter of the future Building No. 2. System 2 consists of up to 4,300 cf of combined storage and recharge provided through an arrangement of stone and open-bottomed chambers that will be located in the northernmost corner of the site beneath the final site improvements.

Systems 1 and 2 are designed to facilitate infiltration of water into the miscellaneous fill soils anticipated to underlie the project site to a depth of about 20 ft below planned final site grades. For additional details, refer to the Haley & Aldrich letter titled "Stormwater Storage and Infiltration Systems" dated 15 April 2021 provided in Appendix G.

4.10 UTILITIES AND SITE IMPROVEMENTS

Site utilities beyond the building limits are anticipated to be soil-supported. Where these utilities penetrate through the foundation wall, oversized holes should be utilized to reduce the potential for utility breakage (due to post-construction settlement of the soil-supported utility). We also recommend flexible connections at utility transitions from soil-supported (outside the building) to pile supported structures (inside the building). All penetrations should be sealed and waterproofed on the exterior side of the building wall.

Similar to site utilities, sidewalks and building egress slabs could be subject to settlement in areas where grades will be raised. At building egress slabs, transition or "tipping" slabs are often used in such conditions to provide a transition between the pile-supported building and the surrounding ground. The slabs should be designed as a reinforced concrete structural slab supported at the building on a shelf cast into the foundation wall or on a concrete encased corrosion resistant bracket attached to the wall/ grade beam. The "free" end of the slab bears directly on the prepared subgrade soil. The length of such a slab is oftentimes in the range of 8 to 15 ft and usually depends on the anticipated ground settlement at that location and the allowable tilting of the slab over time. Each location should be evaluated on a case-by-case basis.

Raises-in-grade across the site footprint will also need to be reviewed on a case-by-case basis relative the schedule and sequence of utility and other site improvement installations, as well as proximity and potentially loading/impacts to the Tunnel or other existing infrastructure. Depending upon the settlement or structural sensitivity of existing infrastructure or other site improvement structures (i.e., walkways, retaining walls, etc.), use of lightweight fill material may be required to limit net stress increase resulting from the raise-in-grade. Lightweight fill materials may consist of expanded shale aggregate (e.g., Norlite) and/or expanded polystyrene (e.g., Geofoam). Over-excavation of select

“normal weight” fill may be required, as necessary to further limit net stress increase and mitigate resulting ground subsidence.

New utilities and site structures should be evaluated relative to resistance to hydrostatic uplift forces. This will particularly be true in areas where lightweight fill material is used for grade raise materials, where there will be less load imparted by the backfill material to counteract buoyancy forces.

5. Construction Considerations

5.1 GENERAL

This section provides comments related to foundation construction, construction sequence and logistics, instrumentation and monitoring programs, and other aspects of the planned construction. Topics within this section will be incorporated into the project Contract Documents (Specification sections). Estimated quantities are provided for certain foundation/geotechnical-related components (particularly the temporary support of excavation [SOE] system) to assist prospective Contractors bidding the project; however, these quantities are for guidance only and Contractors should evaluate pricing and potential construction issues based on their own knowledge and experience with similar subsurface soil, bedrock and groundwater conditions and local practice, taking into account their own proposed construction methods, procedures, and available equipment.

In addition to the construction guidelines and recommendations provided herein, all construction activities should conform to the requirements of the Occupational Safety and Health Administration (OSHA) and all other applicable Federal, Municipal and State regulatory requirements.

5.2 PRE-TRENCHING/ PRE-EXCAVATION

Pre-trenching/ pre-excavation through the surficial fill to a depth no less than about 10 ft (and/or no less than about El. 6) in advance of installing the sheetpile system and possibly at planned foundation locations is recommended to remove obstructions that could impede sheetpiling and foundation installation. Pre-trenching should be conducted in a controlled manner – particularly where remnant foundations (former building piles may need to be removed. Excavated soil materials, after removal of materials larger than about 4 in. size, should be considered for re-use to backfill pre-trenches; where additional materials are needed to backfill pre-trenches, the Contractor shall consider placing other approved materials that do not impede installation of the sheetpiling system or foundation elements. Placement of materials into the pre-trench should also be controlled and compaction of the backfill should be conducted to the extent practical (e.g., tamping with the excavator bucket).

Remnant tieback anchors associated with the adjacent existing Tunnel's support of excavation system may be encountered during sheetpile installation – primarily along the northern side of the sheetpile SOE system. For current planning purposes, assume that pre-augering or spudding at discrete locations (e.g., at regular intervals in the range of 4 to 5-ft in length along the northern side of the SOE system) could be required to facilitate clearing/removing abandoned tiebacks. It is anticipated that 2 to 3 levels of tiebacks could be encountered along the northern side of the sheetpile SOE system; refer to sketch included in Appendix B.

5.3 TEMPORARY SUPPORT OF EXCAVATION

Temporary excavation support will be required along the entire building perimeter to limit the lateral extent of the excavation, limit impacts to adjacent properties and structures, control groundwater seepage, and maintain groundwater levels outside the excavation for the below grade parking structure and foundations. The type of lateral earth support system recommended to satisfy these requirements is an interlocking steel sheetpile wall; the sheetpile section selected should be hot-rolled. The position of the sheetpiling should consider the configuration of the proposed foundations and methods to form

perimeter below-grade walls. Steel sheetpiles should be installed using a variable-moment/ variable frequency (VMVF) vibratory hammer to allow adjustment of the hammer energy to mitigate the magnitude of construction-induced vibrations.

Although final SOE design is typically by the Contractor, we have conducted analyses to develop a conceptual layout of excavation support as shown on Figure 3, which consists of a combination of cantilevered and internally braced (1-level) steel sheetpile SOE system. The SOE system as shown was developed assuming 2-sided forms would be utilized for below grade foundation wall construction and a maximum lateral wall movement criterion equal to about no greater than 2 to 4 inches along the north (Tunnel/ 54 in. SD) and east (Northern Avenue) sides, and up to 6 inches along the south and west (Harbor Street) sides. In order for the SOE system as shown to satisfy those lateral movement criteria, the system relies on certain assumptions (e.g., site grade bench cut and limits on surcharge magnitude and proximity to the sheet piling wall). The system and assumptions shown on Figure 3 are not intended to be a Contractor-requirement but rather are provided for the purpose of obtaining budget level pricing.

The Contractor and the Contractor's SOE Designer should consider the sequencing of the sheetpiling installation relative to the steel H-pile foundation installations for the building and the sequencing of excavation activities in the evaluation of bracing requirements. Furthermore, the alignment and performance tolerance of the excavation support system should consider the proposed methods for forming, placing, waterproofing and backfilling of the foundation wall (e.g., two-sided formwork with positive side waterproofing and placement of impervious backfill (flowable fill) between the sheetpiling and outside face of foundation wall; or one-sided formwork with any necessary surface preparation to sheetpile wall to facilitate placement and protection of blind-side waterproofing.

5.4 FOUNDATION INSTALLATION

We recommend the following be considered when planning for driven pile installations:

- Each pile should be outfitted with a steel point (driving shoe) at the tip to facilitate penetration into the bearing stratum and to minimize potential pile damage. Over-sized materials and other subsurface obstructions should be anticipated in the Fill soils – including remnant pile caps and piles from the existing on-site building. Near surface pre-excavation may be required to remove buried obstructions in advance of pile driving activities. Pre-augering to reduce heave is not currently anticipated; however, see next bullet below regarding other potential subsurface obstructions.
- Remnant tieback anchors associated with the adjacent existing Tunnel support of excavation system may be encountered during pile installation along at least grid lines 1, 1.5, 2.5, and 3. While pile installations at these locations may be impacted (i.e., slowed installation progress and cause potential misalignment/out of plumbness), we would expect that advancement of the steel H-pile through the overburden soils should be able to overcome the potential interference presented by the abandoned tiebacks. For planning purposes, we recommend that the Contractor include a contingency allowance for spudding or pre-augering (and backfilling with approved materials) at 25% of the pile cap locations along these grid lines.
- Steel H-piles may be initially advanced with a vibratory hammer (VMVF); an impact hammer must be used for final driving to end bearing. The selected hammer should be capable of delivering the minimum rated energy that is compatible with the design pile configuration and

capacity. The Contractor should propose a final driving criterion for the selected hammer rated energy, based on the results of computer Wave equation analyses (i.e., GRLWEAP) conducted by the Contractor's Engineer.

- Prior to starting production pile installation, the Contractor will be required to successfully complete a dynamic testing program, and may be required to undertake and successfully complete a static load testing program to verify design compression capacity.
- Foundation pile installations will cause noise and vibrations that can disturb people and may become a nuisance to the adjacent business operations, disrupt computers, cause settlement to utilities (e.g., 54-in. SD), and impact other sensitive receptors (e.g., the Tunnel). Mitigation measures (e.g., designated hours for pile driving activities), if any, should be planned prior to construction to reduce possible delays during construction. In addition, vibrations from pile installations can cause vibrations that might impact freshly placed concrete. It is recommended that vibration monitoring be conducted during construction to develop a correlation between vibrations and distance. Initially (until that correlation is formed) it is recommended that vibration generating activities shall not be conducted within 100 ft of fresh concrete that is less than 24 hours old. In addition, vibration generating activities shall not be conducted within 50 ft of fresh concrete that is less than 48 hours old.

Production piles should be installed from (or near) existing site grades to avoid equipment stability issues if operating within/near the Organic Deposits. Design cut-off elevation for piles is anticipated to be several feet below the pile installation grade. Following completion of pile installations and during excavation for the below grade parking structure, pile stickups will need to be carefully cut down and protected as the excavation proceeds.

5.5 EXCAVATION

The Fill soils likely contains over-size materials including debris, cobbles and boulders, and remnant foundations (concrete pile caps, concrete piles) from the former on-site building to be demolished. Excavations will be required for construction of the below-grade parking structure, pile caps, grade beams, elevator pits, utilities and other features. We anticipate that excavations can be conducted using conventional, mechanical earth-moving equipment. Excavation depths are anticipated to range from about 13 to 18 ft below existing site grades, although those depths could possibly be adjusted should the Contractor consider benching down to a uniform elevation at the start of construction to allow for a more efficient working grade for planned foundation installation activities and reduce lateral surcharging demands on the SOE system.

Following foundation installations, excavation to construct the below grade parking structure, pile caps and grade beams will need to consider protection of foundation elements and maintaining those elements within positional tolerances for subsequent pile cap construction. The Contractor is advised to develop a coordinated excavation sequencing plan to limit movements of the support of excavation (SOE) system, to also limit movement of foundation piles – primarily those piles installed to support the exterior perimeter pile caps, which are closest to the SOE system.

In addition, the excavation bottom is anticipated to be underlain by up to approximately 13 to 23 ft of Fill and/or Organic soils that may be loose/soft and unstable – even more so from the vibrations induced from sheetpile and pile installation activities. Upon reaching design bottom of excavation the

Contractor may also need to over-excavate in advance of placement of a mud mat to achieve a suitable working surface, which will need to be coordinated with the SOE design.

5.6 CONSTRUCTION DEWATERING

During construction, the potential exists for the need to pump and manage groundwater on a continuous basis (24/7) to construct the below grade parking structure, pile caps (including placement and protection of waterproofing against foundation walls). Dewatering may need to extend through the completion of the sub-slab pressure relief system and parking level slab is constructed.

On-site recharge may be feasible on occasion and on an intermittent basis; however, the project will need to obtain a temporary construction dewatering permit (EPA NPDES RGP) to facilitate discharge of effluent to an approved municipal system and/or water body. The time required to file and receive approval from the permitting authority can oftentimes take 6 or more months. A base dewatering system typically consists of sedimentation and pH control. However, depending upon groundwater quality, additional measures of pre-treatment prior to off-site discharge may be required. The Contractor shall be responsible for conformance with the requirements of the permit, including treatment and legal discharge of effluent.

The Contractor shall be responsible for the design and operation of the temporary dewatering system and maintenance of the support of excavation system (to control leakage at joints) so that groundwater drawdown outside the limits of the excavation is limited.

5.7 MANAGEMENT OF BURIED DEMOLITION DEBRIS/RUBBLE FILL AND EXCAVATED SOIL

Debris such as asphalt, brick, concrete, metal/steel, and other miscellaneous rubble may be present below the former on-site building; and granite blocks, wood piles, timber may be buried elsewhere on the site from historical uses. Management and disposal of these types of materials should be to an approved solid waste facility. Landfills or other soil receiving facilities will not accept solid waste; accordingly, these materials, if encountered, will require segregation from soil prior to off-site transport as solid waste.

Excess or unsuitable soil that requires off-site disposal must be managed in accordance with applicable federal, state, and local laws and regulations, including the requirements of the Massachusetts Contingency Plan (MCP, 310 CMR 40.000). Soil designated for off-site disposal will require analytical testing. If reportable concentrations of contaminants are detected in the soils, regulatory compliance may be required in accordance with the timelines established in the MCP.

An initial soil precharacterization program has been completed; additional soil precharacterization will be undertaken prior to construction. The results of the soil precharacterization programs will be compiled into one report and provided to the Contractor once available.

5.8 GEOTECHNICAL INSTRUMENTATION

A geotechnical instrumentation program is recommended to confirm predictions of soil and structure behavior, provide documented performance for the Owner's records, monitor and document the Contractor's performance, provide early warning of problems, and aid assessments of the need for measures to mitigate unacceptable movements. The various types and proposed locations of

instrumentation that are recommended as a minimum to be installed and monitored during construction, along with performance criteria, are included in the project Contract Documents.

In general, geotechnical instrumentation (by the Owner and Contractor) is planned to include the following:

- Survey points to measure vertical movements of adjacent buildings, structures and streets;
- Offset survey points to measure vertical and lateral movements of the top of the temporary support of excavation system;
- Vertical monitoring points set on top of the Tunnel's roof protective slab and at manholes located along the alignment of the BWSC's 54-in. diameter storm drain utility; and
- Seismographs to monitor vibrations along the alignment of the tunnel and BWSC storm drain utility.

In addition, we recommend the Owner conduct a pre-construction conditions survey (video/photo documentation) be conducted of the exterior of select buildings, streets, and sidewalks adjacent to the site; and the Tunnel per the limits agreed to with MassDOT; we also recommend that a video survey of the existing 54-in. storm drain be conducted prior to the start of construction. The purpose of the pre-construction conditions survey is to document existing readily observable physical conditions of structures, surface improvements, and infrastructure near the work to establish a baseline before work at the subject site begins.

5.9 CONSTRUCTION OBSERVATIONS

We recommend that an engineer or technician, qualified by training and experience, be present to make observations during pertinent construction phases such as pre-trenching activities, support of excavation installation, foundation installation and load testing (dynamic and static), site excavation and dewatering, and final subgrade preparation of foundation subgrades. The general purpose of the on-site monitoring program is to provide accurate documentation of construction activities, correlate these activities with visual observations and measurements obtained from the instrumentation data, and verify compliance with the Code and project Contract Documents.

6. Limitations

This report has been prepared for specific application to the proposed development at 2 Harbor Street / 329 Northern Avenue in Boston, Massachusetts. This report is intended for the exclusive use of the project team in connection with the geotechnical aspects of the project as described herein. In the event that changes in the nature, design, or location of the facilities are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report are modified or verified in writing by Haley & Aldrich.

The analyses and recommendations submitted in this report are based in part upon data obtained from the referenced subsurface explorations. The nature and extent of variations between the explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report. The applicability of the recommendations in this report should be confirmed after structural and site grading designs are finalized.

The scope of work undertaken for this Report does not include the development of criteria or procedures to minimize the risk of mold or other biological pollutant infestations in or near any structure nor does it include a site assessment for the presence of oil or hazardous materials as defined by the Massachusetts Oil and Hazardous Materials Prevention and Response Act (M.G.L. Chapter 21E).

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TABLES

TABLE I
SUMMARY OF SUBSURFACE SOIL CONDITIONS
SOUTH BOSTON INNOVATION CAMPUS
2 HARBOR STREET / 329 NORTHERN AVENUE
BOSTON, MASSACHUSETTS
FILE NO. 132753-006

EXPLORATION DESIGNATION	DEPTH OF EXPLORATION (FT)	GROUND SURFACE EL. (BCB) (NOTES 1,2)	FILL	ORGANIC DEPOSITS			MARINE DEPOSITS (CLAY)			GLACIAL DEPOSITS			BEDROCK	
			THICKNESS (FT)	DEPTH TO TOP (FT)	EL. OF TOP (FT, BCB)	THICKNESS (FT)	DEPTH TO TOP (FT)	EL. OF TOP (FT, BCB)	THICKNESS (FT)	DEPTH TO TOP (FT)	EL. OF TOP (FT, BCB)	THICKNESS (FT)	DEPTH TO TOP (FT)	EL. OF TOP (FT, BCB)
RECENT HALEY & ALDRICH TEST BORINGS (2019)														
HA19-B1	119.0	16.2	24.0	24.0	-7.8	11.0	35.0	-18.8	69.9	104.9	-88.7	3.1	108.0	-91.8
HA19-B2(OW)	119.0	16.8	24.0	24.0	-7.2	10.0	34.0	-17.2	68.0	102.0	-85.2	8.5	110.5	-93.7
HA19-B3	104.0	16.9	24.0	24.0	-7.1	5.0	29.0	-12.1	64.5	93.5	-76.6	1.9	95.4	-78.5
HA19-B4	94.0	16.0	18.0	18.0	-2.0	16.0	34.0	-18.0	43.0	77.0	-61.0	10.0	87.0	-71.0
HA19-B5	51.0	15.5	24.0	24.0	-8.5	10.0	34.0	-18.5	> 17.0	-	-	-	-	-
PREVIOUS EXPLORATIONS (NOTE 3)														
SB1-1	114.3	15.9	5.0	5.0	10.9	29.0	34.0	-18.2	70.0	104.0	-88.2	> 10.3	-	-
SB2-70	114.0	16.0	23.5	23.5	-7.6	10.0	33.5	-17.6	62.5	96.0	-80.1	7.0	103.0	-87.1
SB2-72	110.6	17.1	23.5	23.5	-6.4	12.0	35.5	-18.5	65.5	101.0	-84.0	6.0	107.0	-90.0
SB2-73	114.5	17.1	28.0	28.0	-11.0	4.5	32.5	-15.5	50.5	83.0	-66.0	12.0	95.0	-78.0
SB2-74	111.8	16.9	21.0	21.0	-4.1	10.0	31.0	-14.2	57.5	88.5	-71.7	4.8	93.3	-76.5
B201	42.0	15.8	24.0	24.0	-8.3	12.5	36.5	-20.8	> 5.5	-	-	-	-	-
387	96.0	15.2	21.5	21.5	-6.3	7.5	29.0	-13.9	63.0	92.0	-76.9	> 4.0	-	-
388	88.0	16.7	15.0	15.0	1.7	15.0	30.0	-13.4	> 58.0	-	-	-	-	-
391	101.0	15.2	13.5	13.5	1.7	22.5	36.0	-20.9	60.0	96.0	-80.9	> 5.0	-	-

NOTES:
1. ESTIMATED GROUND SURFACE ELEVATIONS ARE IN FEET, REFERENCE THE BOSTON CITY BASE (BCB) DATUM AND CORRESPOND TO THE GROUND SURFACE ELEVATION AT THE TIME OF DRILLING.
2. ELEVATIONS WERE NOT SURVEYED AND ARE THEREFORE CONSIDERED APPROXIMATE (+/-1 FT). ELEVATIONS ARE BASED ON PLAN TITLED "EXISTING CONDITIONS SURVEY", PREPARED BY FELDMAN LAND SURVEYORS AND DATED 5 SEPTEMBER 2019.
3. PREVIOUS SELECT EXPLORATIONS CONDUCTED FOR THE CENTRAL ARTERY / TUNNEL PROJECT; LOGS OBTAINED FROM HALEY & ALDRICH, INC. FILES.
4. PREVIOUS EXPLORATIONS B203, B204 AND B205 CONDUCTED BY ESS GROUP, INC. WERE SHALLOW AND DID NOT PENETRATE THE FILL; ACCORDINGLY, EXPLORATIONS NOT INCLUDED HEREIN.

ABBREVIATIONS:
"-" : INDICATES NOT DETERMINED; DEPOSIT NOT SAMPLED OR EXPLORATION TERMINATED BEFORE PRESENCE OF DEPOSIT VERIFIED
">" : INDICATES TOTAL THICKNESS NOT DETERMINED; EXPLORATION TERMINATED AT DEPTH INDICATED WITHIN MATERIAL/DEPOSIT
"(OW)" : INDICATES OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE

FIGURES

GIS FILE PATH: \\haleyaldrich.com\shared\bos_common\132753 - 2 Harbor Street\GLOBAL\GIS\Maps\2019_09\132753_006_0001_PROJECT_LOCUS.mxd — USER: hwachholz — LAST SAVED: 9/5/2019 5:46:30 PM

MAP SOURCE: ESRI
SITE COORDINATES: 42°20'42"N, 71°2'15"W

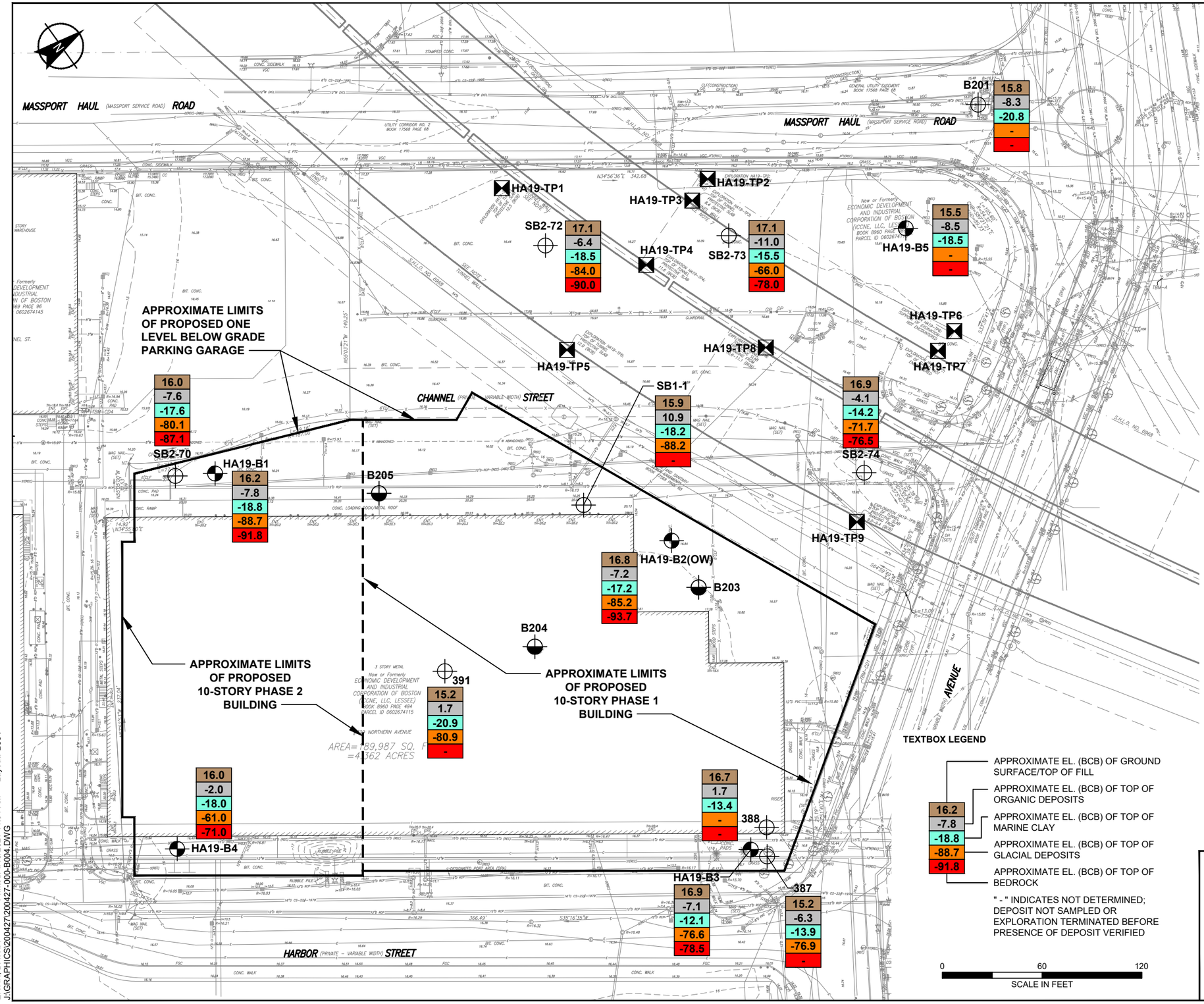
HALEY ALDRICH

SOUTH BOSTON INNOVATION CAMPUS
2 HARBOR STREET / 329 NORTHERN AVENUE
BOSTON, MASSACHUSETTS

PROJECT LOCUS

APPROXIMATE SCALE: 1 IN = 2000 FT
MAY 2021

FIGURE 1



LEGEND

HA19-B3 — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORING DRILLED BY GEOLOGIC EARTH EXPLORATION, INC. AND MONITORED BY HALEY & ALDRICH, INC. BETWEEN 24 JUNE AND 15 JULY 2019.

HA19-TP1 — DESIGNATION AND APPROXIMATE LOCATION OF TEST PIT EXCAVATION COMPLETED BY JAMES W. FLETT CO., INC. AND MONITORED BY HALEY & ALDRICH, INC. BETWEEN 22 AND 29 JULY 2019.

(OW) — INDICATES OBSERVATION WELL INSTALLED IN COMPLETED BOREHOLE

SB2-72 — DESIGNATION AND APPROXIMATE LOCATION OF HISTORIC TEST BORING CONDUCTED FOR THE CENTRAL ARTERY / TUNNEL PROJECT

B204 — DESIGNATION AND APPROXIMATE LOCATION OF SHALLOW TEST BORING CONDUCTED FOR CARGO VENTURES IN 2004.

NOTES

1. BASE PLAN OBTAINED FROM PLAN TITLED "EXISTING CONDITIONS SURVEY", PREPARED BY FELDMAN LAND SURVEYORS AND DATED 5 SEPTEMBER 2019.
2. CONFIGURATION OF PROPOSED BUILDINGS TAKEN FROM AN ELECTRONIC FILE TITLED "A-100 LEVEL P OVERALL PLAN.dwg", PROVIDED BY HANDEL ARCHITECTS ON 24 MARCH 2021.
3. TECHNICAL MONITORING OF THE EXPLORATIONS CONDUCTED IN 2019 WAS PERFORMED BY HALEY & ALDRICH, INC.; THE LOCATIONS OF THE EXPLORATIONS WERE ESTIMATED BY TAPING TO EXISTING SITE FEATURES IN THE FIELD.
4. APPROXIMATE LOCATIONS OF PREVIOUS EXPLORATIONS CONDUCTED FOR CENTRAL ARTERY / TUNNEL PROJECT OBTAINED FROM "FIGURE 2A: SITE AND SUBSURFACE EXPLORATION LOCATION PLAN" AND "FIGURE 2B: SITE AND SUBSURFACE EXPLORATION LOCATION PLAN", TAKEN FROM REPORT TITLED "FINAL GEOTECHNICAL DATA REPORT, DESIGN SECTION D004A, CENTRAL ARTERY (I-93)/TUNNEL (I-90) PROJECT, BOSTON, MASSACHUSETTS", PREPARED BY HALEY & ALDRICH, INC. AND DATED 10 OCTOBER 1991.
5. APPROXIMATE LOCATIONS OF PREVIOUS EXPLORATIONS CONDUCTED FOR CARGO VENTURES IN 2004 OBTAINED FROM "FIGURE 3: SITE PLAN" TAKEN FROM REPORT TITLED "PHASE 1 AND PHASE II ENVIRONMENTAL SITE ASSESSMENT, BOSTON FREIGHT PROJECT, SOUTH BOSTON, MASSACHUSETTS", PREPARED BY ESS GROUP, INC. AND DATED 11 FEBRUARY 2005.
6. TEST BORINGS B203, B204 AND B205 WERE SHALLOW EXPLORATIONS THAT DID NOT PENETRATE THE FILL; ACCORDINGLY, TEXT BOXES NOT PROVIDED FOR THESE EXPLORATIONS.

HALEY ALDRICH

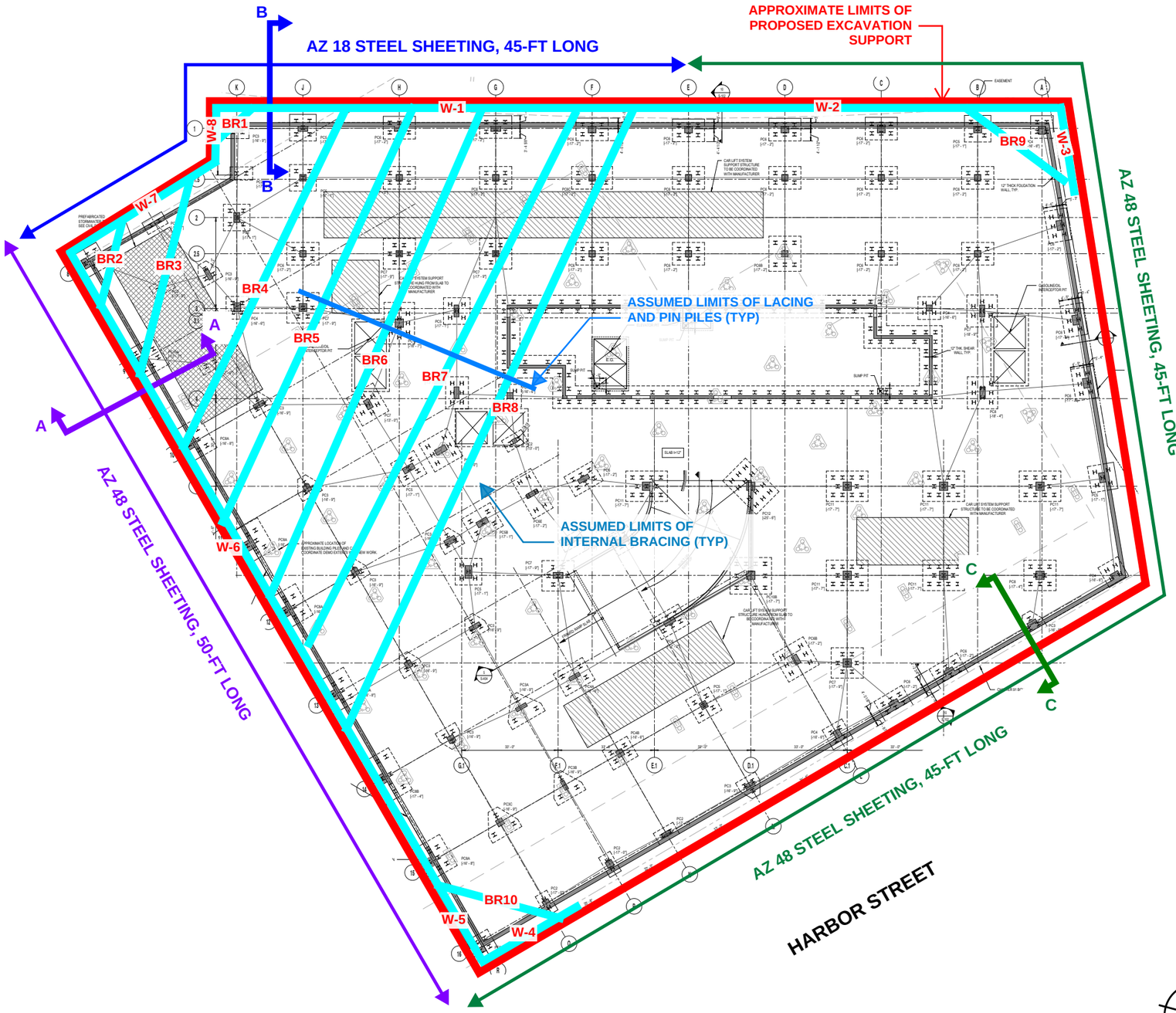
SOUTH BOSTON INNOVATION CAMPUS
2 HARBOR STREET / 329 NORTHERN AVENUE
BOSTON, MASSACHUSETTS

SITE AND SUBSURFACE EXPLORATION LOCATION PLAN

SCALE: AS SHOWN
MAY 2021

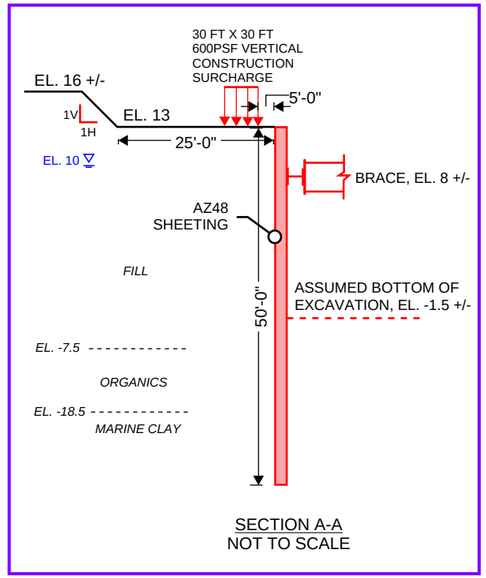
FIGURE 2

ERVIN, DAYNA
J:\GRAPHICS\200427\200427-000-B004.DWG
Printed: 4/16/2021 11:04 AM Layout: B004

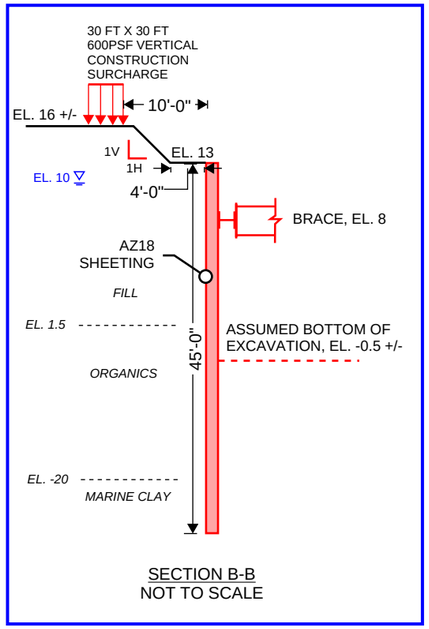


BRACE NAME	DESIGN SECTION
BR-1	36X3/8
BR-2	36X3/8
BR-3	36X3/8
BR-4	36X7/8
BR-5	36X3/8
BR-6	36X3/8
BR-7	36X1/2
BR-8	36X5/8
BR-9	36X3/8
BR-10	36X3/8

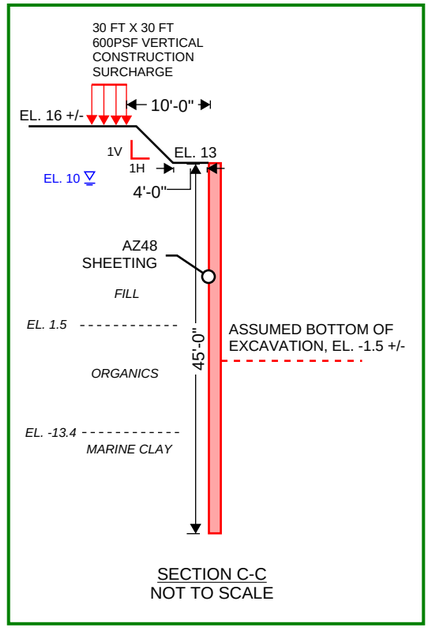
WALER NAME	DESIGN SECTION
W-1	W36x247
W-2	W36x232
W-3	W36x232
W-4	W36x210
W-5	W36x210
W-6	W36x330
W-7	W36x247
W-8	W36x210



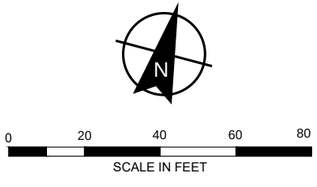
SECTION A-A
NOT TO SCALE



SECTION B-B
NOT TO SCALE



SECTION C-C
NOT TO SCALE



NOTES:

1. LIMITS OF PROPOSED FOUNDATION ELEMENTS TAKEN FROM PLAN TITLED "S-101 FOUNDATION/P1 FRAMING PLAN" BY DESIMONE CONSULTING ENGINEERS DATED 9 APRIL 2021.
2. ELEVATIONS ARE IN FEET AND REFER TO BOSTON CITY BASE (BCB).
3. SUPPORT OF EXCAVATION (SOE) AND BRACING LIMITS ARE SHOWN FOR CONCEPTUAL PURPOSES ONLY. FINAL DESIGN OF THE TEMPORARY LATERAL EARTH SUPPORT SYSTEM IS THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 315000.
4. REFER TO SECTIONS A-A, B-B, AND C-C FOR ASSUMED LIMITS OF BENCHING AND POSITION OF CONSTRUCTION/EQUIPMENT SURCHARGING OUTSIDE LIMITS OF SHEETING.
5. ADDITIONAL TEST BORING EXPLORATIONS ARE PLANNED BY THE OWNER AND THAT INFORMATION WILL BE PROVIDED TO THE CONTRACTOR.

HALEY ALDRICH

2 HARBOR STREET
BOSTON, MASSACHUSETTS

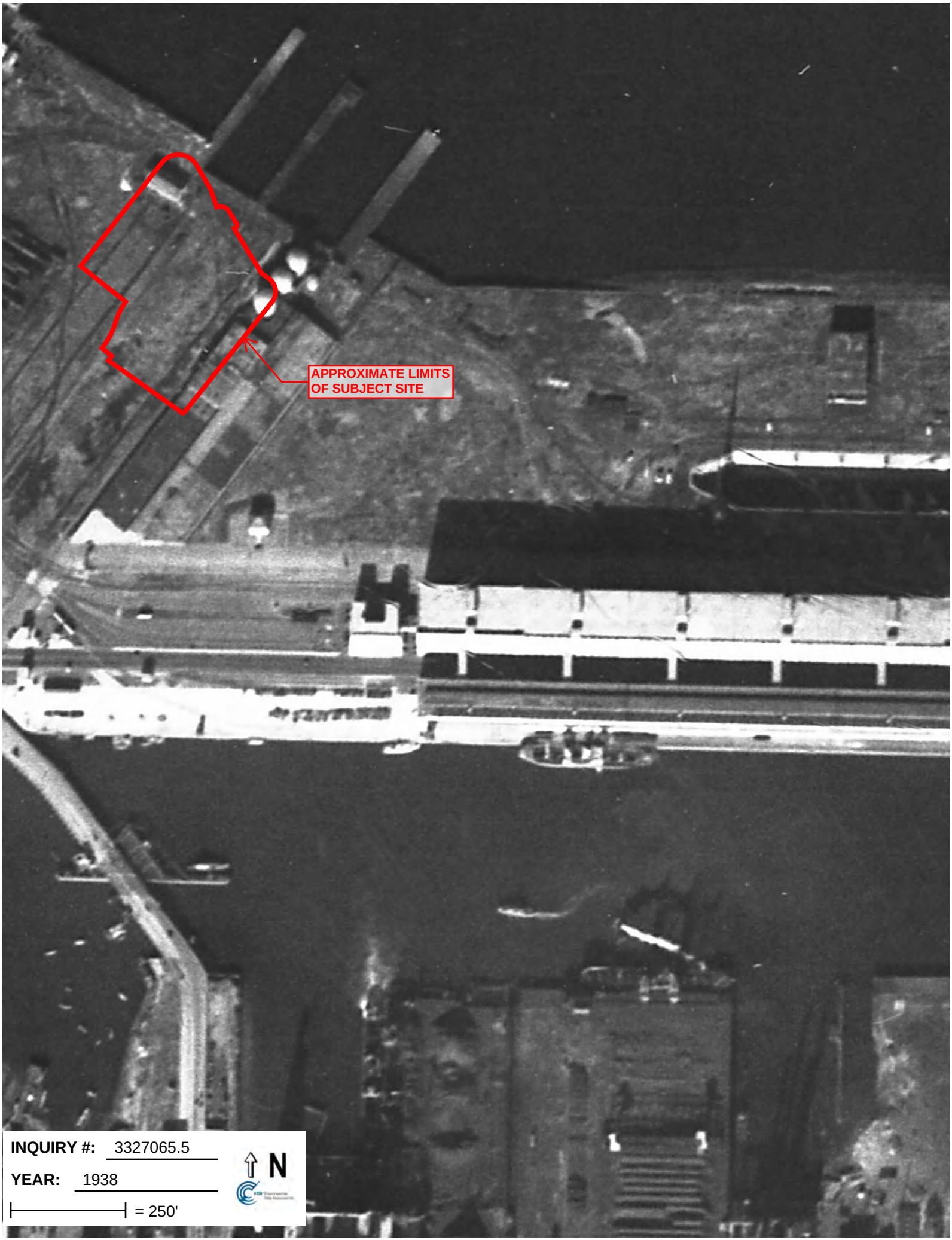
CONCEPTUAL EXCAVATION SUPPORT DESIGN

SCALE: AS SHOWN
MAY 2021

FIGURE 3

APPENDIX A

Historical Maps and Aerial Photographs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OF SUBJECT SITE
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YEAR: 1938
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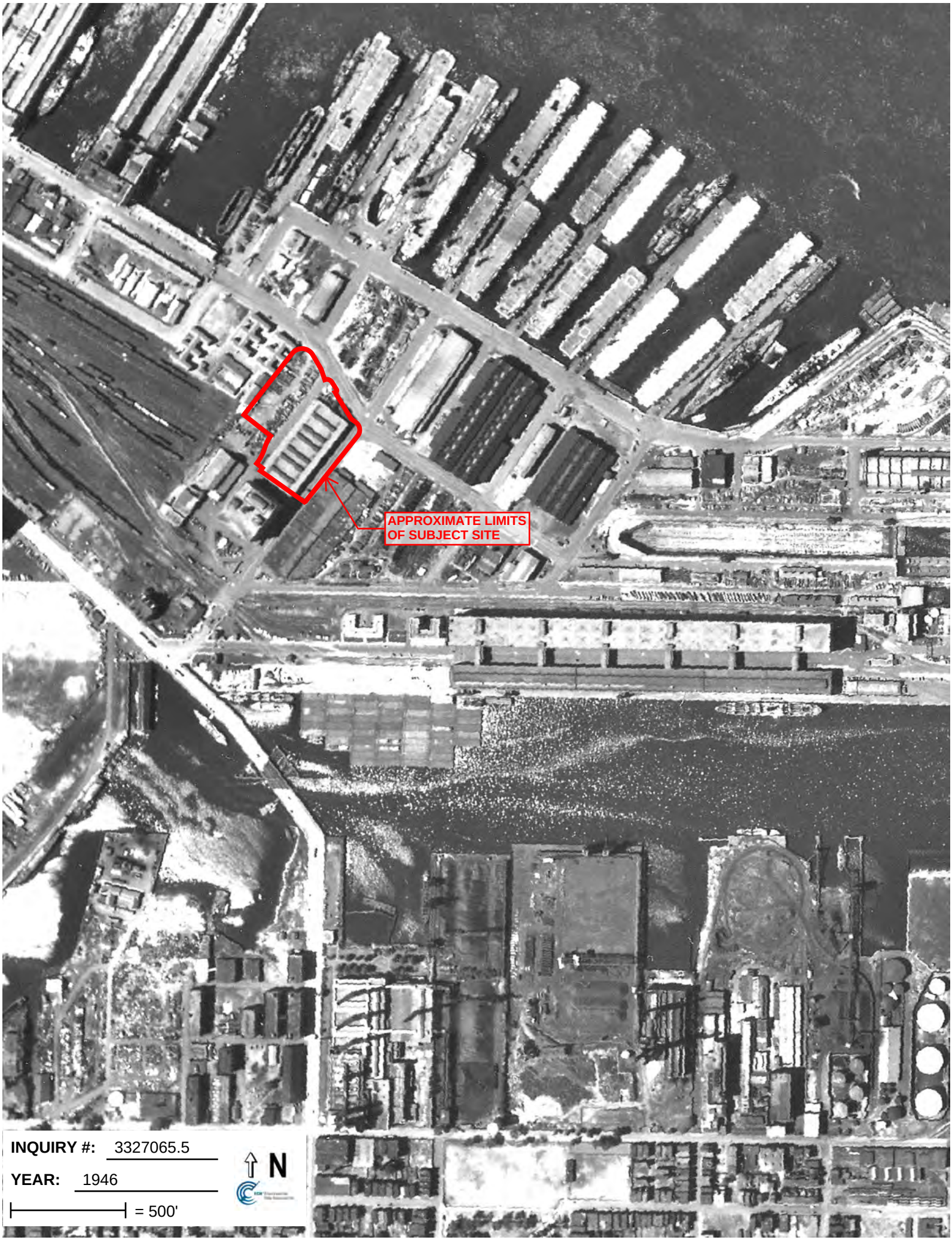


INQUIRY #: 3327065.5

YEAR: 1946

= 500'

N

INQUIRY #: 3327065.5

YEAR: 1955

= 500'

N

INQUIRY #: 3327065.5

YEAR: 1960

= 1000'

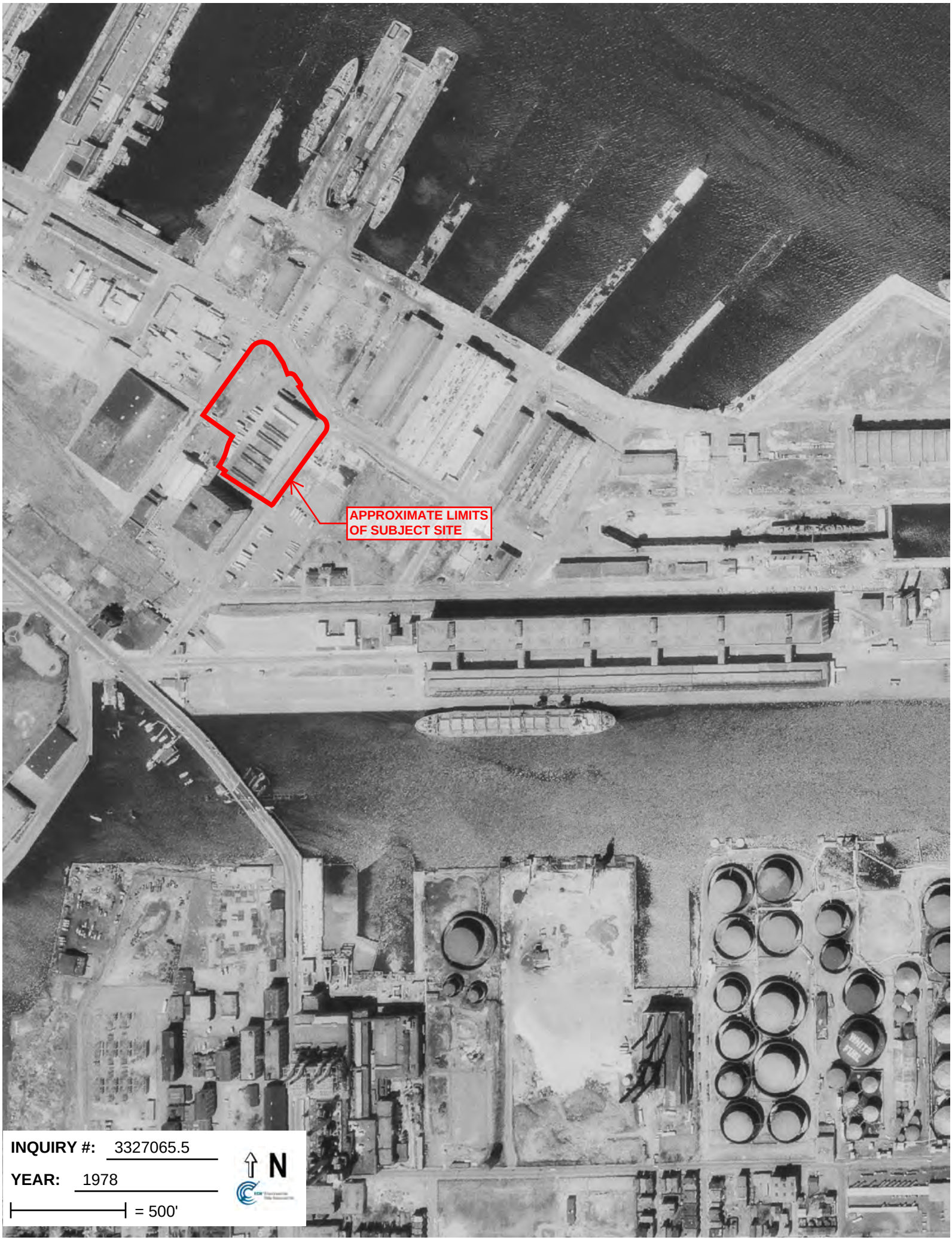
N

INQUIRY #: 3327065.5

YEAR: 1969

= 500'

N



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YEAR: 1978

= 500'

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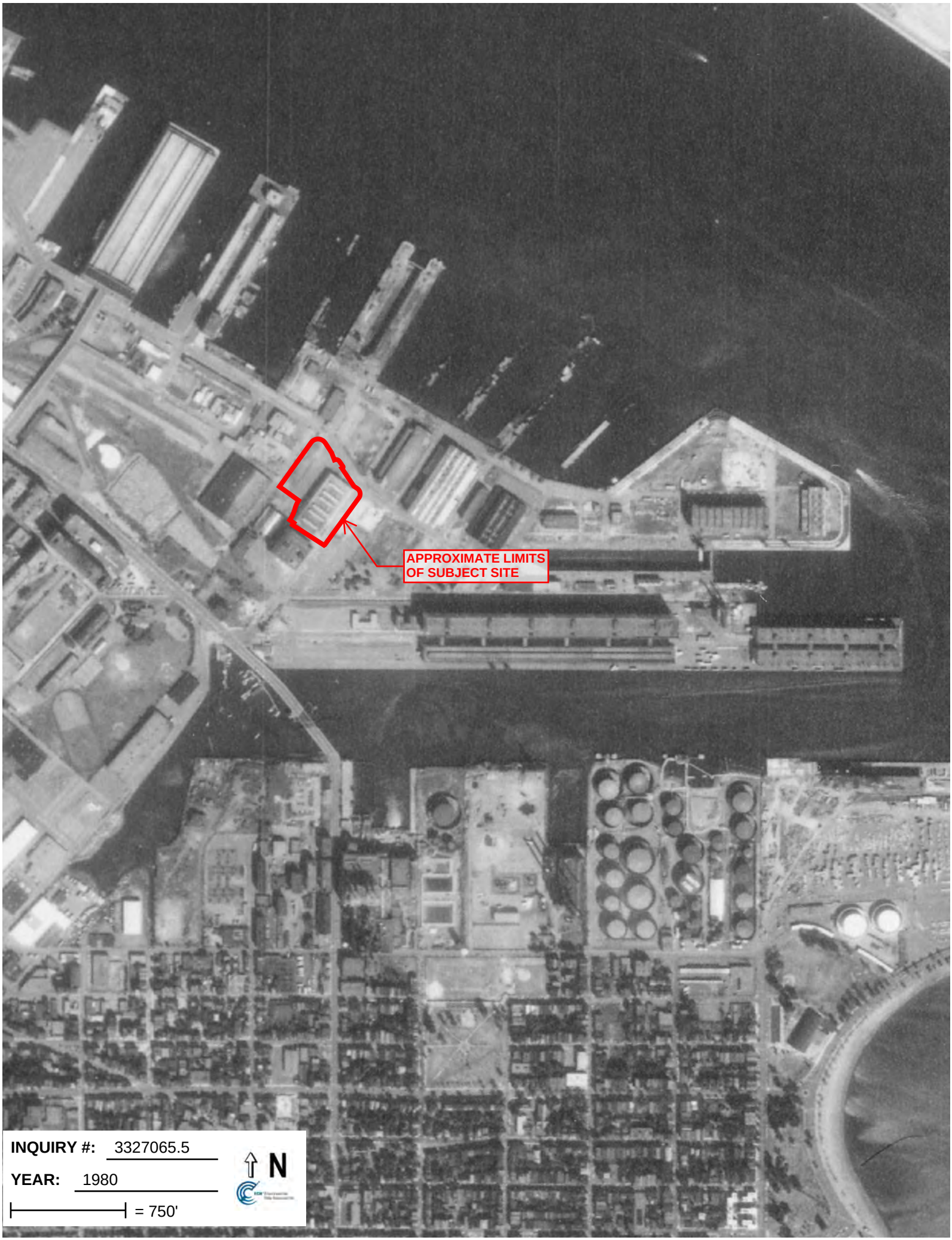
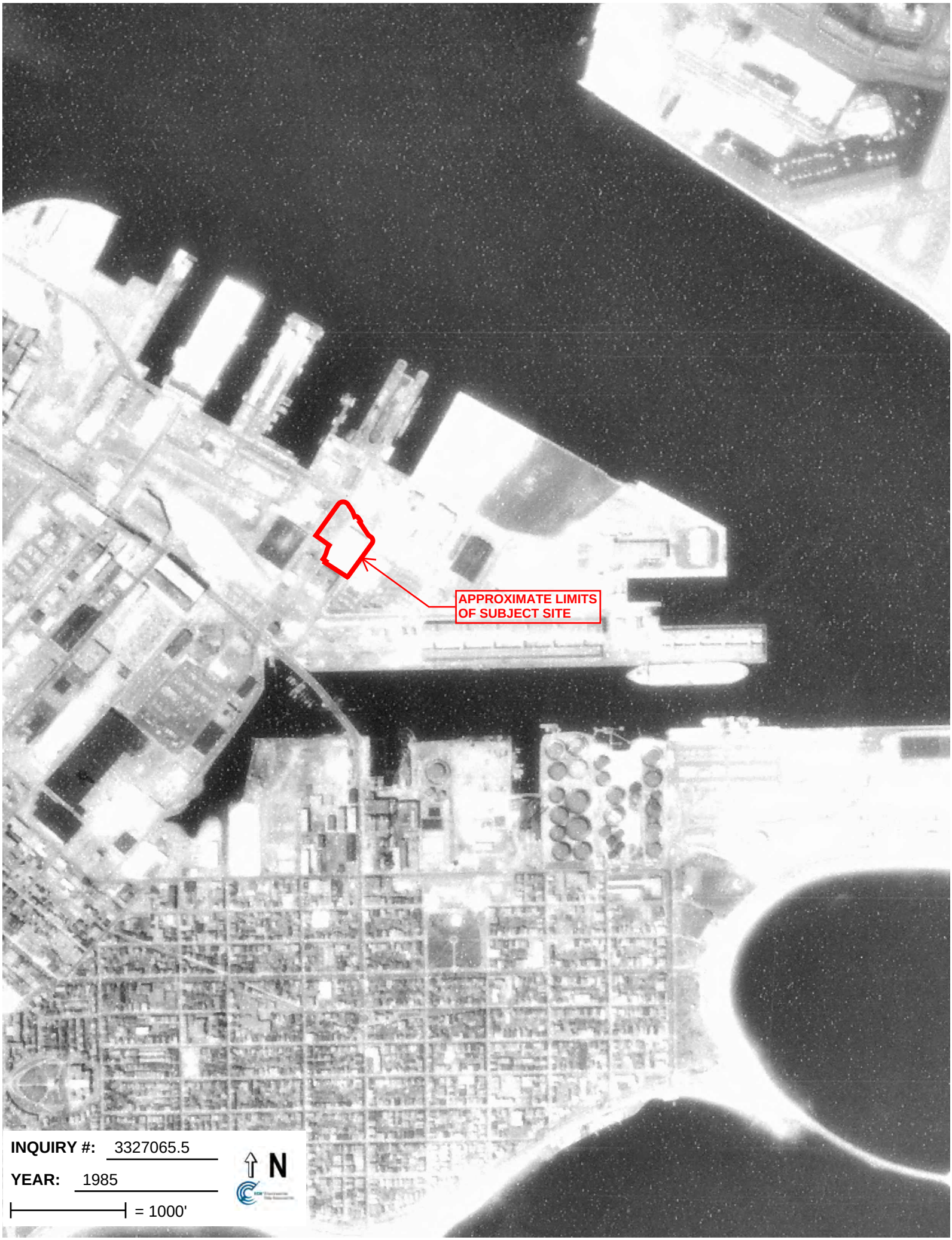

APPROXIMATE LIMITS
OF SUBJECT SITE
INQUIRY #: 3327065.5
YEAR: 1980
= 750'
N



INQUIRY #: 3327065.5

YEAR: 1985

= 1000'

N


APPROXIMATE LIMITS
OF SUBJECT SITE
INQUIRY #: 3327065.5
YEAR: 1995
= 500'
N


APPROXIMATE LIMITS
OF SUBJECT SITE
INQUIRY #: 3327065.5
YEAR: 2008
= 500'
N

Boston Seaport
One Design Center Place
Boston, MA 02210

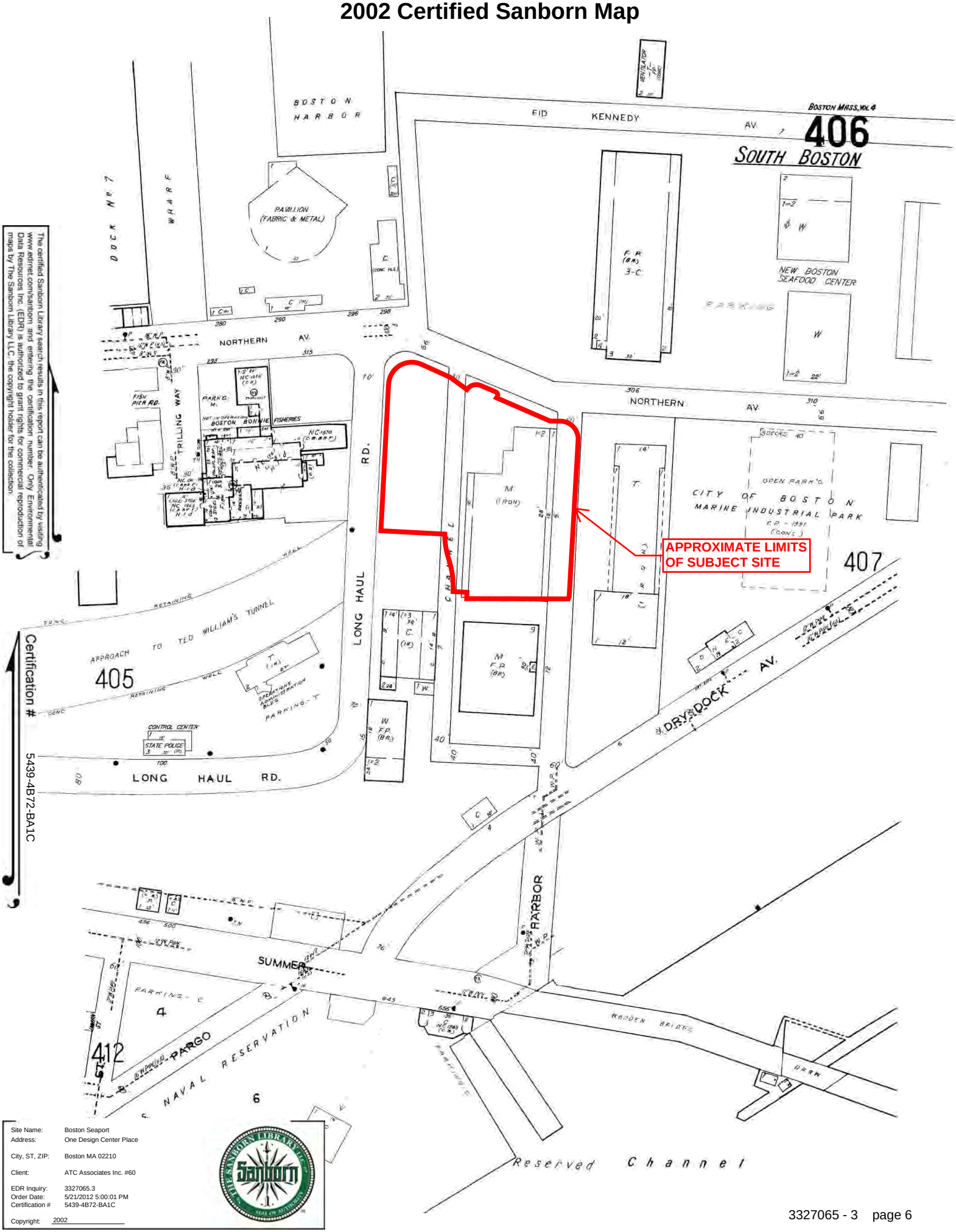
Inquiry Number: 3327065.3
May 21, 2012

Certified Sanborn® Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

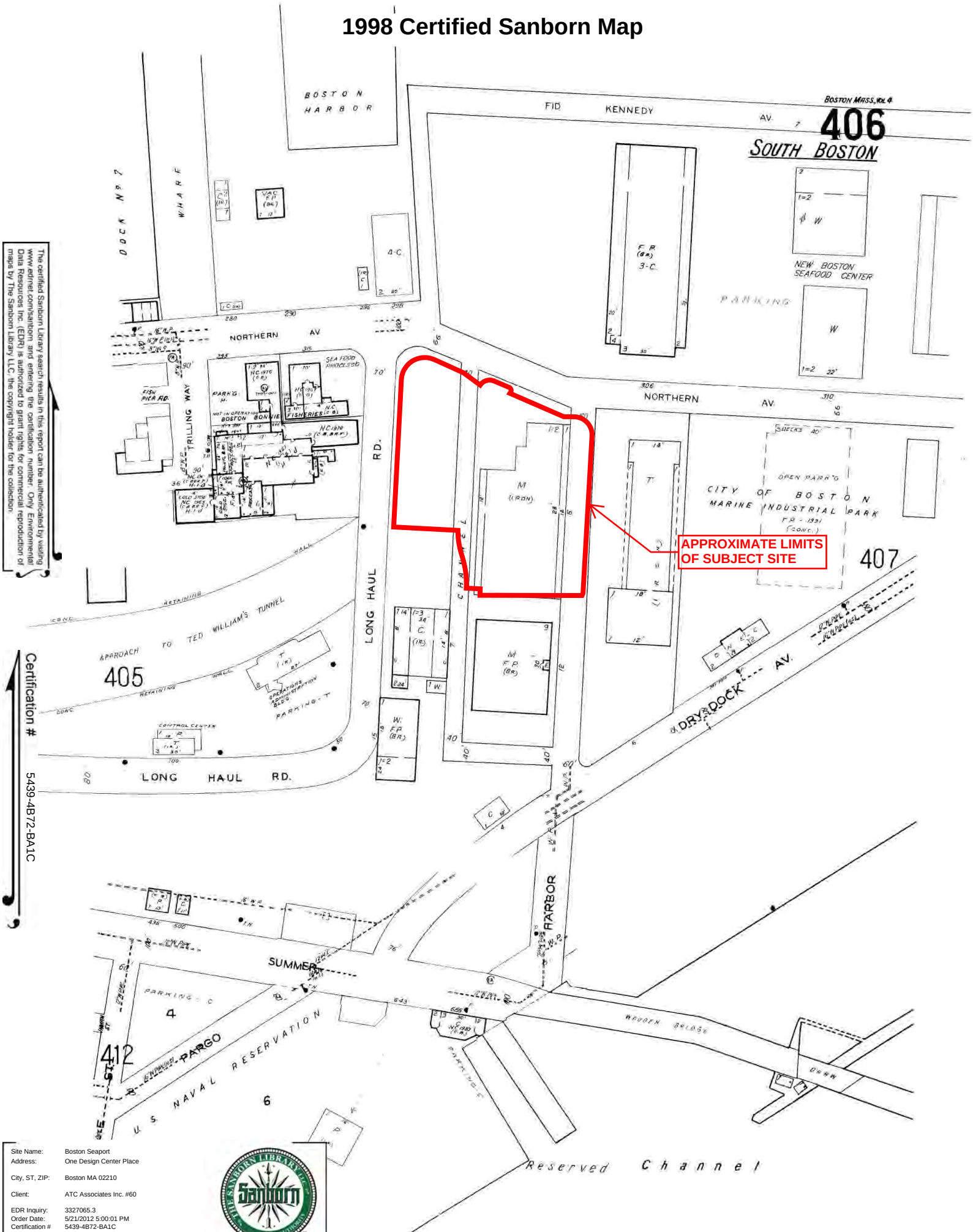
2002 Certified Sanborn Map



Certification # 5439-4B72-BA1C

Site Name: Boston Seaport
Address: One Design Center Place
City, ST, ZIP: Boston MA 02210
Client: ATC Associates Inc. #60
EDR Inquiry: 3327065.3
Order Date: 5/21/2012 5:00:01 PM
Certification # 5439-4B72-BA1C

1998 Certified Sanborn Map



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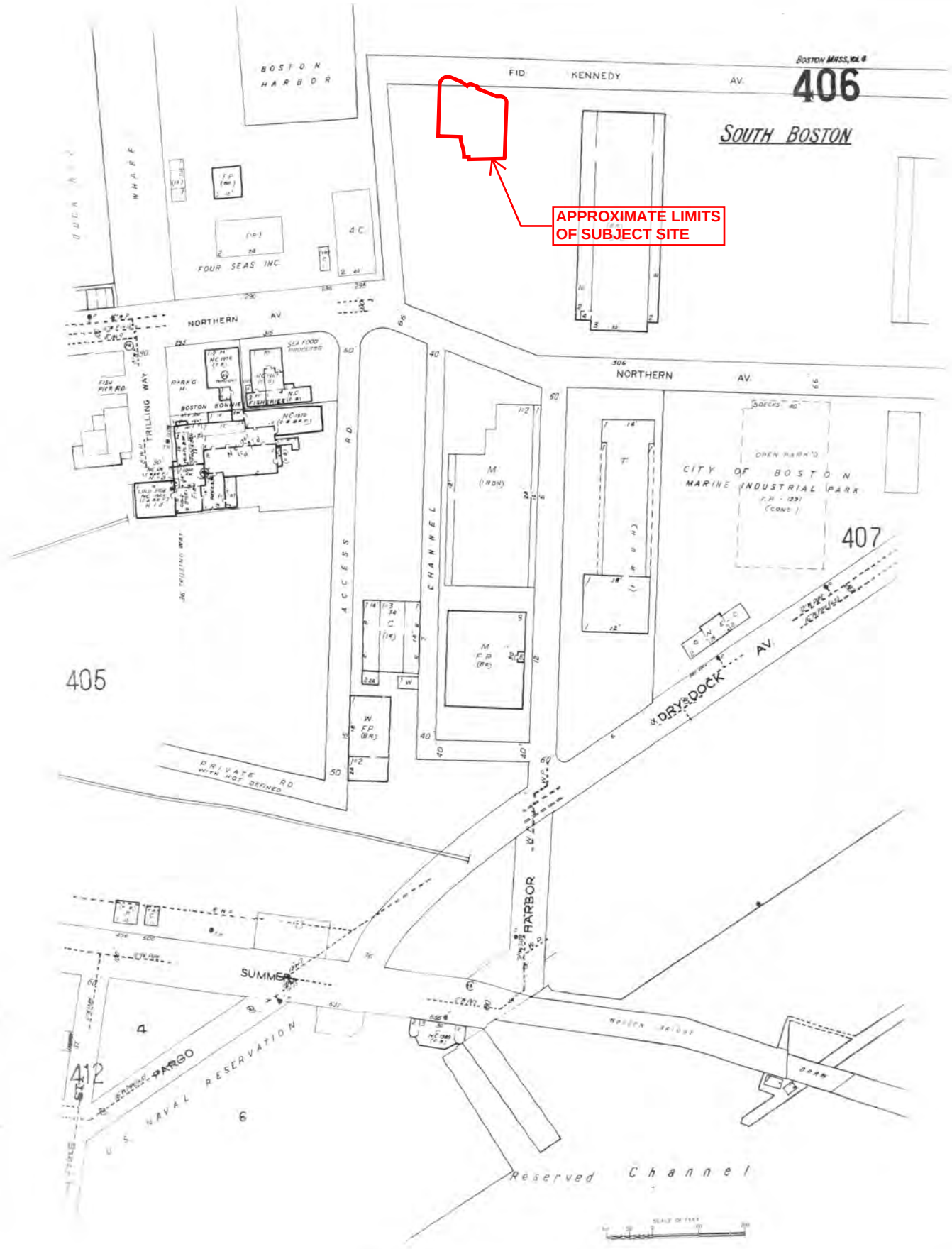
Certification #	5439-4B72-BA1C

Copyright: 1998

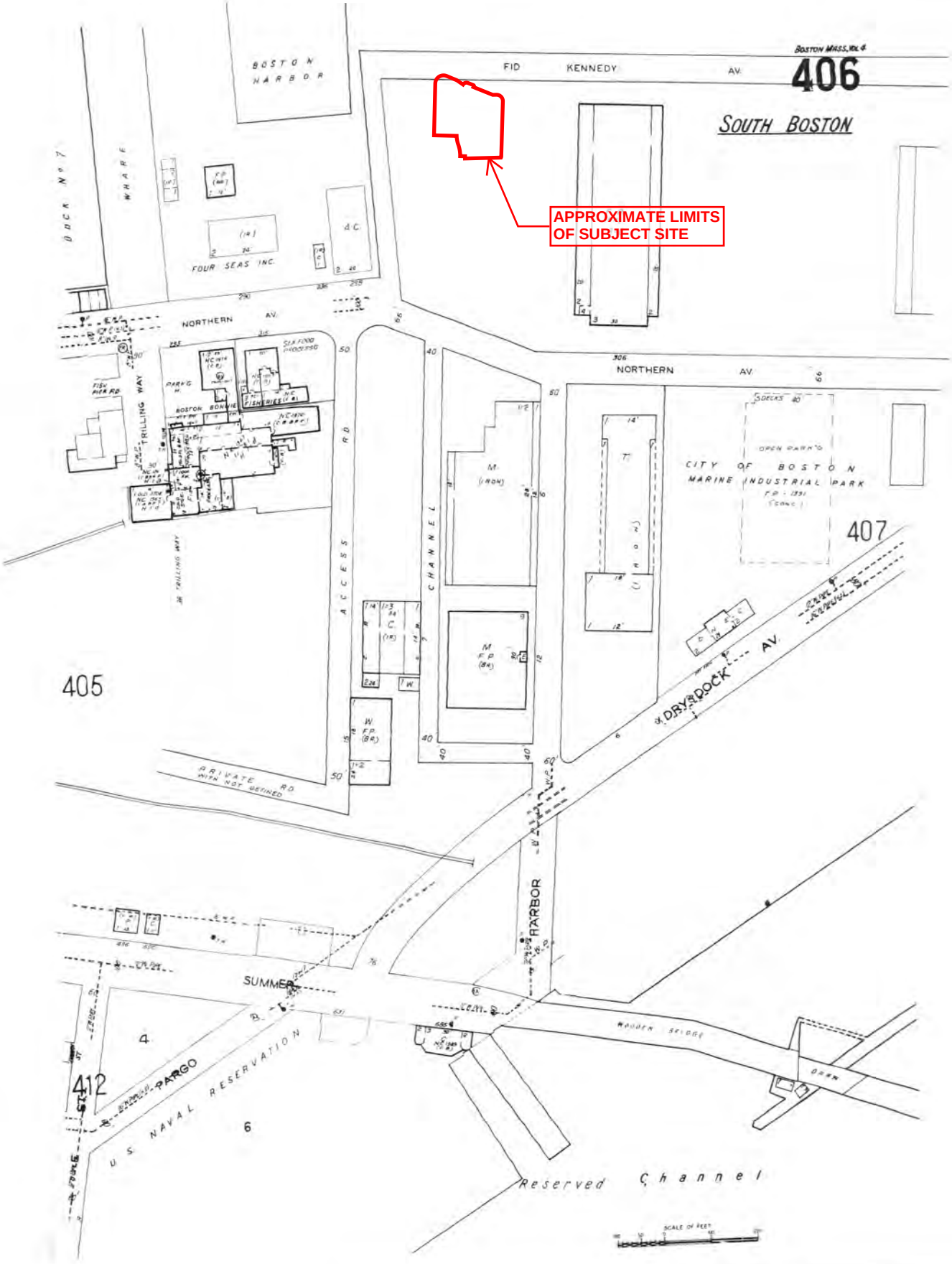
1995 Certified Sanborn Map



Certification # 5439-4B72-BA1C

Site Name:	Boston Seaport
Address:	One Design Center Place
City, ST, ZIP:	Boston MA 02210
Client:	ATC Associates Inc. #60
EDR Inquiry:	3327065.3
Order Date:	5/21/2012 5:00:01 PM
Certification #	5439-4B72-BA1C
Copyright:	1995

1994 Certified Sanborn Map



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EDR Inquiry:	3327065.3
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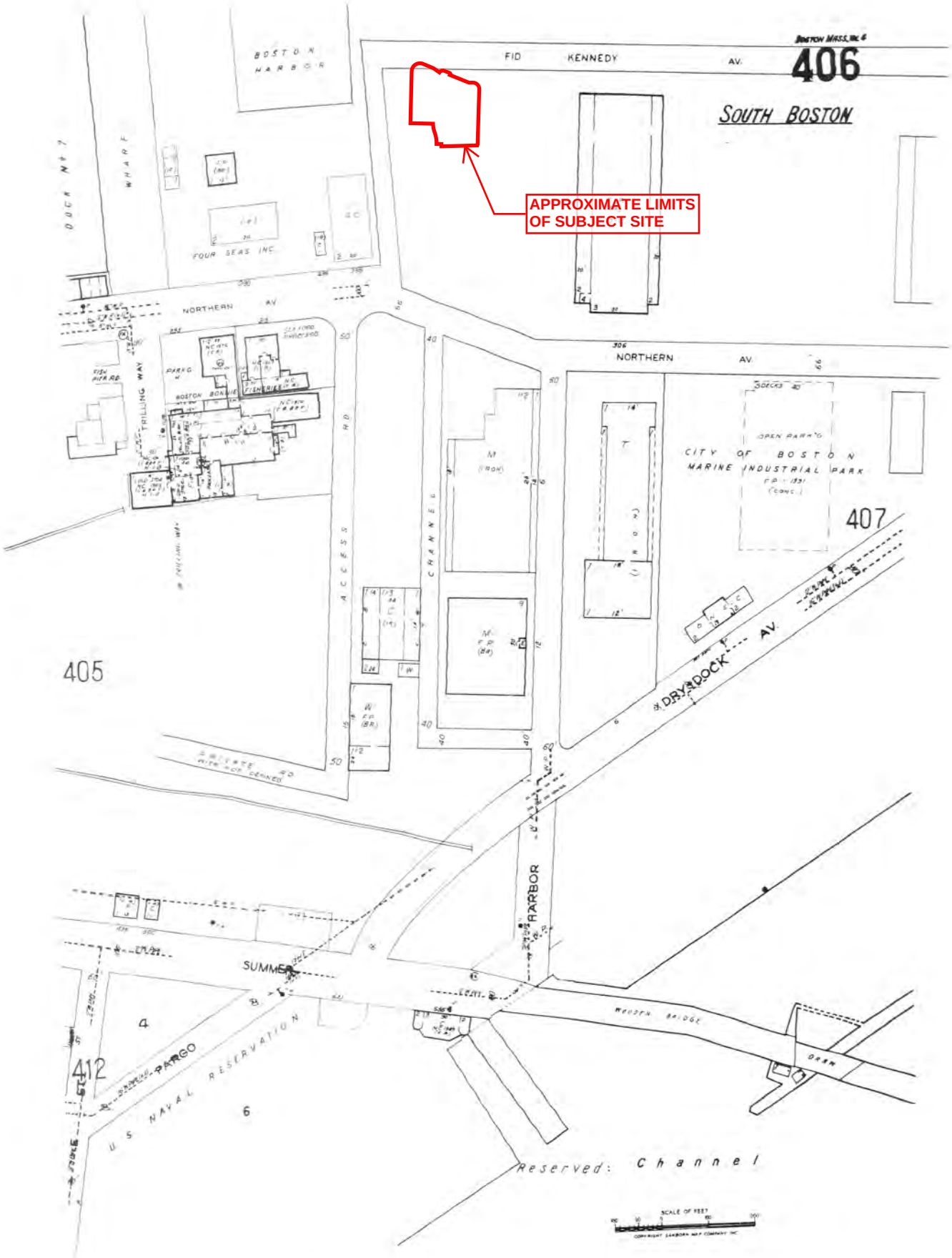
Certification #	5439-4B72-BA1C
Copyright:	1994

1993 Certified Sanborn Map



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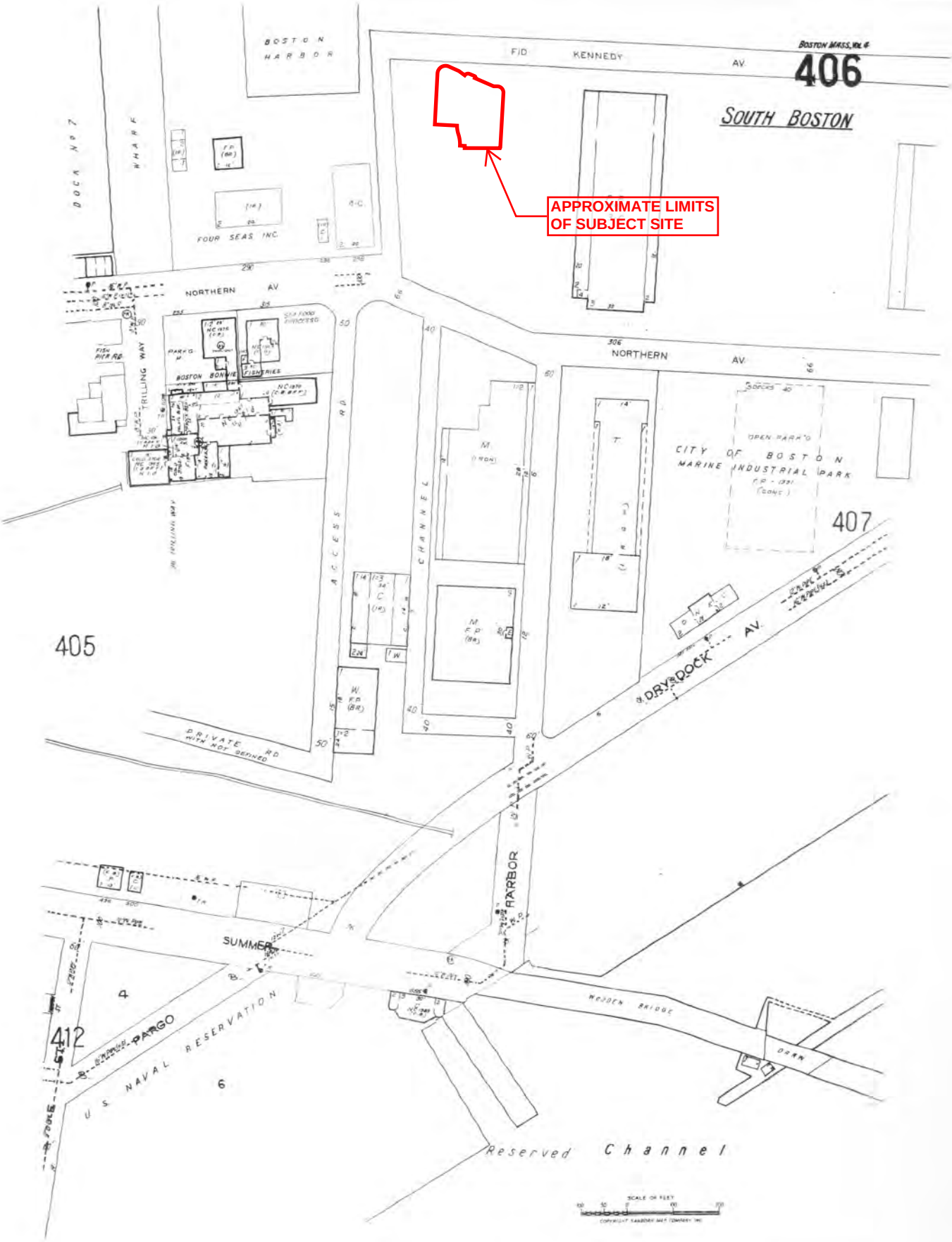
Order Date: 5/21/2012 5:00:01 PM
Certification # 5439-4B72-BA1C
Copyright: 1993

1992 Certified Sanborn Map



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Site Name: Boston Seaport
Address: One Design Center Place
City, ST, ZIP: Boston MA 02210
Client: ATC Associates Inc. #60
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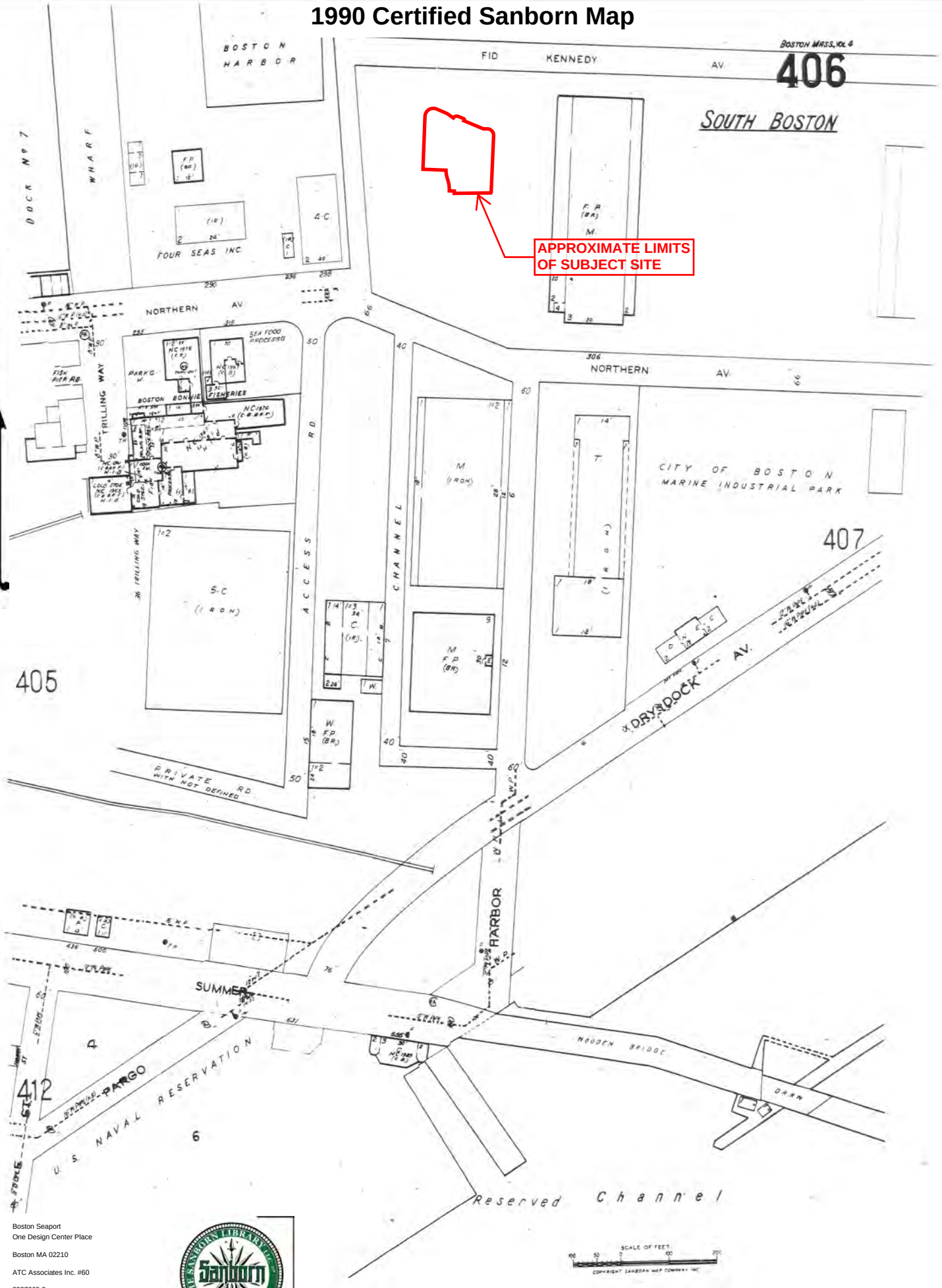
Order Date: 5/21/2012 5:00:01 PM
Certification # 5439-4B72-BA1C
Copyright: 1992

1990 Certified Sanborn Map



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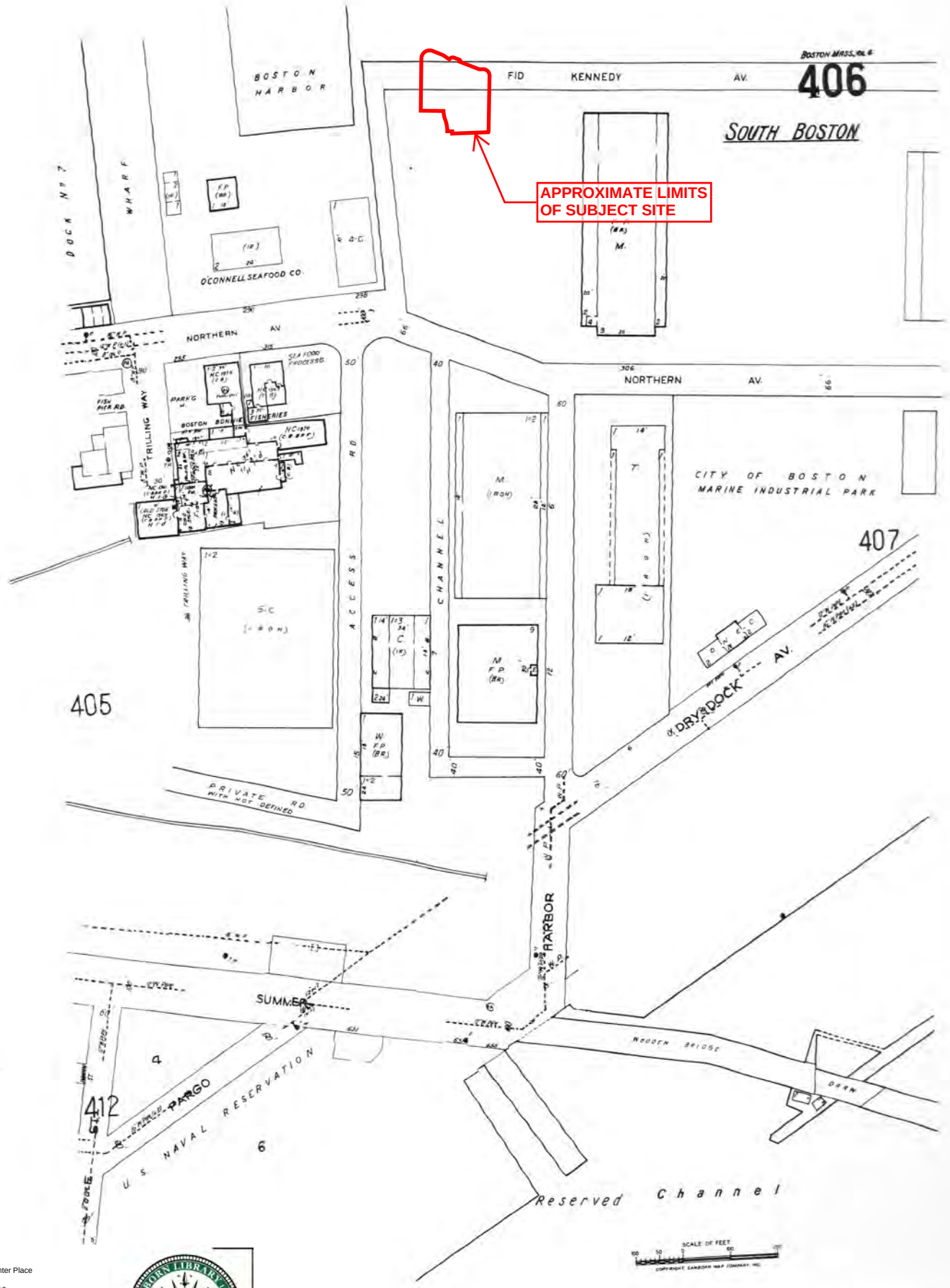
Client: ATC Associates Inc. #60
EDR Inquiry: 3327065.3
Order Date: 5/21/2012 5:00:01 PM
Certification # 5439-4B72-BA1C
Copyright: 1990

1988 Certified Sanborn Map



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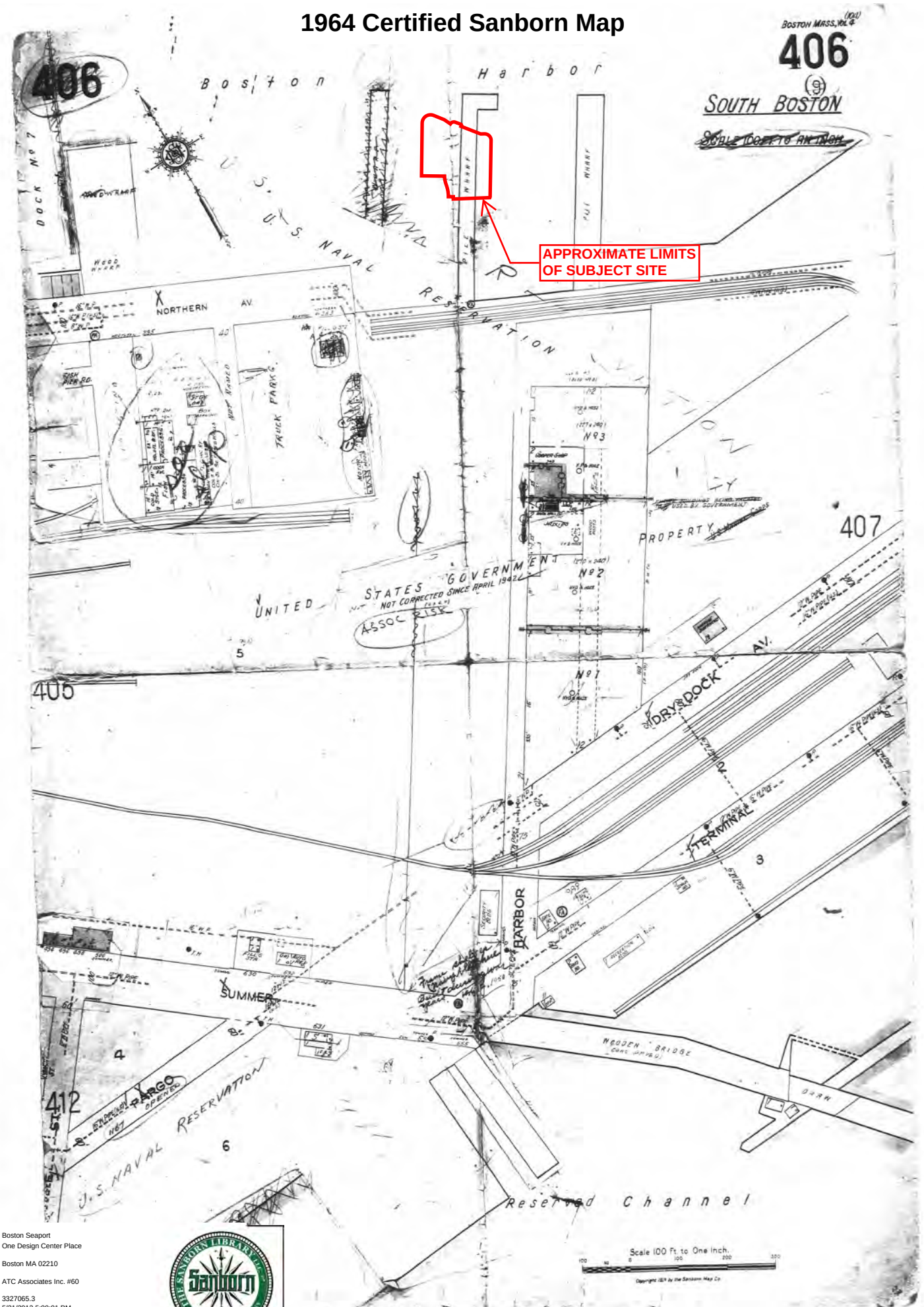
Address: One Design Center Place
City, ST, ZIP: Boston MA 02210
Client: ATC Associates Inc. #60
EDR Inquiry: 3327065.3
Order Date: 5/21/2012 5:00:01 PM
Certification # 5439-4B72-BA1C
Copyright: 1988

1964 Certified Sanborn Map



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Address: One Design Center Place
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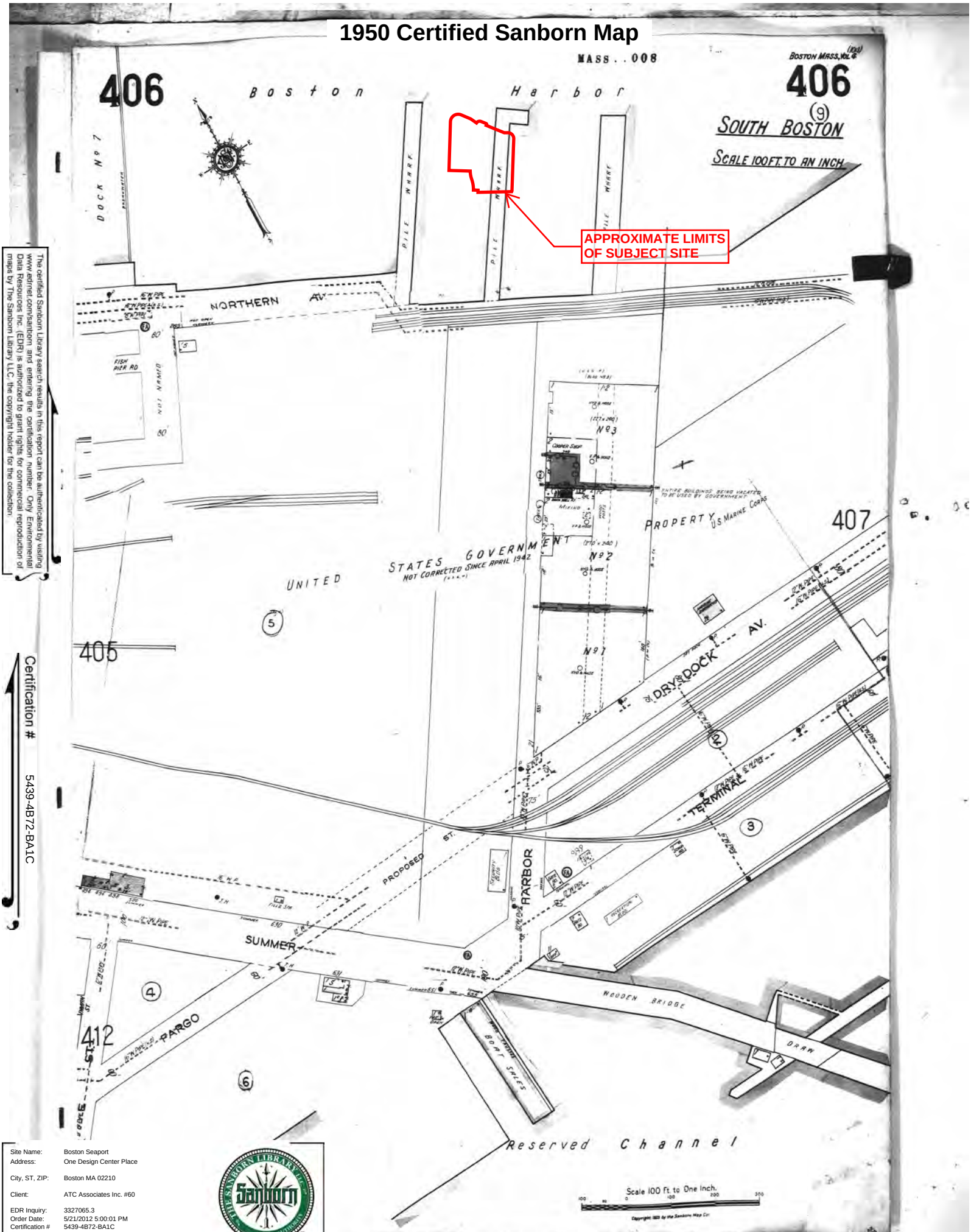
Client: ATC Associates Inc. #60
EDR Inquiry: 3327065.3
Order Date: 5/21/2012 5:00:01 PM
Certification # 5439-4B72-BA1C
Copyright: 1964

1950 Certified Sanborn Map



Certification # 5439-4B72-BA1C

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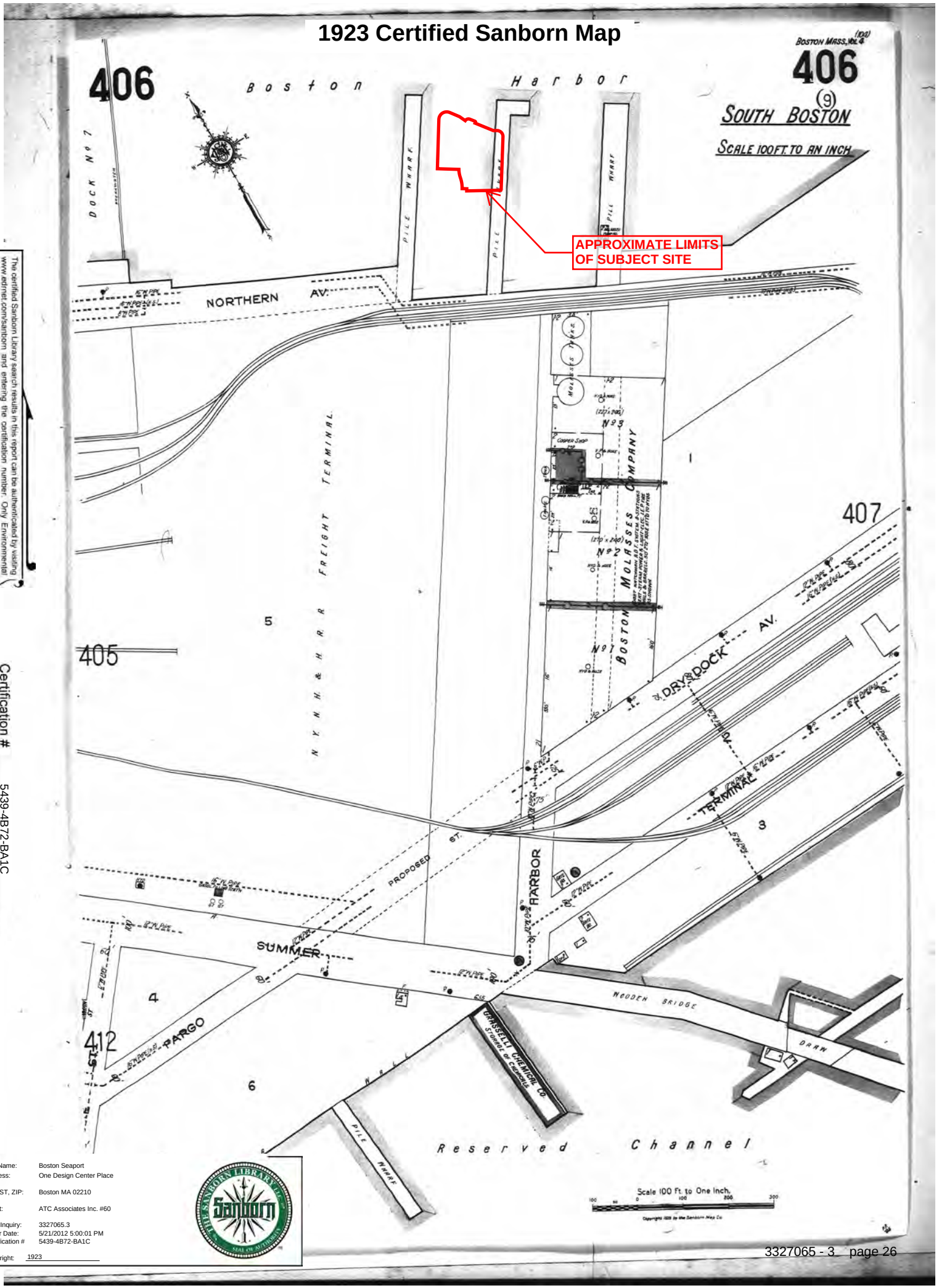
Address: One Design Center Place
City, ST, ZIP: Boston MA 02210
Client: ATC Associates Inc. #60
EDR Inquiry: 3327065.3
Order Date: 5/21/2012 5:00:01 PM
Certification # 5439-4B72-BA1C
Copyright: 1950

1923 Certified Sanborn Map



Certification # 5439-4B72-BA1C

Site Name:	Boston Seaport
Address:	One Design Center Place
City, ST, ZIP:	Boston MA 02210
Client:	ATC Associates Inc. #60
EDR Inquiry:	3327065.3
Order Date:	5/21/2012 5:00:01 PM
Certification #	5439-4B72-BA1C
Copyright:	1923

Boston Seaport
One Design Center Place
Boston, MA 02210

Inquiry Number: 3327065.4
May 21, 2012

EDR Historical Topographic Map Report

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

Historical Topographic Map

N	TARGET QUAD NAME: BOSTON MAP YEAR: 1903 SERIES: 15 SCALE: 1:62500	SITE NAME: Boston Seaport ADDRESS: One Design Center Place Boston, MA 02210 LAT/LONG: 42.3443 / -71.0334	CLIENT: ATC Associates Inc. #60 CONTACT: Chris Amorelli INQUIRY#: 3327065.4 RESEARCH DATE: 05/21/2012

Historical Topographic Map

N	TARGET QUAD NAME: BOSTON AND VICINITY MAP YEAR: 1903 SERIES: 15 SCALE: 1:62500	SITE NAME: Boston Seaport ADDRESS: One Design Center Place Boston, MA 02210 LAT/LONG: 42.3443 / -71.0334	CLIENT: ATC Associates Inc. #60 CONTACT: Chris Amorelli INQUIRY#: 3327065.4 RESEARCH DATE: 05/21/2012

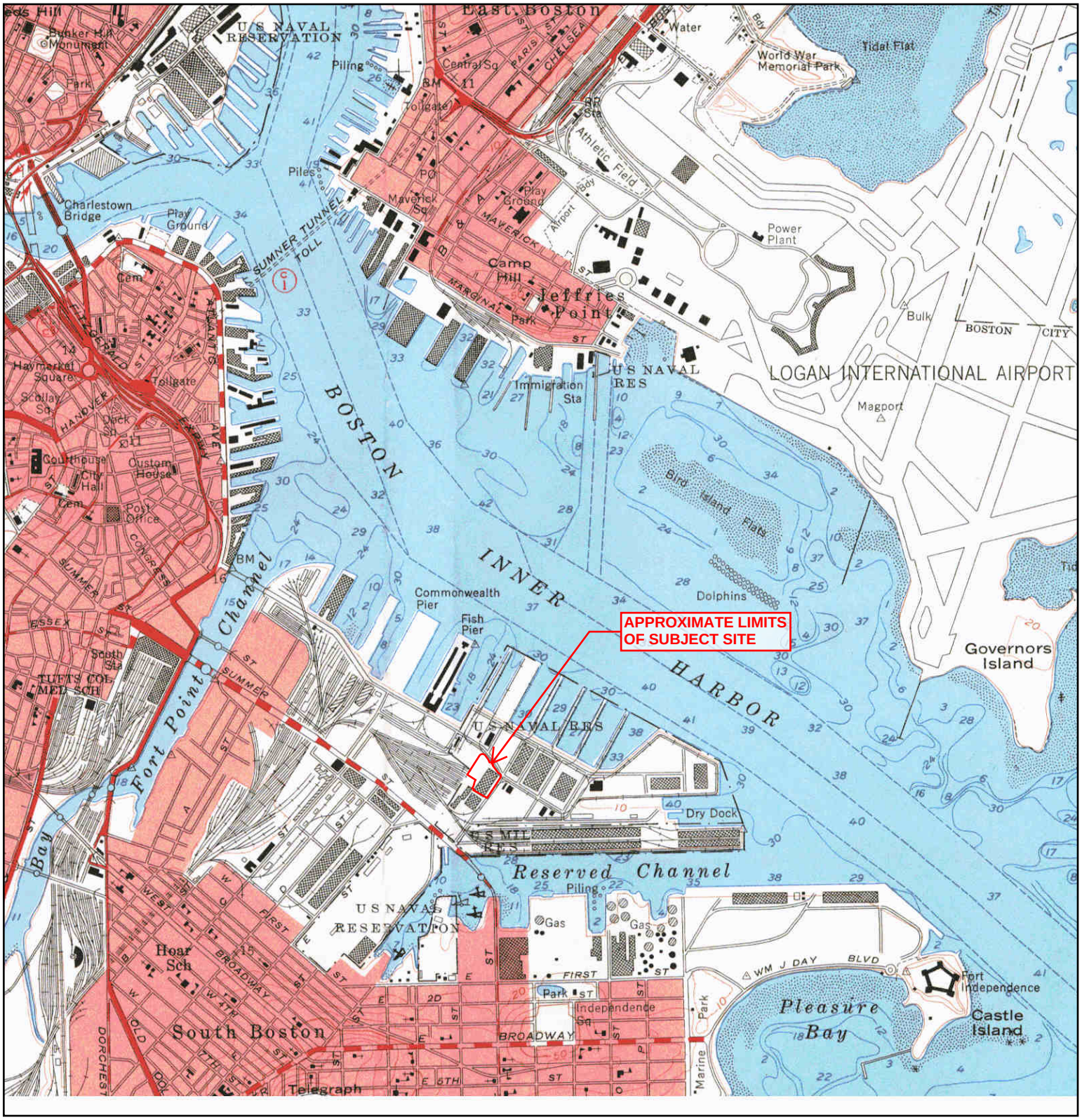
Historical Topographic Map

N	TARGET QUAD NAME: BOSTON SOUTH MAP YEAR: 1946 SERIES: 7.5 SCALE: 1:25000	SITE NAME: Boston Seaport ADDRESS: One Design Center Place Boston, MA 02210 LAT/LONG: 42.3443 / -71.0334	CLIENT: ATC Associates Inc. #60 CONTACT: Chris Amorelli INQUIRY#: 3327065.4 RESEARCH DATE: 05/21/2012

Historical Topographic Map

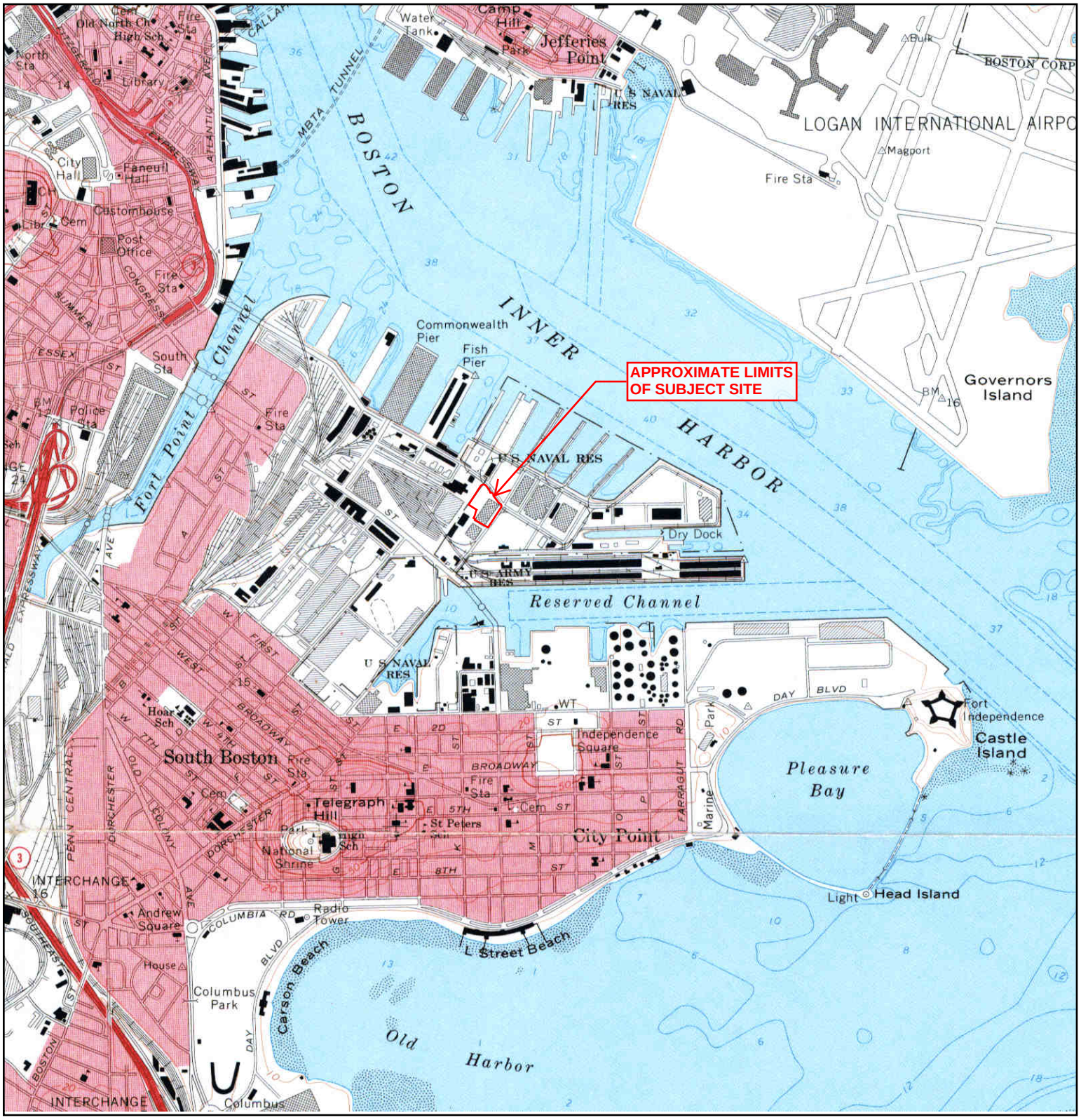
N	TARGET QUAD NAME: BOSTON SOUTH MAP YEAR: 1956 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Boston Seaport ADDRESS: One Design Center Place Boston, MA 02210 LAT/LONG: 42.3443 / -71.0334	CLIENT: ATC Associates Inc. #60 CONTACT: Chris Amorelli INQUIRY#: 3327065.4 RESEARCH DATE: 05/21/2012

Historical Topographic Map



N	TARGET QUAD NAME: BOSTON VICINITY 2 OF 4 MAP YEAR: 1958 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Boston Seaport ADDRESS: One Design Center Place Boston, MA 02210 LAT/LONG: 42.3443 / -71.0334	CLIENT: ATC Associates Inc. #60 CONTACT: Chris Amorelli INQUIRY#: 3327065.4 RESEARCH DATE: 05/21/2012

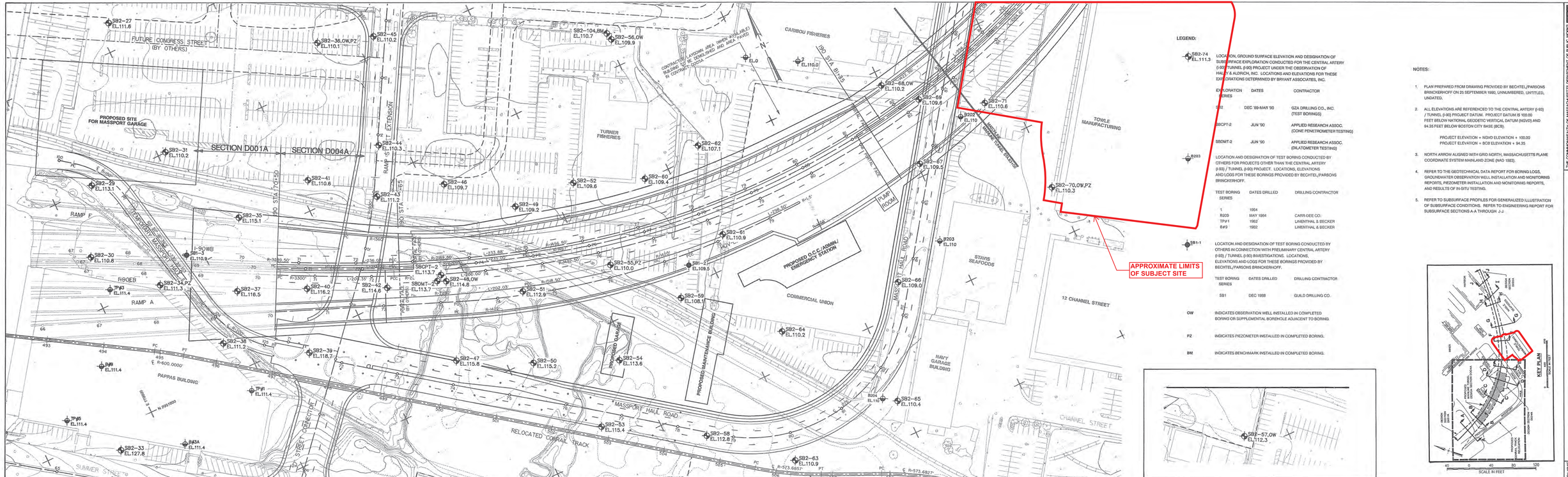
Historical Topographic Map



N	TARGET QUAD NAME: BOSTON SOUTH MAP YEAR: 1970 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Boston Seaport ADDRESS: One Design Center Place Boston, MA 02210 LAT/LONG: 42.3443 / -71.0334	CLIENT: ATC Associates Inc. #60 CONTACT: Chris Amorelli INQUIRY#: 3327065.4 RESEARCH DATE: 05/21/2012

Historical Topographic Map

N	TARGET QUAD NAME: BOSTON SOUTH MAP YEAR: 1979 PHOTOREVISED FROM :1970 SERIES: 7.5 SCALE: 1:25000	SITE NAME: Boston Seaport ADDRESS: One Design Center Place Boston, MA 02210 LAT/LONG: 42.3443 / -71.0334	CLIENT: ATC Associates Inc. #60 CONTACT: Chris Amorelli INQUIRY#: 3327065.4 RESEARCH DATE: 05/21/2012



THE COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS
CENTRAL ARTERY / TUNNEL PROJECT (I-93 / I-90)
DESIGN SECTION D004A

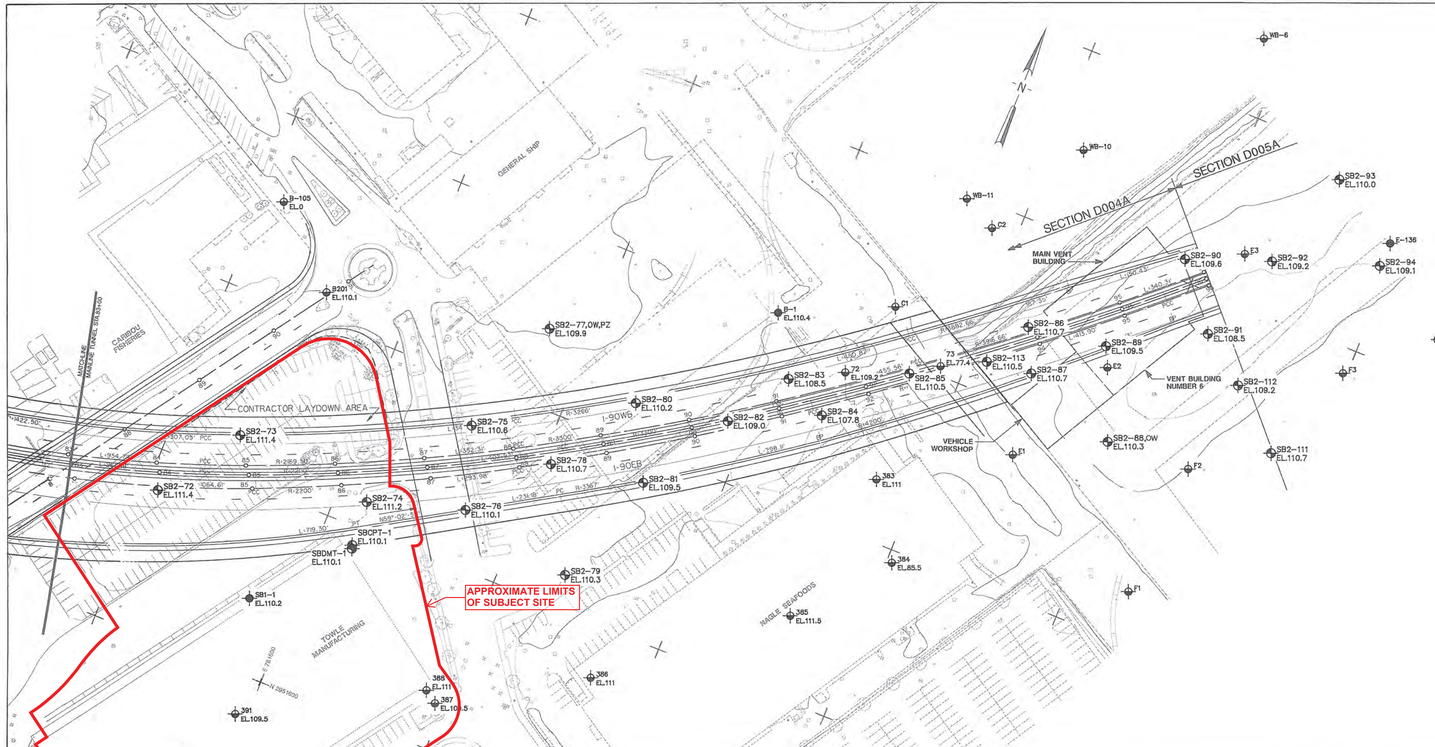
HALEY & ALDRICH, INC.
Geotechnical Engineers & Environmental Consultants

OCTOBER 1991

SITE AND SUBSURFACE EXPLORATION LOCATION PLAN

STA. 70+50 TO STA. 83+00

FIGURE 2A



LEGEND:

SB2-74 EL.111.3 LOCATION, GROUND SURFACE ELEVATION AND DESIGNATION OF SUBSURFACE EXPLORATION CONDUCTED FOR THE CENTRAL ARTERY (I-93)/TUNNEL (I-90) PROJECT UNDER THE OBSERVATION OF HALEY & ALDRICH, INC. LOCATIONS AND ELEVATIONS FOR THESE EXPLORATIONS DETERMINED BY BRYANT ASSOCIATES, INC.

EXPLORATION SERIES	DATES	CONTRACTOR
SB2	DEC '89-MAR '90	GZA DRILLING CO., INC. (TEST BORINGS)
SBCPT-2	JUN '90	APPLIED RESEARCH ASSOC. (CONE PENETROMETER TESTING)
SBDMT-2	JUN '90	APPLIED RESEARCH ASSOC. (DILATOMETER TESTING)

C1 LOCATION AND DESIGNATION OF TEST BORING CONDUCTED BY OTHERS FOR PROJECTS OTHER THAN THE CENTRAL ARTERY (I-93) / TUNNEL (I-90) PROJECT. LOCATIONS, ELEVATIONS AND LOGS FOR THESE BORINGS PROVIDED BY BECHTEL/PARSONS BRINCKERHOFF.

TEST BORING SERIES	DATES DRILLED	DRILLING CONTRACTOR
E3	OCT-DEC 1959	GUILD DRILLING CO.
F2	OCT-DEC 1959	GUILD DRILLING CO.
B-105	NOV 1952	GUILD DRILLING CO.
1	1954	
B203	MAY 1994	CARR-DEE CO.
391	1951	
C1	OCT-DEC 1959	GUILD DRILLING CO.
WB-10	SEP-OCT 1979	BAY STATE TEST BORING, INC.

SB1-1 LOCATION AND DESIGNATION OF TEST BORING CONDUCTED BY OTHERS IN CONNECTION WITH PRELIMINARY CENTRAL ARTERY (I-93) / TUNNEL (I-90) INVESTIGATIONS. LOCATIONS, ELEVATIONS AND LOGS FOR THESE BORINGS PROVIDED BY BECHTEL/PARSONS BRINCKERHOFF.

TEST BORING SERIES	DATES DRILLED	DRILLING CONTRACTOR
SB1	DEC 1988	GUILD DRILLING CO.
E	MAY 1988	CORTELL ASSOCIATES
B-1	JAN 1987	GUILD DRILLING CO.

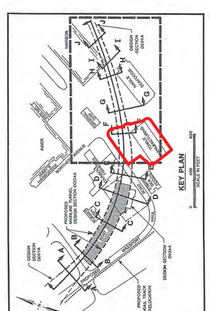
OW INDICATES OBSERVATION WELL INSTALLED IN COMPLETED BORING OR SUPPLEMENTAL BOREHOLE ADJACENT TO BORING.

PZ INDICATES PIEZOMETER INSTALLED IN COMPLETED BORING.

NOTES:

1. PLAN PREPARED FROM DRAWING PROVIDED BY BECHTEL/PARSONS BRINCKERHOFF ON 25 SEPTEMBER 1990, UNNUMBERED, UNTITLED, UNDATED.
2. ALL ELEVATIONS ARE REFERENCED TO THE CENTRAL ARTERY (I-93) / TUNNEL (I-90) PROJECT DATUM. PROJECT DATUM IS 100.00 FEET BELOW NATIONAL GEODETIC VERTICAL DATUM (NGVD) AND 94.35 FEET BELOW BOSTON CITY BASE (BCB).

   PROJECT ELEVATION = NGVD ELEVATION + 100.00
   PROJECT ELEVATION = BCB ELEVATION + 94.35
3. NORTH ARROW ALIGNED WITH GRID NORTH, MASSACHUSETTS PLANE COORDINATE SYSTEM MAINLAND ZONE (NAD 1983).
4. REFER TO THE GEOTECHNICAL DATA REPORT FOR BORING LOGS, GROUNDWATER OBSERVATION WELL INSTALLATION AND MONITORING REPORTS, PIEZOMETER INSTALLATION AND MONITORING REPORTS, AND RESULTS OF IN-SITU TESTING.
5. REFER TO SUBSURFACE PROFILES FOR GENERALIZED ILLUSTRATION OF SUBSURFACE CONDITIONS. REFER TO ENGINEERING REPORT FOR SUBSURFACE SECTIONS A-A THROUGH J-J.



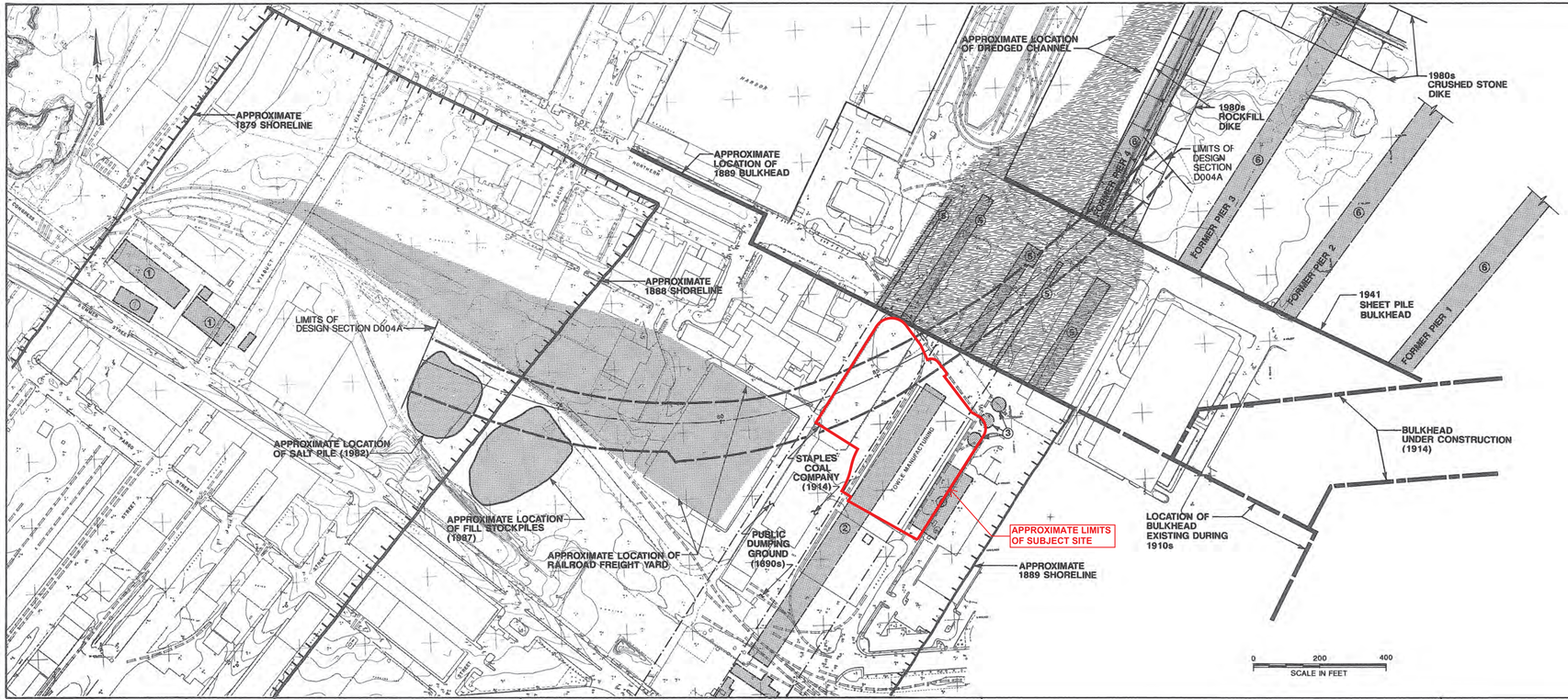
THE COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS
CENTRAL ARTERY (I-93)/TUNNEL (I-90) PROJECT
DESIGN SECTION D004A

HALEY & ALDRICH, INC.
Geotechnical Engineers & Environmental Consultants

SITE AND SUBSURFACE EXPLORATION LOCATION PLAN
STA. 83+00 TO STA. 96+02

OCTOBER 1991

FIGURE **2B**



LEGEND:

- APPROXIMATE LOCATION OF PREVIOUSLY EXISTING STRUCTURE:
  - (1) WALWORTH CORPORATION BUILDINGS (1920s)
  - (2) METROPOLITAN COAL CO. COAL SHED (1890s)
  - (3) BOSTON MOLASSES CO. TANKS (1910s)
  - (4) BOSTON MOLASSES CO. COOPER SHOP (1910s)
  - (5) TIMBER PIERS (1850s - 1941)
  - (6) TIMBER PIERS (1941 - 1962)
- RAILROAD FREIGHT YARD - MANY TRACKS IN AREA
- APPROXIMATE LOCATION OF FORMER DREDGED CHANNEL.
- APPROXIMATE LOCATION OF SALT PILES (1982)
- APPROXIMATE LOCATION OF FILL STOCKPILES (1987)

NOTES:

1. HISTORICAL SITE FEATURES DEPICTED REPRESENT SELECTED INFORMATION OBTAINED FROM THE REFERENCED PLANS AND DO NOT REPRESENT ALL PAST SITE DEVELOPMENT. LOCATIONS SHOWN WERE ESTIMATED BY SCALING FROM HISTORICAL PLANS, AND SHOULD BE CONSIDERED VERY APPROXIMATE.
2. LOCATIONS OF PREVIOUSLY EXISTING BUILDINGS OBTAINED FROM:
   - (A) MAPS OF SOUTH BOSTON PREPARED BY BROMLEY, DATED 1899, APPROXIMATE ORIGINAL SCALE: 1 IN. = 150 FT.
   - (B) MAPS OF SOUTH BOSTON PREPARED BY THE SANDSORN MAP COMPANY, DATED 1899 AND 1923.
   - (C) LOCATION PLAN THE NAVY DEPARTMENT, BUREAU OF YARDS & DOCKS, ENTITLED "NAVAL DRY DOCK NO.-4, SOUTH BOSTON," DATED 5 NOVEMBER 1941, ORIGINAL SCALE: 1 IN. = 100 FT.
3. LOCATIONS OF PIERS AND BULKHEADS EXISTING AND UNDER CONSTRUCTION DURING 1914 OBTAINED FROM PLAN PREPARED BY COMMONWEALTH OF MASSACHUSETTS, DIRECTORS OF THE PORT OF BOSTON, ENTITLED "SOUTH BOSTON FLATS, PRESENT CONDITION AND IMPROVEMENTS UNDER CONSTRUCTION," DATED 1 JANUARY 1914, ORIGINAL SCALE: 1 IN. = 400 FT.
4. LOCATIONS OF N.Y.N.H. & H.R.R. FREIGHT TERMINAL TRACKS OBTAINED FROM PLAN PREPARED BY U.S. COAST AND GEODETIC SURVEY, ENTITLED "BOSTON HARBOR, MASSACHUSETTS, CHART 246, 1:20,000," DATED 1932.
5. LOCATION OF ROCK DIKE AND PIERS 3 AND 4, IN MASSPORT MARINE TERMINAL OBTAINED FROM PLANS ENTITLED, "MASSPORT MARINE TERMINAL - PHASE II, DIKE PLAN," PREPARED BY CE MAGUIRE, INC., MPA CONTRACT 3,111 C/P-813, DWGS NOS. 1 AND 3 OF 5, UNDATED.
6. LOCATION OF APPROXIMATE 1879 SHORELINE OBTAINED FROM PLAN ENTITLED "MAP OF BOSTON, 1879," PREPARED BY SAMPSON, DAVENPORT & COMPANY, AS PUBLISHED IN THE REPORT BY PEABODY MUSEUM, HARVARD UNIVERSITY, INSTITUTE FOR CONSERVATION ARCHAEOLOGY, ENTITLED "ARCHAEOLOGICAL SURVEY OF THE THIRD HARBOR TUNNEL CROSSING, BOSTON, MASSACHUSETTS," DATED 1982.
7. LOCATION OF APPROXIMATE 1838 SHORELINE OBTAINED FROM PLAN PREPARED BY MASSACHUSETTS BOARD OF HARBOR AND LAND COMMISSIONERS, DATED 1886.
8. LOCATION OF APPROXIMATE 1889 SHORELINE OBTAINED FROM PLAN PREPARED BY MASSACHUSETTS BOARD OF HARBOR AND LAND COMMISSIONERS, DATED 1896.
9. APPROXIMATE LOCATION OF 1982 SALT PILE OBTAINED FROM AERIAL PHOTOGRAPH OF SOUTH BOSTON, DATED DECEMBER 1982.
10. APPROXIMATE LOCATION OF 1987 FILL STOCKPILES OBTAINED FROM AERIAL PHOTOGRAPH OF SOUTH BOSTON, DATED 21 DECEMBER 1987

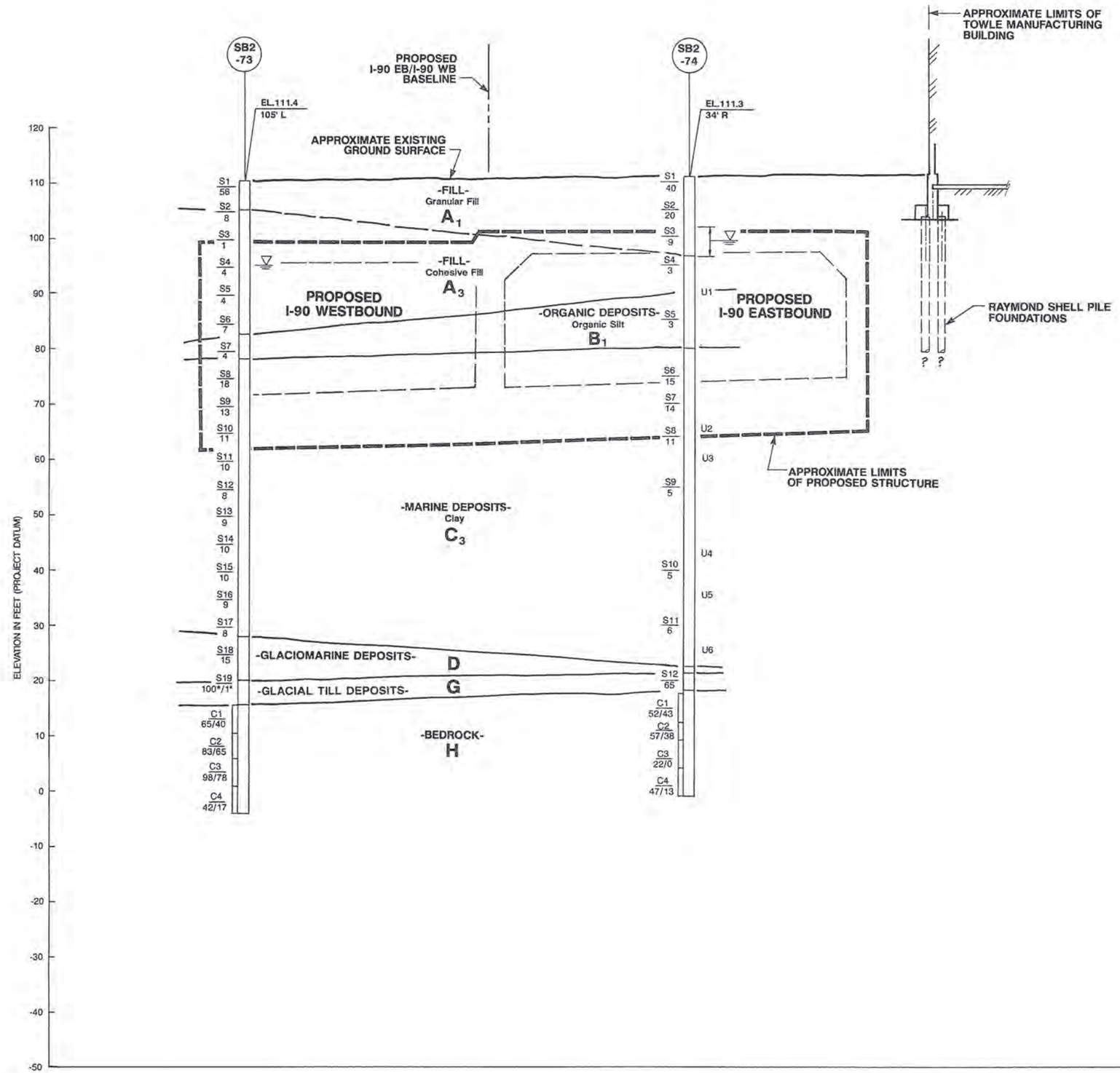
THE COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS CENTRAL ARTERY/TUNNEL PROJECT (CA/T PROJECT)
DESIGN SECTION - D004A

HALEY & ALDRICH, INC.
Consultant Engineers & Environmental Conscience Consultants

LIMITS OF HISTORICAL FILLING AND FORMER STRUCTURES SOUTH BOSTON

OCTOBER 1991

FIGURE 3



GEOLOGIC LEGEND :

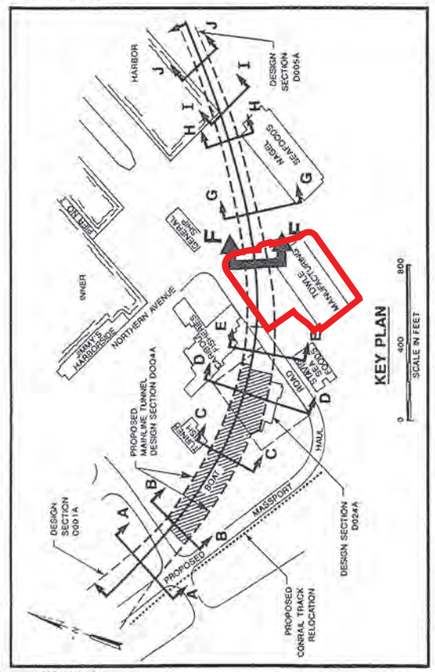
GEOLOGIC DESCRIPTION	LETTER CODE
FILL	A
GRANULAR FILL	A_1
MISCELLANEOUS FILL	A_2
COHESIVE FILL	A_3
ORGANIC DEPOSITS	B
ORGANIC SILT	B_1
PEAT	B_2
MARINE DEPOSITS	C
SAND	C_1
SILT	C_2
CLAY	C_3
GLACIOMARINE DEPOSITS	D
UPPER UNIT	D_1
LOWER UNIT	D_2
GLACIOLACUSTRINE DEPOSITS	E
SAND	E_1
SILT	E_2
CLAY	E_3
GLACIOFLUVIAL DEPOSITS	F
SAND & GRAVEL	F_1
GLACIAL TILL DEPOSITS	G
FLOW TILL	G_1
ABLATION TILL	G_2
LODGEMENT TILL	G_3
BEDROCK	H

——— INTERFACE BETWEEN STRATA BASED ON INTERPOLATION BETWEEN BORINGS.

— — — GRADATIONAL CHANGE WITHIN THE SAME STRATUM BASED ON INTERPOLATION BETWEEN BORINGS.

—?—?— INFERRED STRATA CHANGE OR GRADATIONAL CHANGE WHERE INTERPOLATION BETWEEN BORINGS NOT POSSIBLE DUE TO LIMITED INFORMATION.

NOTE: SEE PROFILE AND SECTION GENERAL LEGENDS AND NOTES FOR DETAILS



THE COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS
CENTRAL ARTERY (I-93)/TUNNEL (I-90) PROJECT
DESIGN SECTION - D004A

HALEY & ALDRICH, INC.
Geotechnical Engineers & Environmental Consultants

OCTOBER 1991

SUBSURFACE SECTION F-F
STA. 86+00

FIGURE 14

APPENDIX B

Available Drawings – On-Site Building, Central Artery / Tunnel (CA/T) and BWSC Utility

BOSTON
INTERSTATE I-90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1991	18	881

SHEET 4 OF 19 , GEOTECHNICAL

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

LEGEND

- SB2-XX INDICATES LOCATION AND DESIGNATION OF TEST BORING PERFORMED FOR THE AGC
- SB2-TPXX INDICATES LOCATION AND DESIGNATION OF TEST PIT PERFORMED FOR THE AGC
- PZ — INDICATES PIEZOMETER INSTALLED IN COMPLETED TEST BORING.
- OW — INDICATES OBSERVATION WELL INSTALLED IN COMPLETED TEST BORING.
- BM — INDICATES BENCH MARK INSTALLED IN COMPLETED TEST BORING.

GENERAL NOTES:

1. ONLY BORINGS AND TEST PITS PERFORMED FOR THE AGC ARE SHOWN. PILOT BORINGS (SBI SERIES), ENVIRONMENTAL CA/T BORINGS, AND OTHER NON-CA/T BORING DATA ARE AVAILABLE ON REQUEST
2. THE BORINGS WERE DRILLED BY GZA DRILLING, INC. FROM DECEMBER 1989 THROUGH MARCH 1990. THE BORINGS WERE OBSERVED BY THE AGC (HALEY AND ALDRICH, INC.)
3. BORING LOGS AND A SUMMARY OF BORING LOCATIONS AND ELEVATIONS ARE SUMMARIZED IN THE CONTRACT DOCUMENT ENTITLED "BORING LOGS"
4. REFER TO "GEOTECHNICAL ENGINEERING REPORT" (AGC REPORT) FOR SUBSURFACE CROSS SECTIONS AND PROFILES.
5. REFER TO "FINAL REPORT ON TEST PIT PROGRAM, SOUTH BOSTON AREA" FOR TEST PIT LOGS.
6. TOPOGRAPH BASED ON DATA OBTAINED PRIOR TO DEMOLITION OF PAPPAS, NOYMER AND COMMERCIAL UNION BUILDINGS AND THE REGRADING OF FILL PILES.
7. REFER TO AGC REPORT FOR DATA ON BORINGS SBDMT-XX AND SBCPT-XX.

SCALE
HORIZONTAL :1"=40'

HORIZONTAL
40 20 0 40 80 120 160

REV	DATE	BY	SUB	APP	DESCRIPTION
1	15MAY98	VP		KSS	INCORPORATED FIELD CONDITIONS

DESIGNED BY K A PIGEON
DRAWN BY W E DAVIS
CHECKED BY K A PIGEON
IN CHARGE S J POULOS
DATE 14 OCT 91

COMMONWEALTH OF MASSACHUSETTS — STEVE J POULOS #20780

MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93) / Tunnel (I-90) Project
HDR / HAYDEN-WEGMAN — SECTION DESIGNER-D004A GEI CONSULTANTS, INC. — SUBMITTED:
BECHTEL/ PARSONS BRINCKERHOFF — MANAGEMENT CONSULTANTS — SUBMITTED FOR APPROVAL:

CENTRAL ARTERY TUNNEL

BOSTON MARINE INDUSTRIAL PARK
TUNNEL
BORING AND TEST PIT LOCATION PLAN
SHEET 4 OF 5

SCALE: 1" = 40'
CONTRACT NO. C04A2
DRAWING NO. C04A2-K-004
REV. 1

STA. 67+56.38 I-90 WESTBOUND ℄
N26°59'46"E 12.25' LEFT FROM
STA. 67+44.09 MAIN ℄ LAYOUT NO. 6968.

STA. 67+27.25 I-90 EASTBOUND ℄
S 26°59'46"W 9.84' RIGHT FROM
STA. 67+44.09 MAIN ℄ LAYOUT NO. 6968.

I-90 WESTBOUND PROFILE BASELINE

I-90 EASTBOUND PROFILE BASELINE

MAIN BASELINE OF LAYOUT NO. 6968

S62°39'31"E 280.19'

S 62°36'07"E 305.06'

PT

PC +36.57

PC +44.09

PC +32.31

R=3289.50' L=229.15'

R=3300.00' L=207.02'

+54.09

+65.72

PCC +39.33

R= 2189.50' L=233.88'

R=2200.00' L=200.00'

+99.60

PCC +39.33

+89.09

R= 1456.50'

L= 954.79'

R= 1482.50'

L= 1064.61'

A

A

STA. 96+02.5
N 42°26' 14"W
STA. 96+02.5

STA. 92+00.00 MAIN ℄ LAYOUT NO. 6968 =
STA. 92 MAIN ℄ LAYOUT NO. 6954.

I-90 WESTBOUND PROFILE BASELINE

I-90 EASTBOUND PROFILE BASELINE

MAIN BASELINE OF LAYOUT NO. 6968

MAIN BASELINE OF LAYOUT NO. 6954

L= 954.79'

R= 1456.50'

L= 1064.61'

R= 1482.50'

+54.39

+50.76

+03.94

R= 2189.50' L= 352.31'

R=2200.00' L=293.98'

+06.70

+97.92

+53.68

R=3300.00' L=455.56'

R=3330.00' L=338.07'

+00.00

+36.00

+62.26

R=3916.66'

R=4200.00'

L= 41

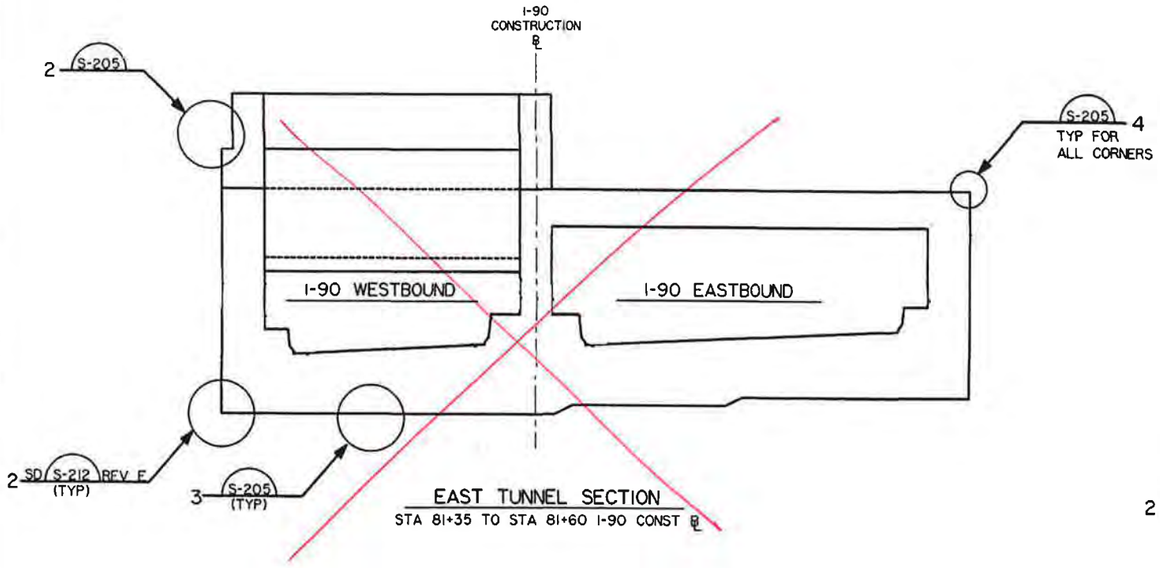
60 30 0 60 120 180 240

SCALE: 1" = 60'

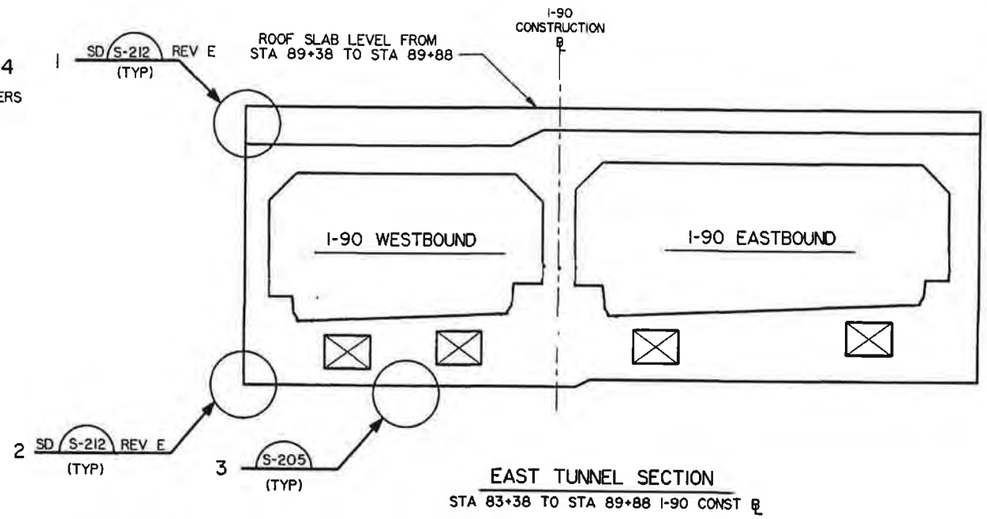
BOSTON
INTERSTATE I-90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS.	I-90-1(053)	1991	347	881

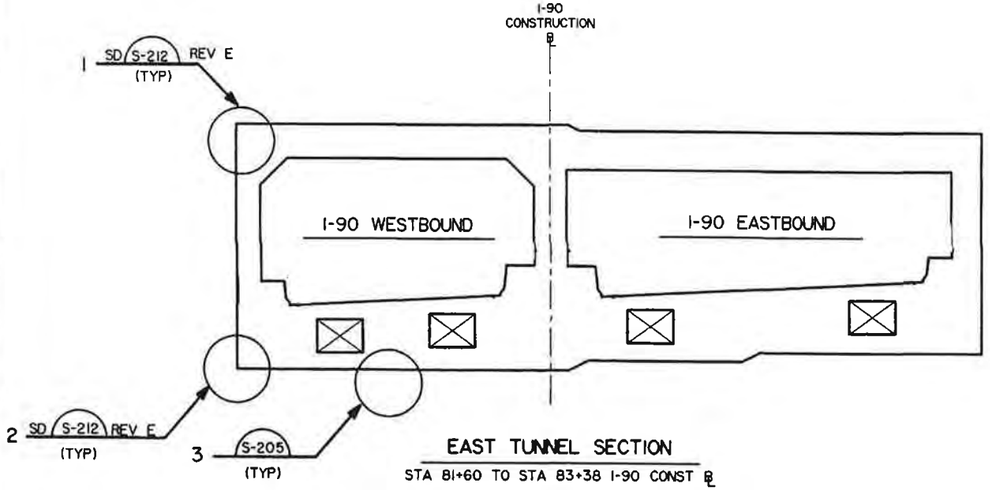
SHEET 138 OF 204 , STRUCTURAL



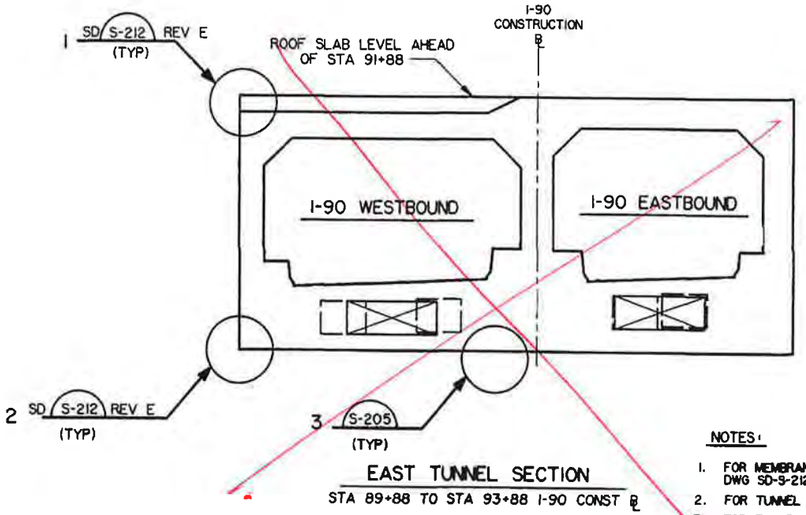
EAST TUNNEL SECTION
STA 81+35 TO STA 81+60 I-90 CONST ℄



EAST TUNNEL SECTION
STA 83+38 TO STA 89+88 I-90 CONST ℄



EAST TUNNEL SECTION
STA 81+60 TO STA 83+38 I-90 CONST ℄



EAST TUNNEL SECTION
STA 89+88 TO STA 93+88 I-90 CONST ℄

RECORD DRAWING
ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

NOTES:
1. FOR MEMBRANE WATERPROOFING DETAILS SEE DWG SD-S-212 (REV E).
2. FOR TUNNEL PLAN SEE DWG S-304 THRU S-306.
3. FOR TUNNEL SECTION ELEVATION AND DIMENSIONS SEE DWG S-307 THRU S-312 AND S-360.
4. FOR TUNNEL REINFORCING SECTIONS SEE DWG S-313 THRU S-321, S-337c AND S-361.
5. FOR TYPICAL ROADWAY DIMENSIONS SEE SEE DWG C-008 AND C-009.

STRUCTURE NO B-16-549

REV	DATE	BY	SUB	APP	DESCRIPTION
4	08JUN98	CCH		KSS	INCORPORATED FIELD CONDITIONS
3	01MAR93	QCS	RDC	JMY	PORTAL & SIDEWALK REDESIGN
2	10MAR92	KAS	MK	DLT	CHANGED SD REVISION
1	27JAN92	KAS	MK	DLT	CLARIFICATION OF SECTIONS

REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY R D CALL
DRAWN BY A V GORALCZYK
CHECKED BY M KARA
IN CHARGE J M YADLOSKY
DATE 14 OCT 1991

MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93)/Tunnel (I-90) Project
SECTION DESIGNER-0004A HDR / HAYDEN-WEGMAN SUBMITTED:
BECHTEL/ PARSONS BRINCKERHOFF MANAGEMENT CONSULTANTS SUBMITTED FOR APPROVAL:

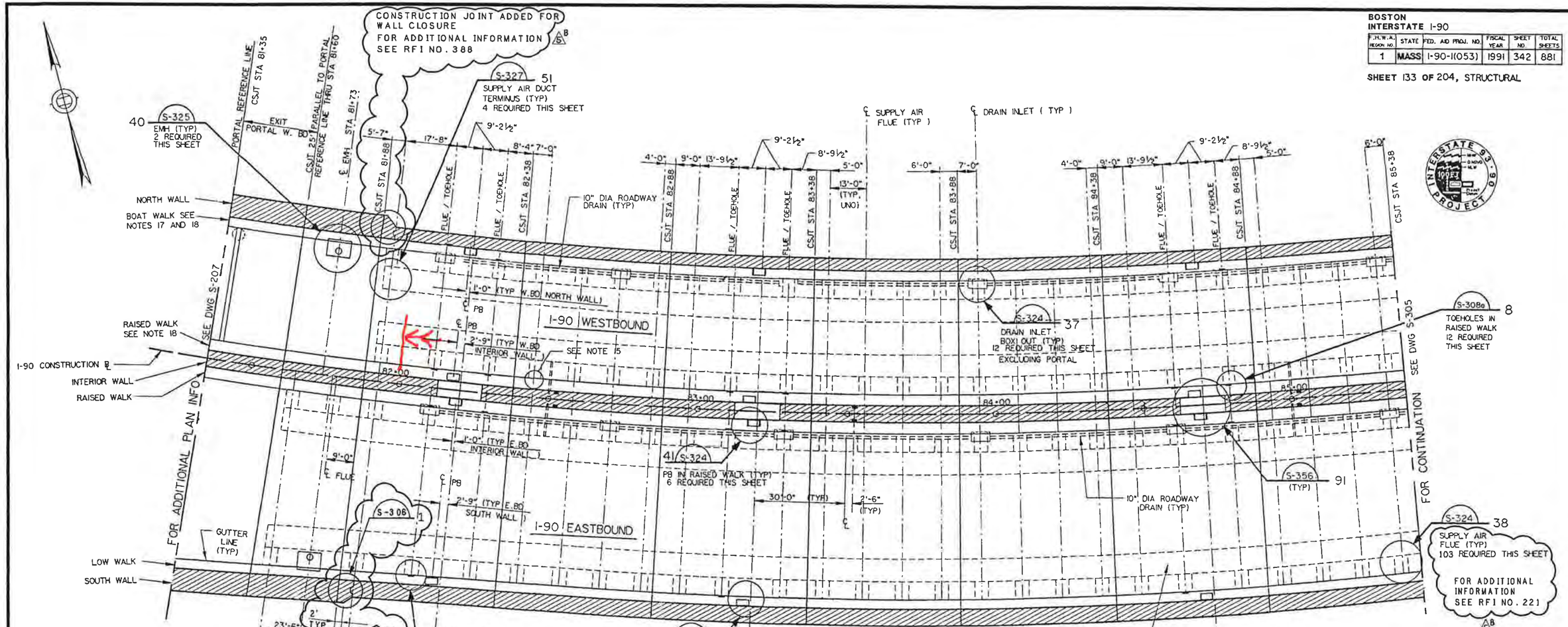
BOSTON MARINE INDUSTRIAL PARK TUNNEL
TYPICAL EAST TUNNEL CROSS SECTIONS

SCALE: NTS
CONTRACT NO. C04A2
DRAWING NO. C04A2-S-302
REV. 4

BOSTON
INTERSTATE I-90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1991	342	881

SHEET 133 OF 204, STRUCTURAL



NOTES:

1. ALL CONSTRUCTION JOINTS AND DIMENSIONS ARE MEASURED RADIALLY ALONG CONSTRUCTION ℄ UNLESS NOTED.
2. FOR MECHANICAL AND ELECTRICAL DETAILS SEE MECHANICAL AND ELECTRICAL DRAWINGS.
3. FOR ADDITIONAL DETAILS IN UTILITY ROOM/CROSS PASSAGES SEE DWG S-356 THRU S-358 AND S-329 THRU S-336.
4. FOR CROSS SECTION GEOMETRY AND ELEVATIONS SEE DWG S-307 THRU S-312 AND S-360.
5. FOR REINFORCING SEE CROSS SECTIONS DWG S-313 THRU S-321, S-337c AND S-361.
6. FOR ADDITIONAL PORTAL INFORMATION SEE DWG S-337 THRU S-337d.
7. FOR ROADWAY DRAIN PLAN SEE DWG U-001 THRU U-004.
8. DRAINAGE FROM DRAINS AND DUCTS IS PUMPED OUT AT IMMERSED TUBE LOW POINT.
9. FOR SUPPLY AIR DUCT TRANSITION DIMENSIONS AT STA 90+88 E.BD AND STA 92+88 W.BD SEE DWG S-355.
10. FOR TYPICAL JOINT DETAILS SEE DWG S-350.
11. ALL TRANSVERSE CONSTRUCTION JOINTS SHOWN ARE MANDATORY.
12. FOR ROADWAY GEOMETRY SEE CIVIL DRAWINGS.
13. FOR TYPICAL CONSTRUCTION JOINT LAYOUT SEE DWG S-312.
14. FOR CONSTRUCTION PENETRATIONS DETAILS SEE DWG S-328.
15. FIRE PROTECTION ROOF SLAB PENETRATION AT STA 82+45 AND STA 93+30. PROVIDE DETAIL 70 ON DWG S-118 AS REQUIRED. COORDINATE WITH LANDSCAPING DWG L-004 AND TUNNEL CEILING FINISHES C05B1.
16. FOR TELEPHONE CONDUIT PENETRATION IN ROOF AT STA 93+08 SEE DWG E-002 AND E-019. PROVIDE AS PER DETAIL 1 ON DWG S-258 AS REQUIRED.
17. FOR SOUTH WALK, TRANSITION TOP OF WALK SMOOTHLY FORM BOAT WALK AT START OF PORTAL 81+10± TO LOW WALK AT END OF PORTAL 81+35. FOR NORTH WALK, TRANSITION TOP OF WALK SMOOTHLY FROM BOAT WALK AT START OF PORTAL 81+35 TO LOW WALK AT END OF PORTAL 81+60±. START THE WALK GUTTERS AT THE END OF THE TRANSITION.
18. BEGIN SIDEWALK WITH PRECAST PANELS (BY OTHERS) AT STA 81+35 CSJT IN EASTBOUND (2 WALKS) AND AT STA 81+60 CSJT IN WESTBOUND (2 WALKS). (SEE DWGS S-309a, S-308b, S-220 AND S-208).

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED. UNLESS OTHERWISE NOTED

RECORD DRAWING

0 8 16 24 32 96

1/16" = 1'-0" HORIZONTAL

STRUCTURE NO B-16-549

REV	DATE	BY	SUB	APP	DESCRIPTION
4	01DEC93	QCS	DOF	JMY	ADJUST TOEHOLE LOCATIONS
3	17SEP93	QCS	DOF	JMY	ADDITION OF TOEHOLES
2	01MAR93	QCS	RAE	JMY	PORTAL AND SIDEWALK REDESIGN
1	27JAN92	KAS	SSW	DLT	CLARIFICATION OF DETAILS
6	09SEP98	EID		KSS	INCORPORATED FIELD CONDITIONS
5B	09SEP98	EID		KSS	MISCELLANEOUS REVISIONS

DESIGNED BY R. D. CALL
DRAWN BY J. J. WOOMER
CHECKED BY S. S. MORCOS
IN CHARGE J. M. YADLOSKY
DATE 14 OCT 1991

MASSACHUSETTS HIGHWAY DEPARTMENT

Central Artery (I-93)/Tunnel (I-90) Project

SECTION DESIGNER-0004A HDR / HAYDEN-WEGMAN SUBMITTED: Stanley Ward

BECHTEL/ PARSONS BRINCKERHOFF MANAGEMENT CONSULTANTS SUBMITTED FOR APPROVAL: C.M. Wiley

BOSTON MARINE INDUSTRIAL PARK TUNNEL
EAST TUNNEL PLAN

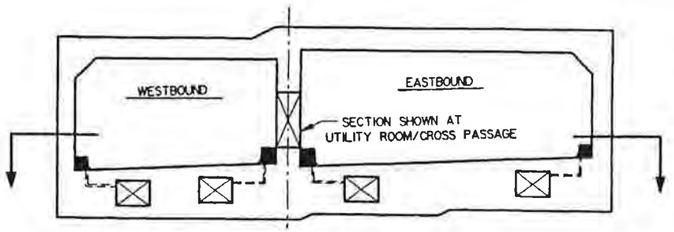
SHEET 1 OF 3

SCALE:	1/16" = 1'-0"
CONTRACT NO.	C04A2
DRAWING NO.	C04A2-S-304
REV.	6

BOSTON
INTERSTATE I-90

F.H.W.A. REGION NO	STATE	FED AID PROJ NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(1053)	1991	343	881

SHEET 134 OF 204, STRUCTURAL



EAST TUNNEL SECTION
PLAN DEPICTS A CUT SECTION
AND SHOWS WALLS CROSSHATCHED
NTS

EAST TUNNEL PLAN
STA 85+38 TO STA 89+88 I-90 CONST ℄
SEE SECTION FOR CROSS HATCHING

FOR INFORMATION SEE RFI NO'S 45, 221, 292, 306, 388.
FOR INFORMATION ON PATROL BOOTH DELETION SEE CA/T LETTER L-317 TO HDR DATED 04/01/94
△6B

RECORD DRAWING

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

NOTE :
SEE NOTES ON DWG S-304.

0 8 16 24 32 96
1/16" = 1'-0" HORIZONTAL

STRUCTURE NO B-16-549

REV	DATE	BY	SUB	APP	DESCRIPTION
4	01DEC93	OCS	DDF	JMY	ADJUST TOEHOLE LOCATIONS
3	17SEP93	OCS	DDF	JMY	ADDITION OF TOEHOLES
2	01MAR93	DAE	RDC	JMY	SIDEWALK REDESIGN
1	27JAN92	KAS	SSM	DLT	CORRECTION
7	08SEP98	EID		KSS	INCORPORATED FIELD CONDITIONS
6B	08SEP98	EID		KSS	NOTE ADDED
5	3JUNE94	WJG	MAS	JMY	UTILITY MODIFICATIONS

DESIGNED BY R D CALL
DRAWN BY J J WOOMER
CHECKED BY S S MORCOS
IN CHARGE J M YADLOSKY
DATE 19 OCT 1991

MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93) / Tunnel (I-90) Project
SECTION DESIGNER-C04A: HDR / HAYDEN-WEGMAN
SUBMITTED:
SECKTEL/ PARSONS BRINCKERHOFF MANAGEMENT CONSULTANTS
SUBMITTED FOR APPROVAL:

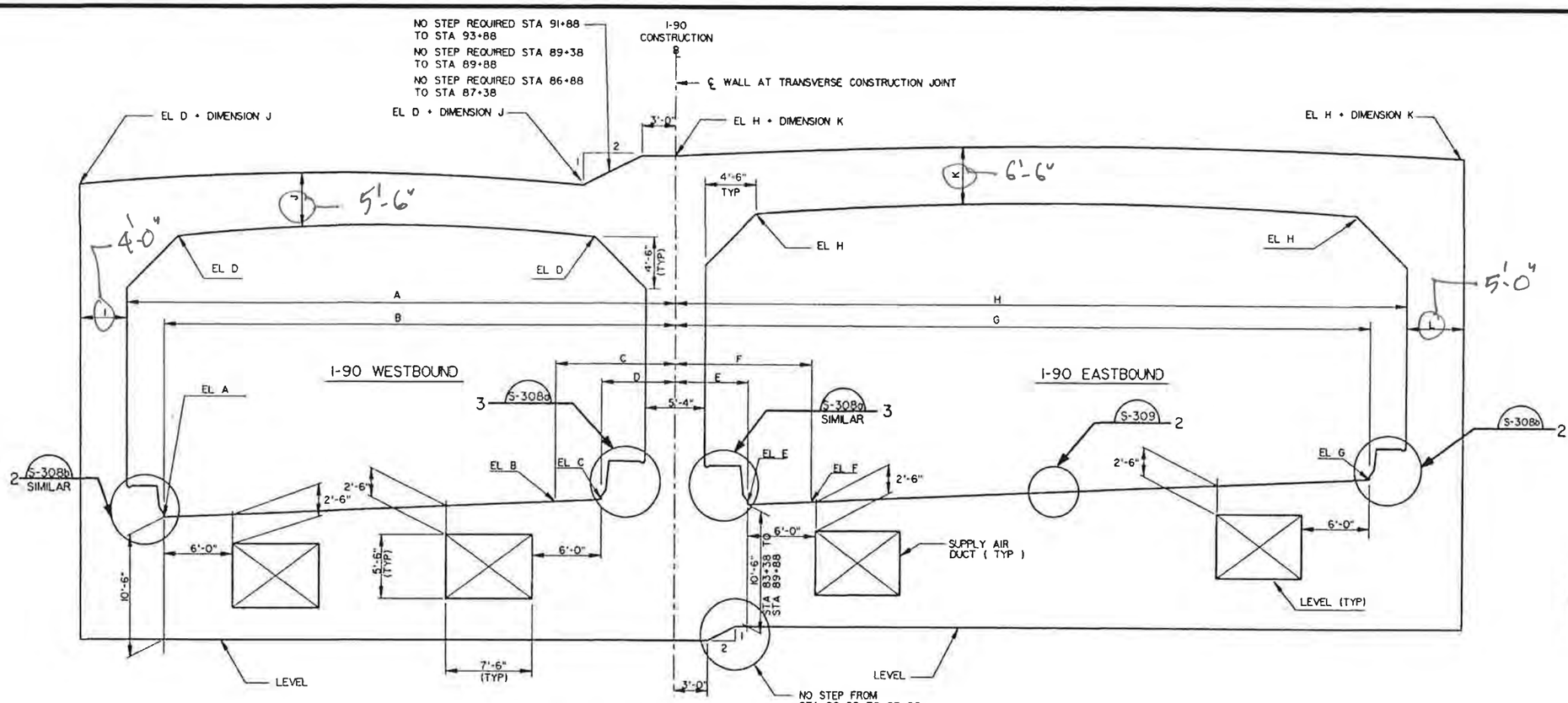
BOSTON MARINE INDUSTRIAL PARK TUNNEL
EAST TUNNEL PLAN
SHEET 2 OF 3

SCALE: 1/16"=1'-0
CONTRACT NO. C04A2
DRAWING NO. C04A2-S-305
REV. 7

BOSTON
INTERSTATE I-90

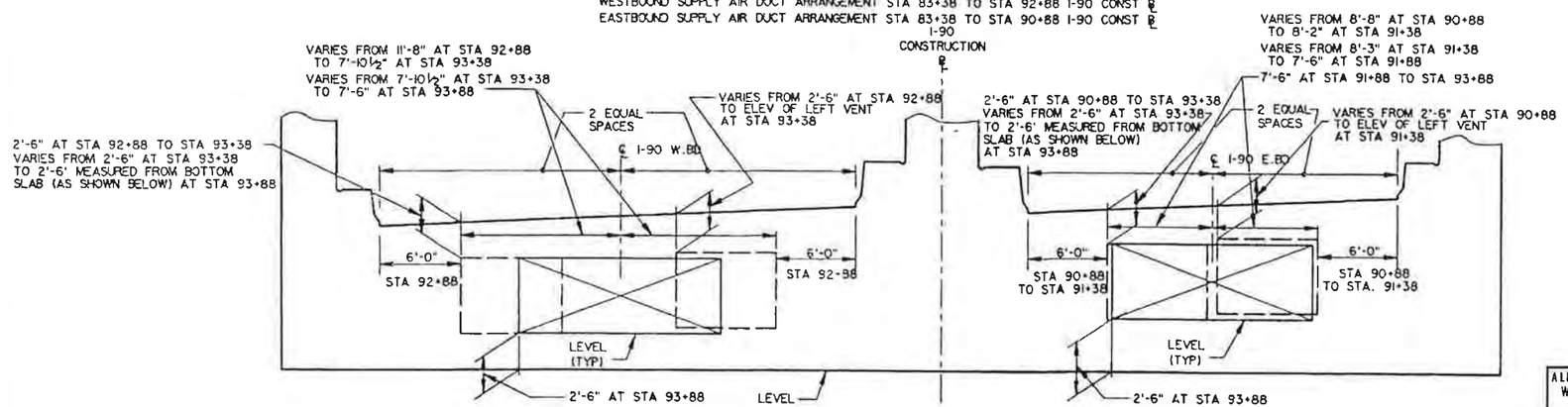
F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1991	350	881

SHEET 141 OF 204, STRUCTURAL



EAST TUNNEL SECTION

STA 83+38 TO STA 93+88 I-90 CONST ℄
WESTBOUND SUPPLY AIR DUCT ARRANGEMENT STA 83+38 TO STA 92+88 I-90 CONST ℄
EASTBOUND SUPPLY AIR DUCT ARRANGEMENT STA 83+38 TO STA 90+88 I-90 CONST ℄



PARTIAL EAST TUNNEL SECTION

FOR DIMENSIONS AND ELEVATIONS NOT SHOWN SEE ABOVE TUNNEL SECTION.
WESTBOUND SUPPLY AIR DUCT ARRANGEMENT STA 92+88 TO STA 93+88 I-90 CONST ℄
EASTBOUND SUPPLY AIR DUCT ARRANGEMENT STA 90+88 TO STA 93+88 I-90 CONST ℄

△4B FOR ADDITIONAL INFORMATION SEE RFI NO'S. 061, 086, 095, AND 388.

NOTES:

1. ALL STATIONS ARE ON I-90 CONSTRUCTION BASELINE.
2. FOR ADDITIONAL SUPPLY AIR DUCT AND FLUE ARRANSEMENT DETAILS SEE PLAN ON DWG S-304 THRU S-306.
3. FOR WEARING COURSE THICKNESS SEE DWG S-309
4. FOR ELEVATIONS AND DIMENSIONS SEE TABLES DWG S-310 THRU S-312.
5. FOR TYPICAL JOINT DETAILS SEE DWG S-350.
6. FOR TYPICAL CONSTRUCTION JOINT LAYOUT SEE DWG S-312
7. FOR PLANS SEE DWG S-304 THRU S-306.
* 8. FOR TYPICAL REINFORCING SEE DWG S-316 THRU S-321.
* 9. FOR SUPPLY AIR DUCT TRANSITION GEOMETRY SEE DWG S-355.
* 10. FOR ROOF TRANSITION DETAILS AT STA 83+38 SEE DWG S-327.
* 11. FOR MOVEMENT JOINT AT STA. 93+88 SEE DWG S-699.
* 12. FOR UTILITY CROSSING IN TUNNEL ROOF AT STA 89+73 SEE DWG S-353.
* 13. FOR UTILITY CROSSING IN TUNNEL ROOF AT STA 87+15.28 SEE DWG S-354A

* INDICATES NOTES FOR THIS SHEET ONLY

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

RECORD DRAWING

STRUCTURE NO B-16-549

REV	DATE	BY	SUB	APP	DESCRIPTION
△4B 4	26AUG98	TYC		KSS	NOTE ADDED
3	3JUNE94	MJG	MAB	JMY	UTILITY MODIFICATIONS
2	01MAR93	DAE	DOF	JMY	SIDEWALK REDESIGN
1	27JAN93	CHS	MK	DLT	CLARIFICATION OF DETAILS
△5	26AUG98	TYC		KSS	INCORPORATED FIELD CONDITIONS

DESIGNED BY R.D. CALL
DRAWN BY D.M. YOUNG
CHECKED BY M. KABA
IN CHARGE J.M. YADLOSKY
DATE 14 OCT 1991

MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93) / Tunnel (I-90) Project
SECTION DESIGNER 00044 HDR / HAYDEN-WEGMAN
SUBMITTED:
BECHTEL/ PARSONS BRINCKERHOFF
MANAGEMENT CONSULTANTS
SUBMITTED FOR APPROVAL: C.M. Wiley

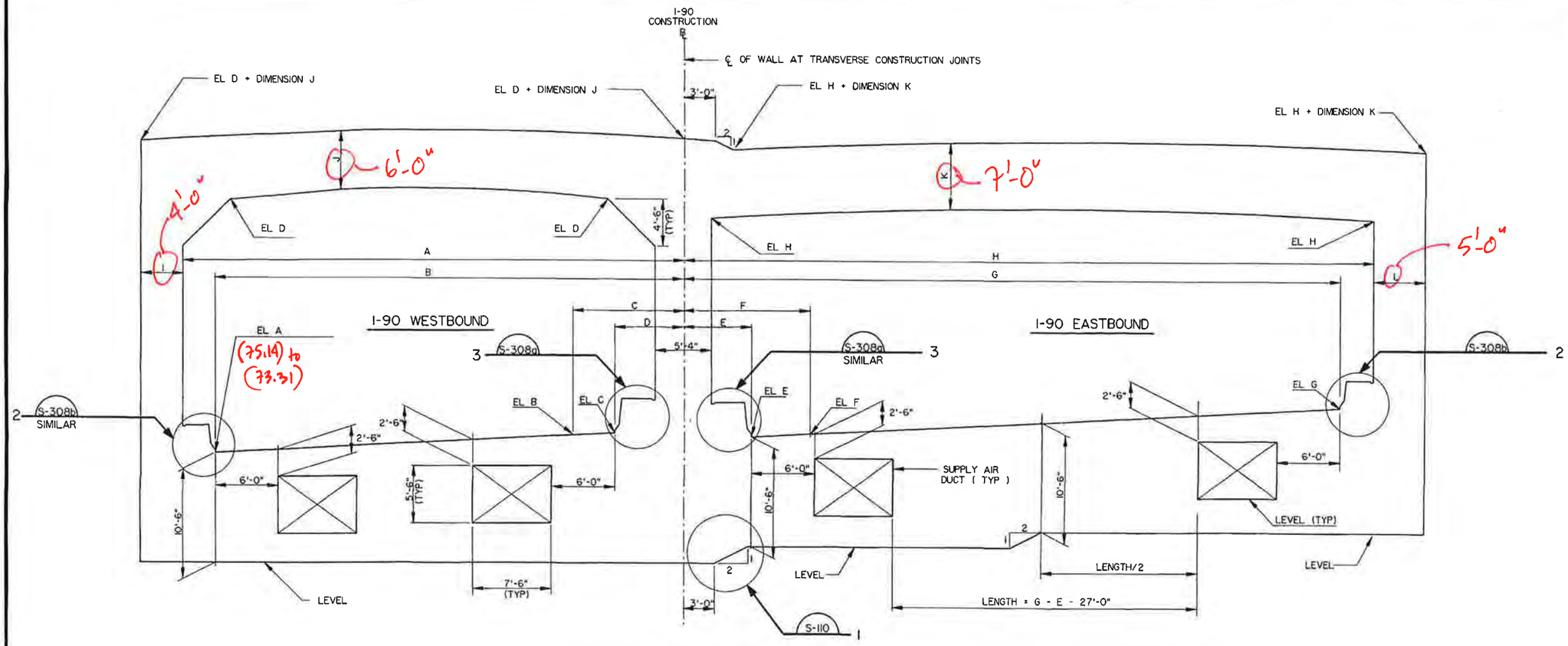
BOSTON MARINE INDUSTRIAL PARK TUNNEL
TYPICAL TUNNEL SECTIONS FOR DIMENSIONS
SHEET 2 OF 2

SCALE: NTS
CONTRACT NO. C04A2
DRAWING NO. C04A2-S-308
REV. 5

BOSTON
INTERSTATE I-90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1991	349	881

SHEET 140 OF 204, STRUCTURAL



EAST TUNNEL SECTION
STA 81+60 TO STA 83+38 I-90 CONST ℄

NOTES :

1. FOR TYPICAL REINFORCING SEE DWG S-314 AND S-361
2. FOR ADDITIONAL NOTES SEE DWG S-308
3. FOR ADDITIONAL INFORMATION, SEE RFI NO'S. 61 AND 252. (3B)

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

RECORD DRAWING

STRUCTURE NO B-16-549

REV	DATE	BY	SUB	APP	DESCRIPTION
4	22JUN98	CMG		KSS	INCORPORATED FIELD CONDITIONS
3B	22JUN98	CMG		KSS	NOTE ADDED
2	01MAR93	DAE	DDF	JMY	SIDEWALK REDESIGN
1	27JAN92	CHS	RDC	DLT	CLARIFICATION OF DETAIL

DESIGNED BY R D CALL
DRAWN BY C H STARZ
CHECKED BY M KABA
IN CHARGE J M YADLOSKY
DATE 14 OCT 1991

MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93) / Tunnel (I-90) Project
SECTION DESIGNER-D004A SUBMITTED: HDR / HAYDEN-WEGMAN
BECHTEL/ PARSONS BRINCKERHOFF MANAGEMENT CONSULTANTS
SUBMITTED FOR APPROVAL:

BOSTON MARINE INDUSTRIAL PARK TUNNEL
TYPICAL TUNNEL SECTIONS FOR DIMENSIONS
SHEET 1 OF 2

SCALE: NTS
CONTRACT NO. C04A2
DRAWING NO. C04A2-S-360
REV. 4

BOSTON
INTERSTATE I-90

F.H.W.A. REGION NO	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1991	352	881

SHEET 143 OF 204, STRUCTURAL

TABLE OF CONCRETE ELEVATIONS AND DIMENSIONS (FT)

LOCATION	ELEVATIONS								DIMENSIONS							
	ELEV. A	ELEV. B	ELEV. C	ELEV. D	ELEV. E	ELEV. F	ELEV. G	ELEV. H	A	B	C	D	E	F	G	H
STA 81+60 (AHD)	75.14	76.89	77.09	99.84	76.85	77.31	79.84	97.96	47.76	44.52	10.51	6.50	6.50	15.50	65.41	68.67
STA 81+70	75.04	76.78	76.99	99.74	76.74	77.20	79.70	97.82		44.51	10.51	6.50	6.50	15.49	64.61	
STA 81+80	74.94	76.68	76.88	99.63	76.64	77.09	79.56	97.68		44.51	10.51	6.50	6.50	15.49	63.98	
STA 81+88	74.86	76.60	76.80	99.55	76.55	77.01	79.45	97.57	47.76	44.50	10.51	6.51	6.50	15.50	63.53	66.78
STA 81+98	74.75	76.49	76.70	99.45	76.44	76.90	79.32	97.44		44.50	10.51	6.51	6.50	15.50	63.03	
STA 82+08	74.65	76.39	76.60	99.35	76.34	76.79	79.19	97.31		44.50	10.51	6.51	6.50	15.50	62.60	
STA 82+18	74.55	76.29	76.49	99.24	76.23	76.69	79.06	97.19		44.50	10.51	6.51	6.50	15.50	62.24	
STA 82+28	74.44	76.19	76.39	99.14	76.12	76.58	78.94	97.06		44.50	10.51	6.51	6.50	15.50	61.95	
STA 82+38	74.34	76.08	76.29	99.04	76.01	76.47	78.82	96.95	47.76	44.50	10.51	6.51	6.50	15.50	61.73	64.98
STA 82+48	74.24	75.98	76.18	98.93	75.91	76.36	78.71	96.83		44.50	10.51	6.51	6.50	15.50	61.59	
STA 82+58	74.14	75.88	76.08	98.83	75.80	76.26	78.60	96.72		44.50	10.51	6.51	6.50	15.50	61.51	
STA 82+68	74.03	75.77	75.98	98.73	75.69	76.15	78.49	96.61		44.50	10.51	6.51	6.50	15.50	61.50	
STA 82+78	73.93	75.67	75.88	98.63	75.59	76.04	78.38	96.51		44.50	10.51	6.51	6.50	15.50	61.49	
STA 82+88	73.83	75.57	75.77	98.52	75.48	75.94	78.27	96.40	47.76	44.51	10.51	6.51	6.50	15.50	61.49	64.74
STA 82+98	73.72	75.46	75.67	98.42	75.37	75.83	78.17	96.29		44.51	10.51	6.51	6.50	15.49	61.49	
STA 83+08	73.62	75.36	75.57	98.32	75.26	75.72	78.06	96.18		44.51	10.51	6.51	6.50	15.49	61.50	
STA 83+18	73.52	75.26	75.46	98.21	75.16	75.61	77.95	96.08		44.51	10.51	6.51	6.50	15.49	61.50	
STA 83+28	73.41	75.16	75.36	98.11	75.05	75.51	77.84	95.97		44.51	10.51	6.51	6.50	15.49	61.50	
STA 83+38	73.31	75.05	75.26	98.01	74.94	75.40	77.74	95.86	47.75	44.51	10.51	6.51	6.50	15.49	61.50	64.75
STA 83+38	73.31	75.05	75.26	98.01	74.94	75.40	77.74	100.36	47.75	44.51	10.51	6.51	6.50	15.49	61.50	64.75
STA 83+48	73.21	74.95	75.15	97.90	74.84	75.29	77.63	100.26		44.51	10.51	6.51	6.50	15.49	61.50	
STA 83+58	73.11	74.85	75.05	97.80	74.73	75.19	77.52	100.15		44.51	10.51	6.51	6.50	15.49	61.50	
STA 83+68	73.00	74.74	74.95	97.70	74.62	75.08	77.42	100.04		44.51	10.51	6.51	6.50	15.49	61.50	
STA 83+78	72.90	74.64	74.85	97.60	74.51	74.97	77.31	99.93		44.51	10.51	6.51	6.50	15.49	61.50	
STA 83+88	72.80	74.54	74.74	97.49	74.41	74.87	77.20	99.83	47.75	44.51	10.51	6.51	6.50	15.49	61.50	64.75
STA 83+98	72.69	74.43	74.64	97.39	74.30	74.76	77.09	99.72		44.51	10.51	6.51	6.50	15.49	61.50	
STA 84+08	72.59	74.33	74.54	97.29	74.19	74.65	76.99	99.61		44.51	10.51	6.51	6.50	15.49	61.50	
STA 84+18	72.49	74.23	74.43	97.18	74.09	74.54	76.88	99.51		44.51	10.51	6.51	6.50	15.49	61.49	
STA 84+28	72.39	74.13	74.33	97.08	73.98	74.44	76.77	99.40		44.51	10.51	6.51	6.50	15.49	61.49	
STA 84+38	72.28	74.02	74.23	96.98	73.87	74.33	76.67	99.29	47.76	44.51	10.51	6.51	6.50	15.49	61.49	64.74
STA 84+48	72.18	73.92	74.13	96.88	73.77	74.22	76.56	99.18		44.50	10.50	6.51	6.50	15.49	61.49	
STA 84+58	72.12	73.82	74.02	96.77	73.66	74.12	76.45	99.08		44.51	10.50	6.50	6.50	15.49	61.49	
STA 84+68	72.09	73.71	73.91	96.66	73.55	74.01	76.35	98.97		44.51	10.50	6.50	6.50	15.46	61.46	
STA 84+78	72.05	73.61	73.79	96.54	73.45	73.90	76.24	98.87		44.51	10.50	6.50	6.50	15.41	61.41	
STA 84+88	72.02	73.51	73.68	96.43	73.35	73.80	76.14	98.76	47.76	44.51	10.50	6.50	6.50	15.34	61.34	64.59
STA 84+98	71.98	73.40	73.57	96.32	73.24	73.69	76.03	98.66		44.50	10.50	6.50	6.50	15.24	61.24	
STA 85+08	71.89	73.30	73.47	96.22	73.14	73.58	75.92	98.55		44.50	10.50	6.50	6.50	15.13	61.13	
STA 85+18	71.79	73.20	73.36	96.11	73.06	73.47	75.75	98.37		44.50	10.50	6.50	6.50	14.99	60.99	
STA 85+28	71.69	73.09	73.26	96.01	72.97	73.37	75.57	98.19		44.50	10.50	6.50	6.50	14.87	60.82	
STA 85+38	71.58	72.99	73.16	95.91	72.88	73.26	75.38	98.01	47.76	44.50	10.50	6.50	6.50	14.74	60.62	63.87
STA 85+48	71.48	72.89	73.05	95.80	72.79	73.15	75.20	97.82		44.50	10.50	6.50	6.50	14.61	60.39	
STA 85+58	71.38	72.79	72.95	95.70	72.71	73.05	75.01	97.64		44.50	10.50	6.50	6.50	14.47	60.14	
STA 85+68	71.27	72.68	72.85	95.60	72.62	72.94	74.83	97.45		44.50	10.50	6.50	6.50	14.34	59.85	
STA 85+78	71.17	72.58	72.74	95.49	72.51	72.83	74.71	97.34		44.50	10.50	6.50	6.50	14.21	59.53	
STA 85+88	71.07	72.48	72.64	95.39	72.41	72.73	74.60	97.22	47.76	44.50	10.50	6.50	6.50	14.08	59.17	62.43
STA 85+98	70.96	72.37	72.54	95.29	72.31	72.62	74.48	97.10		44.50	10.50	6.50	6.50	13.95	58.79	
STA 86+08	70.86	72.27	72.43	95.18	72.21	72.51	74.36	96.99		44.50	10.50	6.50	6.50	13.82	58.38	

SEE NOTE 4

4B FOR DETAILS ON VERTICAL CONSTRUCTION JOINTS, SEE RFI NO. 388.

4B FOR INFORMATION SEE RFI NO. 327.

TABLE OF CONSTRUCTION JOINTS & CONCRETE DIMENSIONS

1, J, K, L ARE MEASURED RADIALLY FROM CONSTRUCTION BASELINE. FOR ADD'L INFO. SEE RFI NO. 286. 4B

CONST JOINT STATIONS	I	J	K	L
STA 81+60 TO STA 81+88	7'-5"	6'-0"	7'-0"	7'-5"
STA 81+88 TO STA 82+38	4'-0"	6'-0"	7'-0"	5'-0"
STA 82+38 TO STA 82+88	4'-0"	6'-0"	7'-0"	5'-0"
STA 82+88 TO STA 83+38	4'-0"	6'-0"	7'-0"	5'-0"
STA 83+38 TO STA 83+88	4'-0"	5'-6"	6'-6"	5'-0"
STA 83+88 TO STA 84+38	4'-0"	5'-6"	6'-6"	5'-0"
STA 84+38 TO STA 84+88	4'-0"	5'-6"	6'-6"	5'-0"
STA 84+88 TO STA 85+38	4'-0"	5'-6"	6'-6"	5'-0"
STA 85+38 TO STA 85+88	4'-0"	5'-6"	6'-6"	5'-0"
STA 85+88 TO STA 86+38	4'-0"	5'-6"	6'-6"	5'-0"
STA 86+38 TO STA 86+88	4'-0"	5'-6'	6'-6"	5'-0"
STA 86+88 TO STA 87+38	4'-0"	8'-0"*	6'-6"	5'-0"
STA 87+38 TO STA 87+88	4'-0"	5'-6"	6'-6"	5'-0"
STA 87+88 TO STA 88+38	4'-0"	5'-6"	5'-6"	4'-0"
STA 88+38 TO STA 88+88	4'-0"	5'-6"	5'-6"	4'-0"
STA 88+88 TO STA 89+38	4'-0"	5'-6"	5'-6"	4'-0"
STA 89+38 TO STA 89+88	4'-0"	12'-3"•	11'-6"	4'-0"
STA 89+88 TO STA 90+38	4'-0"	5'-6"	5'-6"	4'-0"
STA 90+38 TO STA 90+88	4'-0"	5'-6"	5'-6"	4'-0"
STA 90+88 TO STA 91+38	4'-0"	5'-6"	5'-6"	4'-0"
STA 91+38 TO STA 91+88	4'-0"	5'-6"	5'-6"	4'-0"
STA 91+88 TO STA 92+38	4'-0"	5'-6"+	5'-6"	4'-0"
STA 92+38 TO STA 92+88	4'-0"	5'-6"+	5'-6"	4'-0"
STA 92+88 TO STA 93+38	4'-0"	5'-6"+	5'-6"	4'-0"
STA 93+38 TO STA 93+88	5'-0"	5'-6"	5'-6"+	5'-0"

* INDICATES MIN 5'-6" ROOF SLAB THICKNESS STA 91+99 TO STA 93+88 WHEN NO STEP IS REQUIRED IN ROOF SLAB.

• INDICATES MIN ROOF SLAB THICKNESS STA 89+65 TO STA 89+88 FOR LEVEL ROOF SLAB. FROM STA 89+38 TO STA 89+65 THICKNESS VARIES. SEE DWG S-354.

* INDICATES MINIMUM ROOF SLAB THICKNESS STA 86+88 TO STA 87+38 FOR LEVEL ROOF SLAB. THICKNESS GREATER AT HAUNCH FOR SANITARY SEWER LINE. SEE DWG S-354A.

4B FOR ADDITIONAL INFORMATION SEE RFI NO'S. 061, 086, 095, 223, 286, 327 AND 388.

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

NOTES:

1. FOR ELEVATION AND DIMENSION LOCATIONS SEE DWG S-308 AND S-360.
2. FOR CONSTRUCTION JOINT LAYOUT SEE DWG S-312.
3. ALL STATIONS ARE ON I-90 CONSTRUCTION ℄.
4. GEOMETRY GIVEN FOR STATION 81+60 IS ALONG THE CONSTRUCTION JOINT LOCATED PARALLEL TO THE PORTAL REFERENCE LINE AT STA 81+35, SEE DWG S-304.

RECORD DRAWING

STRUCTURE NO B-16-549

REV	DATE	BY	SUB	APP	DESCRIPTION
4B	09SEP98	TYC		KSS	NOTES ADDED
3	3JUNE94	MJG	MAB	JMY	UTILITY MODIFICATION
2	09MAR93	JMH	RAB	JMY	PORTAL REDESIGN
1	27JAN92	KAS	MK	DLT	CORRECTIONS
5	09SEP98	TYC		KSS	INCORPORATED FIELD CONDITIONS

DESIGNED BY R. D. CALL
DRAWN BY D. M. YOUNG
CHECKED BY M. KABA
IN CHARGE J. M. YADLOSKY
DATE 14 OCT 1991

MASSACHUSETTS HIGHWAY DEPARTMENT

Central Artery (I-93)/Tunnel (I-90) Project

SECTION DESIGNER -0004A HDR / HAYDEN-WEGMAN
SUBMITTED:

BECHTEL/ PARSONS BRINCKERHOFF
MANAGEMENT CONSULTANTS
SUBMITTED FOR APPROVAL: C.M. Wiley

BOSTON MARINE INDUSTRIAL PARK TUNNEL
TABLE OF TUNNEL DIMENSIONS AND ELEVATIONS
SHEET 1 OF 3

SCALE: NTS
CONTRACT NO. C04A2
DRAWING NO. C04A2-S-310
REV. 5

TABLE OF CONCRETE ELEVATIONS AND DIMENSIONS (FT)

LOCATION	ELEVATIONS								FOR INFORMATION, SEE RFI NO. 061 DIMENSIONS							
	ELEV. A	ELEV. B	ELEV. C	ELEV. D	ELEV. E	ELEV. F	ELEV. G	ELEV. H	A	B	C	D	E	F	G	H
STA 86+18	70.76	72.17	72.33	95.08	72.11	72.41	74.24	96.87		44.50	10.50	6.50	6.50	13.69	57.94	
STA 86+28	70.66	72.06	72.23	94.98	72.01	72.30	74.12	96.75		44.50	10.50	6.50	6.50	13.55	57.46	
STA 86+38	70.55	71.96	72.13	94.88	71.91	72.19	74.00	96.62	47.76	44.50	10.50	6.50	6.50	13.42	56.96	60.21
STA 86+48	70.45	71.86	72.02	94.77	71.81	72.09	73.87	96.50		44.50	10.50	6.50	6.50	13.29	56.42	
STA 86+58	70.35	71.75	71.92	94.67	71.71	71.98	73.75	96.38		44.50	10.50	6.50	6.50	13.15	55.85	
STA 86+68	70.24	71.65	71.82	94.57	71.60	71.87	73.62	96.25		44.50	10.50	6.50	6.50	13.02	55.26	
STA 86+78	70.14	71.55	71.71	94.46	71.50	71.77	73.50	96.12		44.50	10.50	6.50	6.50	12.89	54.63	
STA 86+88	70.04	71.44	71.61	94.36	71.40	71.66	73.37	95.99	47.75	44.50	10.50	6.50	6.50	12.75	53.96	57.22
STA 86+98	69.93	71.34	71.51	94.26	71.30	71.55	73.24	95.86		44.50	10.50	6.50	6.50	12.62	53.27	
STA 87+08	69.83	71.24	71.40	94.15	71.20	71.45	73.11	95.73		44.50	10.50	6.50	6.50	12.48	52.55	
STA 87+18	69.73	71.13	71.30	94.05	71.10	71.34	72.98	95.60		44.50	10.50	6.50	6.50	12.35	51.80	
STA 87+28	69.62	71.03	71.20	93.95	71.00	71.24	72.84	95.47		44.50	10.50	6.50	6.50	12.21	51.02	
STA 87+38	69.52	70.93	71.09	93.84	70.90	71.13	72.71	95.34	47.75	44.50	10.50	6.50	6.50	12.08	50.25	53.51
STA 87+48	69.42	70.82	70.99	93.74	70.80	71.02	72.58	95.20		44.50	10.50	6.50	6.50	11.94	49.51	
STA 87+58	69.31	70.72	70.89	93.64	70.70	70.92	72.45	95.07		44.51	10.50	6.50	6.50	11.81	48.79	
STA 87+68	69.21	70.62	70.78	93.53	70.59	70.81	72.32	94.94		44.51	10.50	6.50	6.50	11.67	48.10	
STA 87+78	69.11	70.52	70.68	93.43	70.49	70.70	72.19	94.81		44.51	10.50	6.50	6.50	11.53	47.44	
STA 87+88	69.00	70.41	70.58	93.33	70.39	70.60	72.06	94.69	47.75	44.51	10.50	6.50	6.50	11.40	46.80	50.06
STA 87+98	68.90	70.31	70.47	93.22	70.29	70.49	71.90	94.52		44.51	10.50	6.50	6.50	11.26	46.19	
STA 88+08	68.82	70.21	70.37	93.12	70.20	70.38	71.72	94.34		44.50	10.50	6.50	6.50	11.13	45.61	
STA 88+18	68.78	70.10	70.26	93.01	70.10	70.28	71.54	94.16		44.49	10.49	6.50	6.50	11.01	45.05	
STA 88+28	68.74	70.00	70.15	92.90	70.01	70.17	71.36	93.99		44.46	10.46	6.50	6.50	10.91	44.52	
STA 88+38	68.71	69.90	70.03	92.78	69.91	70.06	71.19	93.81	47.67	44.42	10.42	6.50	6.50	10.83	44.01	47.27
STA 88+48	68.67	69.79	69.92	92.67	69.82	69.96	71.01	93.64		44.36	10.36	6.50	6.50	10.75	43.54	
STA 88+58	68.61	69.69	69.81	92.56	69.72	69.85	70.88	93.51		44.29	10.29	6.50	6.50	10.70	43.09	
STA 88+68	68.50	69.59	69.70	92.45	69.61	69.74	70.77	93.39		44.22	10.21	6.50	6.50	10.64	42.65	
STA 88+78	68.40	69.48	69.60	92.35	69.51	69.64	70.65	93.27		44.14	10.14	6.50	6.50	10.59	42.22	
STA 88+88	68.30	69.38	69.49	92.24	69.40	69.53	70.53	93.16	47.32	44.07	10.06	6.50	6.50	10.54	41.81	45.06
STA 88+98	68.19	69.28	69.39	92.14	69.30	69.42	70.41	93.04		43.99	9.99	6.50	6.50	10.48	41.41	
STA 89+08	68.09	69.17	69.28	92.03	69.19	69.32	70.30	92.92		43.92	9.91	6.50	6.50	10.43	41.02	
STA 89+18	67.99	69.07	69.18	91.93	69.09	69.21	70.18	92.80		43.84	9.84	6.50	6.50	10.37	40.63	
STA 89+28	67.88	68.97	69.07	91.82	68.98	69.11	70.06	92.69		43.77	9.76	6.50	6.50	10.32	40.26	
STA 89+38	67.78	68.86	68.96	91.71	68.88	69.00	69.95	92.57	46.94	43.69	9.69	6.50	6.50	10.27	39.91	43.16
STA 89+48	67.68	68.76	68.86	91.61	68.77	68.89	69.83	92.46		43.62	9.61	6.50	6.50	10.22	39.56	
STA 89+58	67.57	68.66	68.75	91.50	68.67	68.78	69.71	92.34		43.54	9.54	6.50	6.50	10.16	39.22	
STA 89+68	67.47	68.55	68.65	91.40	68.55	68.67	69.59	92.21		43.46	9.46	6.50	6.50	10.11	38.90	
STA 89+78	67.36	68.44	68.54	91.29	68.43	68.54	69.45	92.08		43.39	9.38	6.50	6.50	10.06	38.58	
STA 89+88	67.24	68.33	68.42	91.17	68.29	68.40	69.31	91.93	46.56	43.31	9.31	6.50	6.50	10.01	38.28	41.53
STA 89+98	67.12	68.20	68.29	91.04	68.15	68.26	69.16	91.78		43.24	9.23	6.50	6.50	9.95	37.98	
STA 90+08	66.98	68.07	68.15	90.90	68.00	68.11	68.99	91.62		43.16	9.16	6.50	6.50	9.90	37.70	
STA 90+18	66.84	67.92	68.00	90.75	67.83	67.94	68.82	91.45		43.08	9.08	6.50	6.50	9.85	37.43	
STA 90+28	66.69	67.77	67.85	90.60	67.66	67.77	68.64	91.27		43.01	9.01	6.50	6.50	9.80	37.17	
STA 90+38	66.52	67.61	67.68	90.43	67.48	67.59	68.46	91.08	46.18	42.93	8.93	6.50	6.50	9.75	36.92	40.17
STA 90+38	66.52	67.61	67.68	90.43	67.49	67.59	68.46	91.08	46.18	42.93	8.93	6.50	6.50	9.75	36.92	40.17
STA 90+48	66.35	67.43	67.51	90.26	67.30	67.40	68.26	90.88		42.86	8.85	6.50	6.50	9.70	36.68	
STA 90+58	66.17	67.25	67.33	90.08	67.10	67.20	68.06	90.68		42.78	8.78	6.50	6.50	9.65	36.46	
STA 90+68	65.98	67.06	67.13	89.88	66.89	66.99	67.84	90.46		42.70	8.70	6.50	6.50	9.59	36.24	

FOR ADDITIONAL INFORMATION, SEE PCN NO. 97. (3B)

BOSTON
INTERSTATE I-90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1991	353	881

SHEET 144 OF 204, STRUCTURAL

NOTES:
SEE NOTES ON DWG S-310

FOR INFORMATION, SEE RFI NO. 061.

CHANGE FROM 3" TO 1 1/2" WEARING COURSE FROM STA. 90+38 TO STA. 93+88, EASTBOUND LANES. REPLACE VALUES ON DWG NO'S S-311 AND S-312. FOR ADDITIONAL INFORMATION, SEE PCN NO. 097 AND LETTER C04A2-1099.

(3B)

NOTES:
SEE NOTES ON DWG S-310

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

RECORD DRAWING

STRUCTURE NO B-16-549

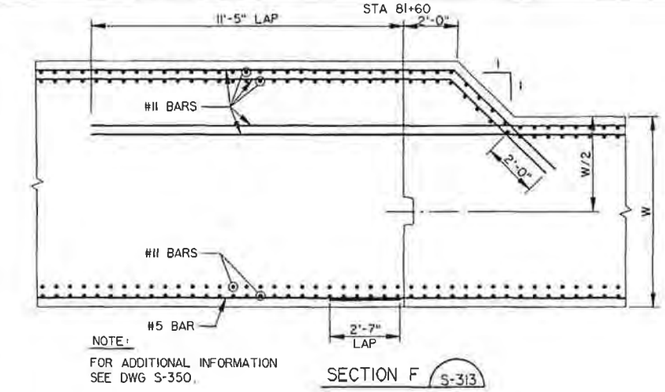
REV	DATE	BY	SUB	APP	DESCRIPTION
4 (3B)	23 JUN98	CMG		KSS	INCORPORATED FIELD CONDITIONS
3 (3B)	23 JUN98	CMG		KSS	TABLE REVISED, NOTES ADDED
2	01MAR93	JMH	RAE	JMY	PORTAL REDESIGN
1	27JAN92	KAS	MK	DLT	CORRECTIONS

DESIGNED BY R D CALL
DRAWN BY D M YOUNG
CHECKED BY M KABA
IN CHARGE J M YADLOSKY
DATE 14 OCT 1991

MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93)/Tunnel (I-90) Project
SECTION DESIGNER-D004A SUBMITTED:
HDR / HAYDEN-WEGMAN
BECHTEL/ PARSONS BRINCKERHOFF MANAGEMENT CONSULTANTS
SUBMITTED FOR APPROVAL:

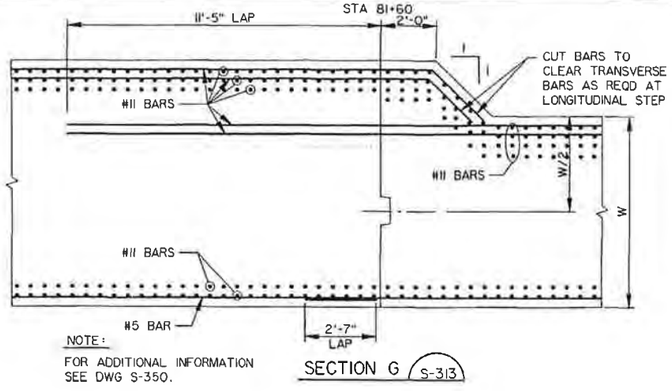
BOSTON MARINE INDUSTRIAL PARK TUNNEL
TABLE OF TUNNEL DIMENSIONS AND ELEVATIONS
SHEET 2 OF 3

SCALE: NTS
CONTRACT NO. C04A2
DRAWING NO. C04A2-S-311
REV. 4



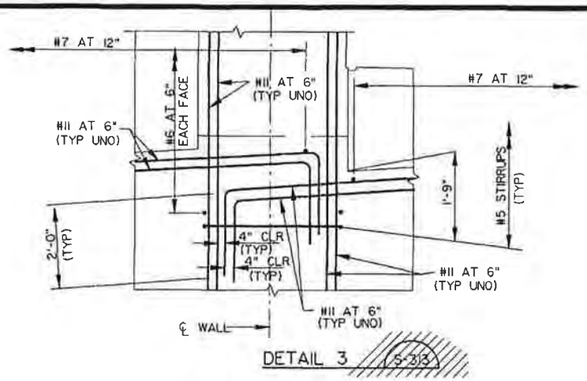
NOTE:
FOR ADDITIONAL INFORMATION SEE DWG S-350.

SECTION F (S-313)



NOTE:
FOR ADDITIONAL INFORMATION SEE DWG S-350.

SECTION G (S-313)

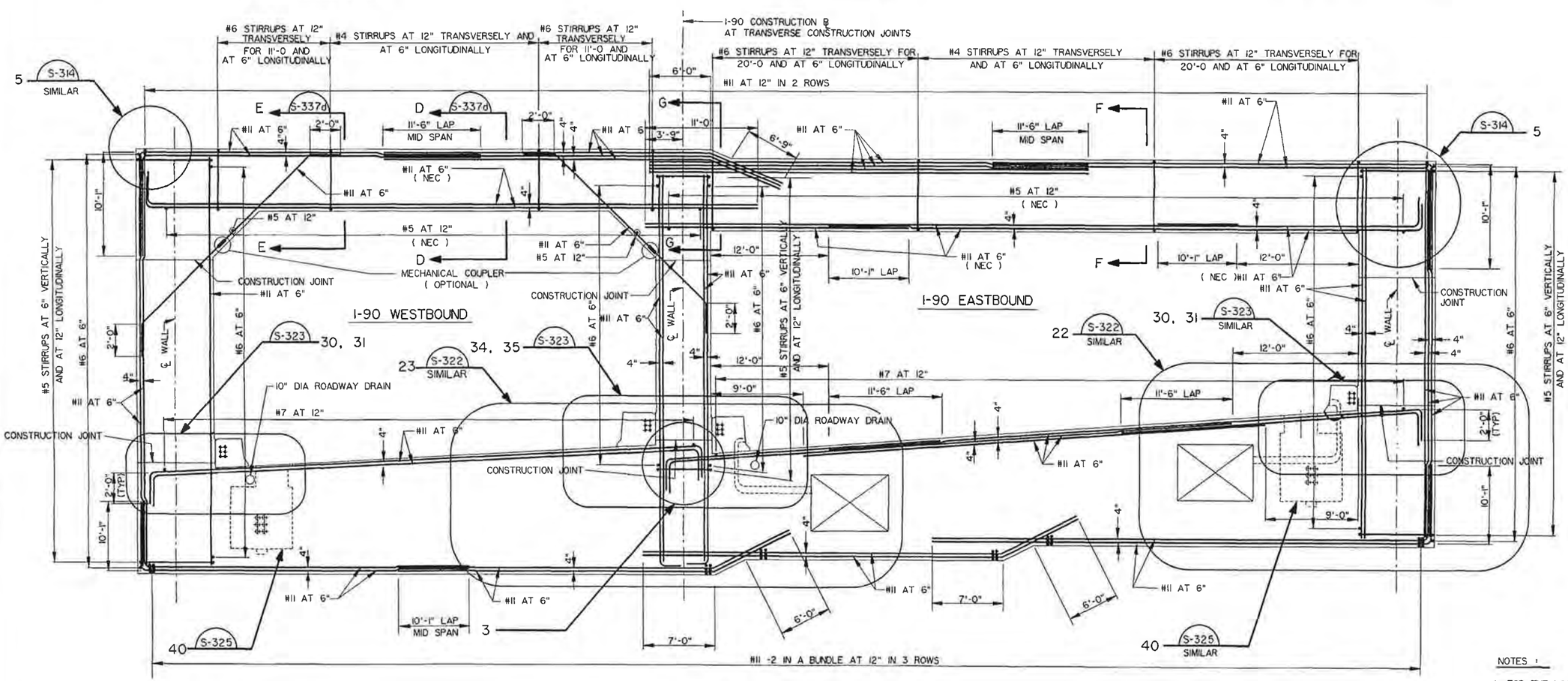


DETAIL 3 (S-313)

BOSTON INTERSTATE I-90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1991	368a	881

SHEET 159a OF 204, STRUCTURAL



EAST TUNNEL SECTION
STA 81+60 TO STA 81+88 I-90 CONST ℄

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

RECORD DRAWING

NOTES :
1. FOR THE LOCATION OF TWO EMH SEE DWG S-304.
2. FOR ADDITIONAL NOTES SEE DWG S-314.

REV	DATE	BY	SUB	APP	DESCRIPTION
3	29JUN98	CMG		KSS	INCORPORATED FIELD CONDITIONS
2	01MAR93	ATC	RAE	JMY	PORTAL AND SIDEWALK REDESIGN
1	27JAN92	CHS	SSM	DLT	CLARIFICATION OF DETAILS

DESIGNED BY R D CALL
DRAWN BY K A STIFFEY
CHECKED BY S S MORCOS
IN CHARGE J M YADLOSKY
DATE 14 OCT 1991

MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93)/Tunnel (I-90) Project
SECTION DESIGNER-D004A SUBMITTED: DR / HAYDEN-WEGMAN
BECHTEL/ PARSONS BRINCKERHOFF MANAGEMENT CONSULTANTS
SUBMITTED FOR APPROVAL:

STRUCTURE NO B-16-549

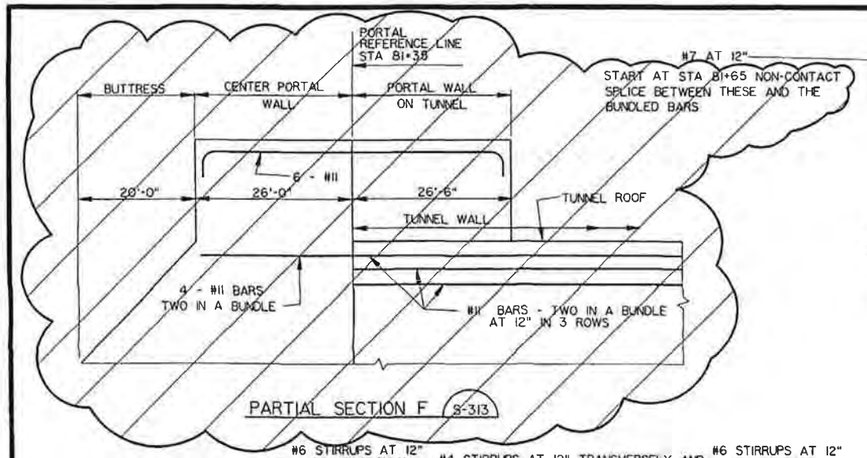
BOSTON MARINE INDUSTRIAL PARK TUNNEL
TUNNEL SECTIONS AND DETAILS
SHEET 15 OF 15

SCALE: NTS
CONTRACT NO. C04A2
DRAWING NO. C04A2-S-361
REV. 3

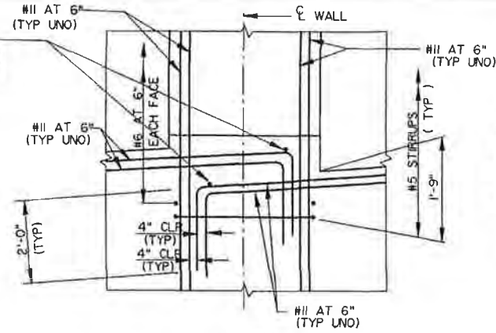
BOSTON INTERSTATE I-90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(1053)	1991	356	881

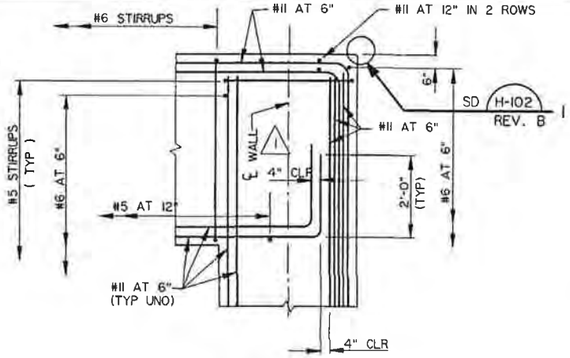
SHEET 147 OF 204, STRUCTURAL



PARTIAL SECTION F (S-313)



DETAIL 4 (S-316) THRU S-321

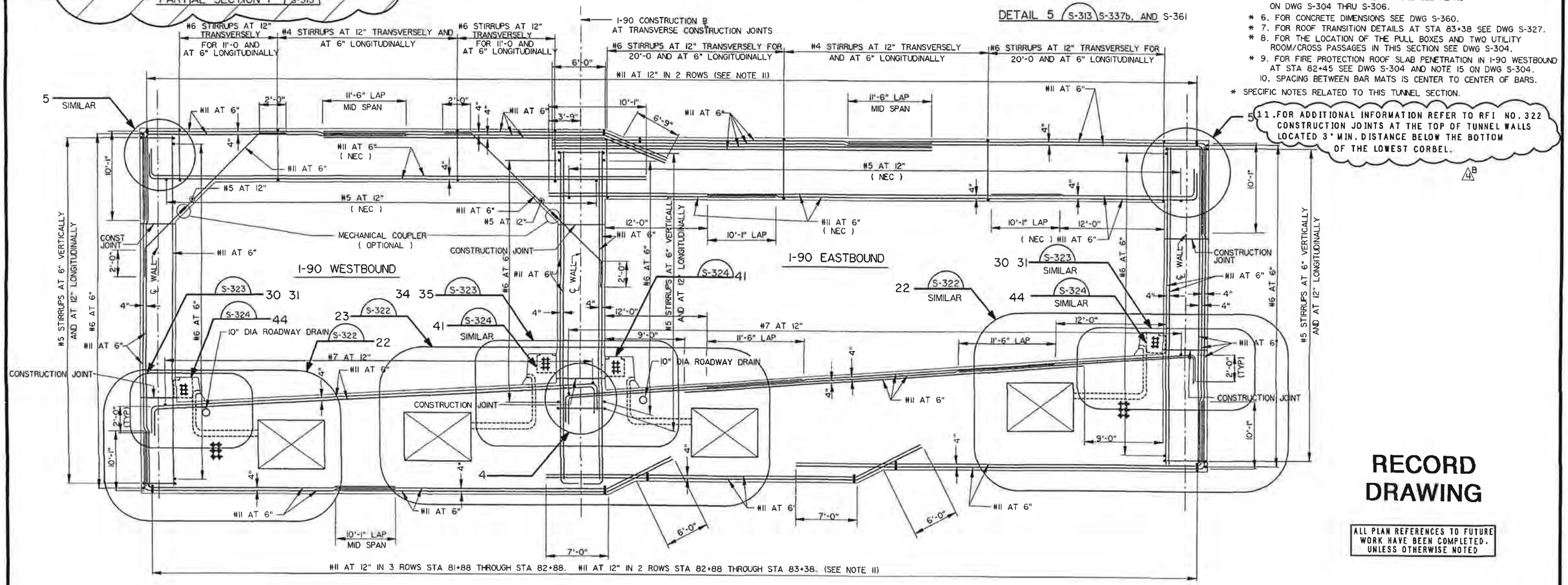


DETAIL 5 (S-313) (S-337b, AND S-361)

NOTES :

1. FOR CONSTRUCTION JOINT DETAILS, SEE DWG S-350.
2. ALL BARS ARE EPOXY COATED UNLESS OTHERWISE NOTED.
3. (NEC) DESIGNATES NOT EPOXY COATED.
4. FOR STIRRUP DETAILS AND CLEAR CONCRETE COVER SEE DWG S-321.
5. FOR SUPPLY AIR FLUE LOCATIONS SEE PLANS ON DWG S-304 THRU S-306.
* 6. FOR CONCRETE DIMENSIONS SEE DWG S-360.
* 7. FOR ROOF TRANSITION DETAILS AT STA 83+38 SEE DWG S-327.
* 8. FOR THE LOCATION OF THE PULL BOXES AND TWO UTILITY ROOM/CROSS PASSAGES IN THIS SECTION SEE DWG S-304.
* 9. FOR FIRE PROTECTION ROOF SLAB PENETRATION IN I-90 WESTBOUND AT STA 82+45 SEE DWG S-304 AND NOTE 15 ON DWG S-304.
10. SPACING BETWEEN BAR MATS IS CENTER TO CENTER OF BARS.

* SPECIFIC NOTES RELATED TO THIS TUNNEL SECTION.



EAST TUNNEL SECTION
STA 81+88 TO STA 83+38 I-90 CONST ℄

11. FOR LONGITUDINAL REINFORCING LAYOUT SEE DWG S-289a.

11. FOR ADDITIONAL INFORMATION REFER TO RFI NO. 322 CONSTRUCTION JOINTS AT THE TOP OF TUNNEL WALLS LOCATED 3" MIN. DISTANCE BELOW THE BOTTOM OF THE LOWEST CORBEL. (B)

RECORD DRAWING

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED. UNLESS OTHERWISE NOTED

REV	DATE	BY	SUB	APP	DESCRIPTION
4 (B) (C)	24JUN98	EID		KSS	NOTE ADDED
3	01MAR93	DAE	DDF	JMY	PORTAL AND SIDEWALK REDESIGN
2	16NOV92	TRH	RDC	JMY	WEST TUNNEL REDESIGN
1	27JAN92	CHS	SSM	DLT	CLARIFICATION OF DETAILS
5	24JUN98	EID		KSS	INCORPORATED FIELD CONDITIONS

DESIGNED BY R R DICKEY
DRAWN BY C H STARZ
CHECKED BY S S MORCOS
IN CHARGE J M YADLOSKY
DATE 14 OCT 1991

MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93)/Tunnel (I-90) Project
SECTION DESIGNER-D004A HDR / HAYDEN-WEGMAN SUBMITTED:
BECHTEL/ PARSONS BRINCKERHOFF MANAGEMENT CONSULTANTS SUBMITTED FOR APPROVAL:

STRUCTURE NO B-16-549

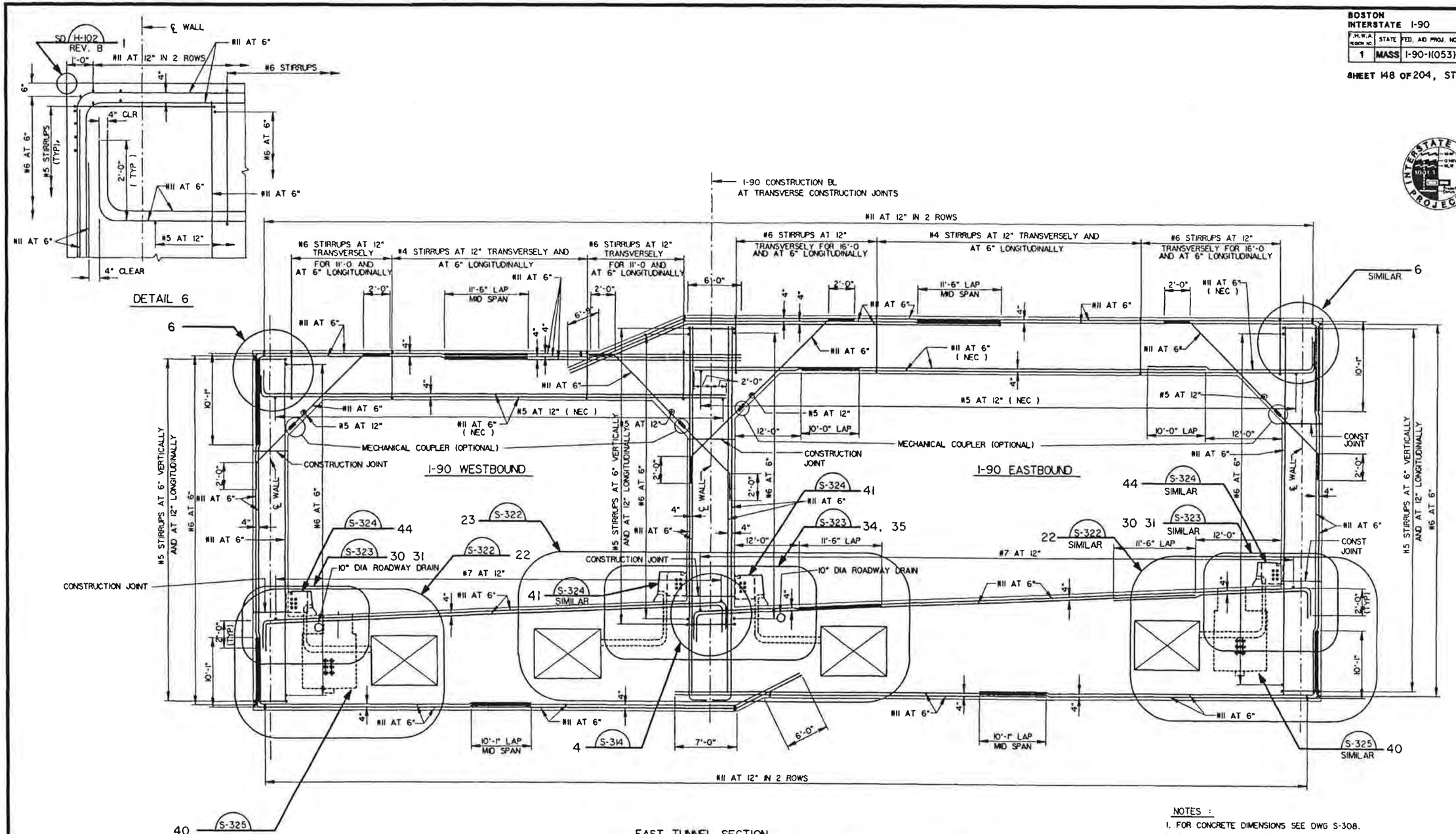
BOSTON MARINE INDUSTRIAL PARK TUNNEL
TUNNEL SECTIONS AND DETAILS
SHEET 2 OF 15

SCALE: NTS
CONTRACT NO. C04A2
DRAWING NO. C04A2-S-314
REV. 5

BOSTON
INTERSTATE I-90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1991	357	881

SHEET 148 OF 204, STRUCTURAL



EAST TUNNEL SECTION

STA 83+38 TO STA 87+88 I-90 CONST ℄
FOR ROOF SLAB REINFORCING AT PIPE LOCATION,
STA 86+88 TO STA 87+38 SEE DWG S-354A

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

RECORD DRAWING

NOTES :

1. FOR CONCRETE DIMENSIONS SEE DWG S-308.
2. FOR ROOF TRANSITION DETAILS AT STA 83+38 SEE DWG S-327.
3. FOR TWO EMH THIS SECTION SEE DWG S-305.
4. FOR THE LOCATION OF THE PULL BOXES AND THREE UTILITY ROOM/CROSS PASSAGES IN THIS SECTION SEE DWG S-304 AND S-305.
5. FOR ADDITIONAL NOTES SEE DWG S-314.
6. FOR INFORMATION, SEE RFI NO. 322.

STRUCTURE NO B-16-549

REV	DATE	BY	SUB	APP	DESCRIPTION
5	25AUG98	CMG		KSS	INCORPORATED FIELD CONDITIONS
4	25AUG98	CMG		KSS	NOTE ADDED
3	3JUNE94	MJG	MAB	JMY	UTILITY MODIFICATIONS
2	01MAR93	ATC	DOF	JMY	SIDEWALK REDESIGN
1	27JAN92	CHG	SSM	DLT	CLARIFICATION OF DETAILS

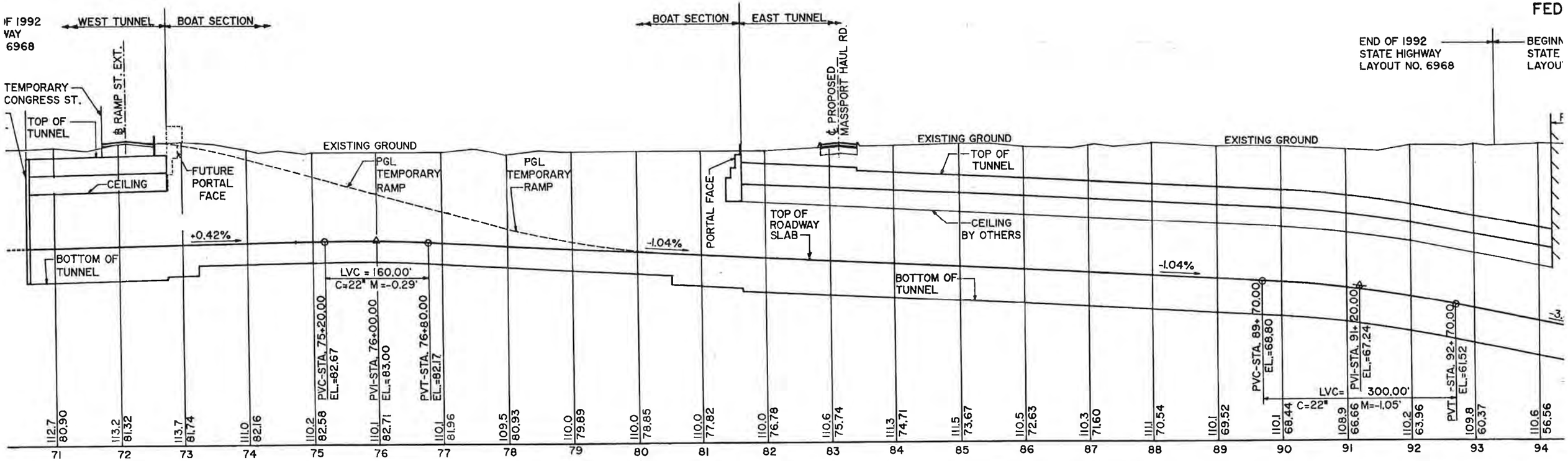
DESIGNED BY R. R. DICKEY
DRAWN BY C. H. STARZ
CHECKED BY S. S. MORCOS
IN CHARGE J. M. YADLOSKY
DATE 14 OCT 1991

MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93) / Tunnel (I-90) Project
SECTION DESIGNER-0004A
SUBMITTED: FOR / HAYDEN-WEGMAN

BECHTEL/ PARSONS BRINCKERHOFF
MANAGEMENT CONSULTANTS
SUBMITTED FOR APPROVAL: C.M. Wiley

BOSTON MARINE INDUSTRIAL PARK TUNNEL
TUNNEL SECTIONS AND DETAILS
SHEET 3 OF 15

SCALE: NTS
CONTRACT NO. C04A2
DRAWING NO. C04A2-S-316
REV. 5



SCALE: 1"= 100'- 0" HORIZONTAL

100 50 0 100 200 300 400 FEET

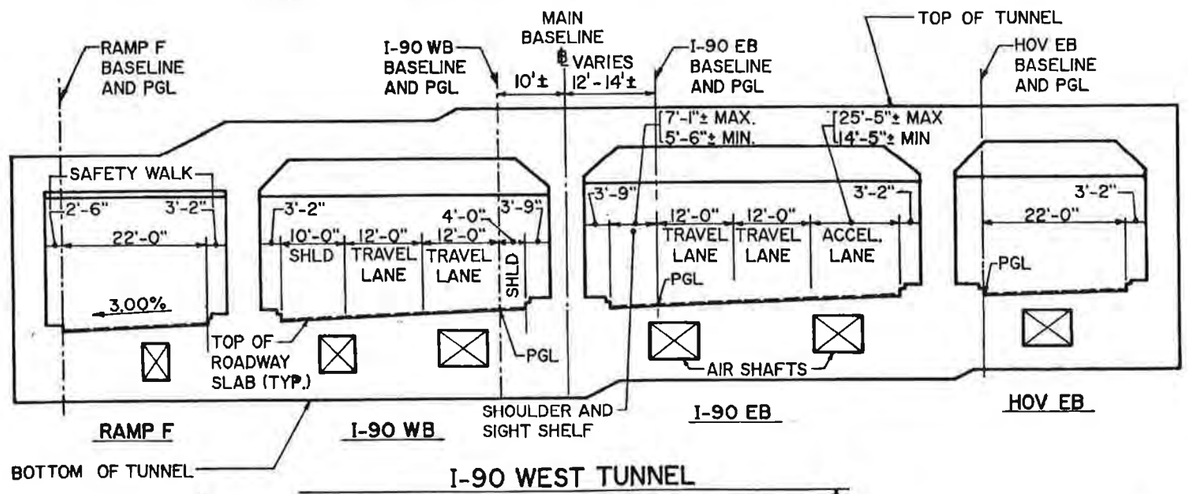
20 10 0 20 40 60 80

SCALE: 1"= 20'- 0" VERTICAL

PROFILE-WESTBOUND ROADWAY

SCALE: 1" = 100'- 0" HORIZONTAL

SCALE: 1" = 20'- 0" VERTICAL



I-90 WEST TUNNEL

STA. 70+50± TO STA. 72+40± I-90 CONST ℄

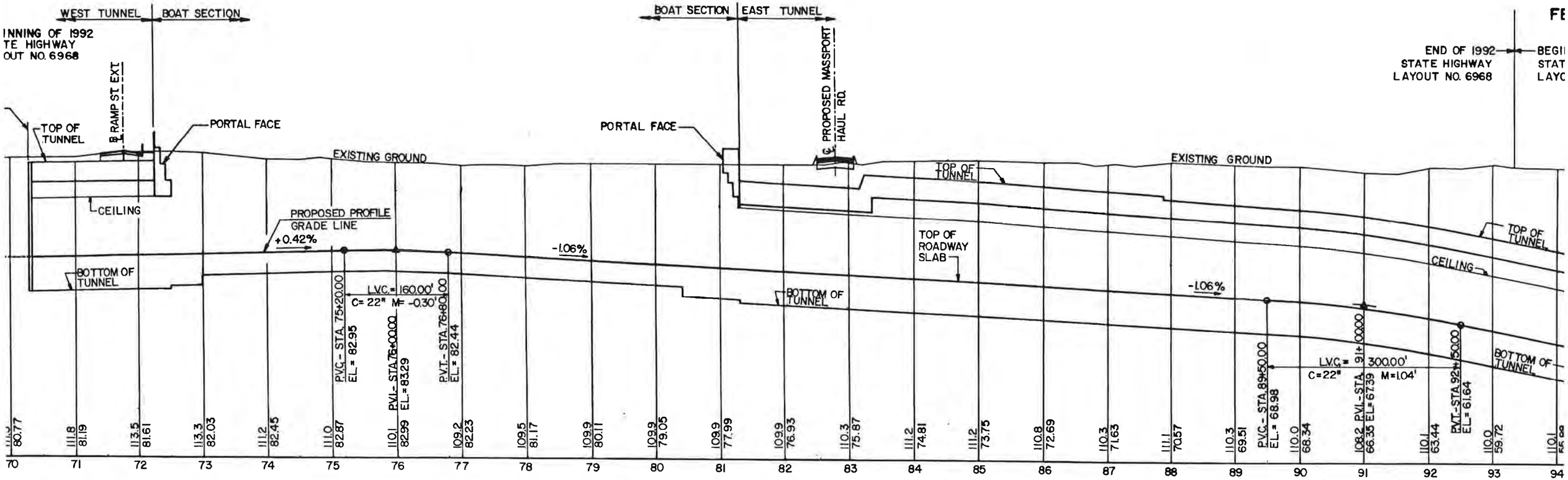
(LOOKING UPSTATION)

SCALE: 1" = 16' - 0"

NOTES:

1. PROJECT VERTICAL DA THE NATIONAL GEODE (N.G.V.D. OF 1929 ELEV
2. THE VERTICAL BENCH FOR THESE PROFILES (a). ARTERY 68 : PR IN S GEO SET SOU OF I

   (b). FARGO : PR IN S PLU BET THE DEP (49



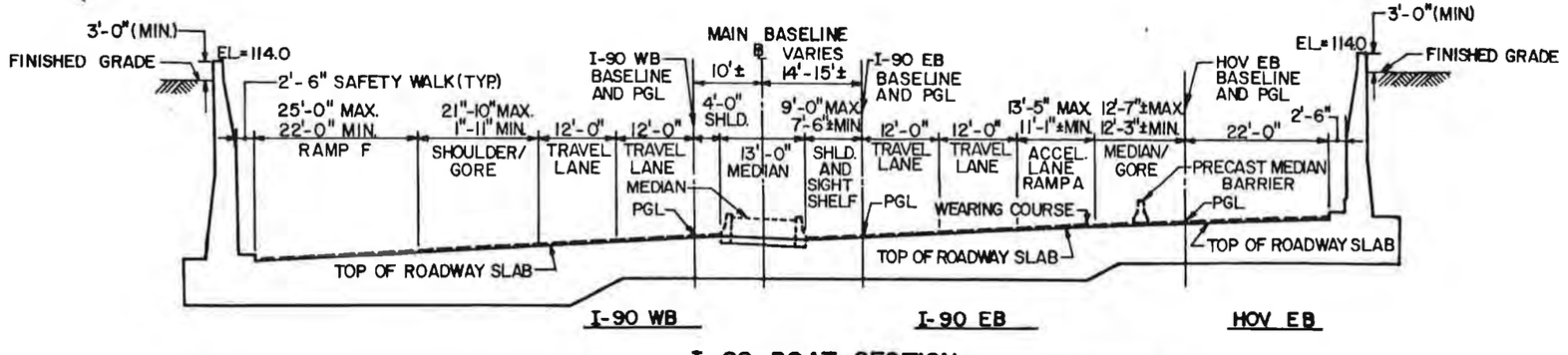
0'- 0" HORIZONTAL

200 300 400 FEET
40 60 80

0'- 0" VERTICAL

PROFILE - EASTBOUND ROADWAY

SCALE: 1" = 100'- 0" HORIZONTAL
SCALE: 1" = 20'- 0" VERTICAL

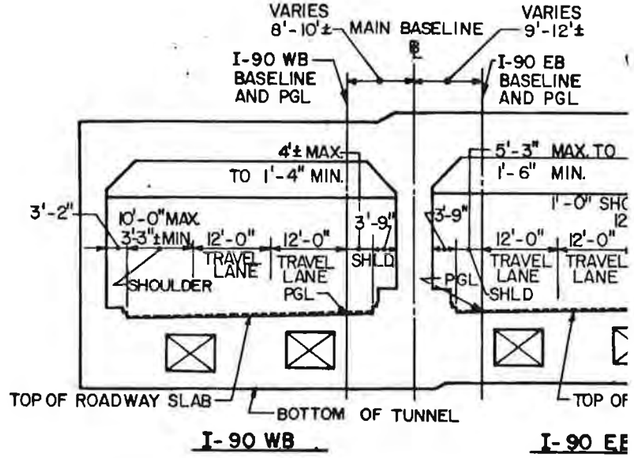


I-90 BOAT SECTION

STA. 72+90± TO STA. 76+00± I-90 CONST. ℄

(LOOKING UPSTATION)

SCALE: 1" = 16' - 0"



I-90 EAST TUNNEL

STA. 87+60± TO STA. 94+20± I-90 CONS

(LOOKING UPSTATION)

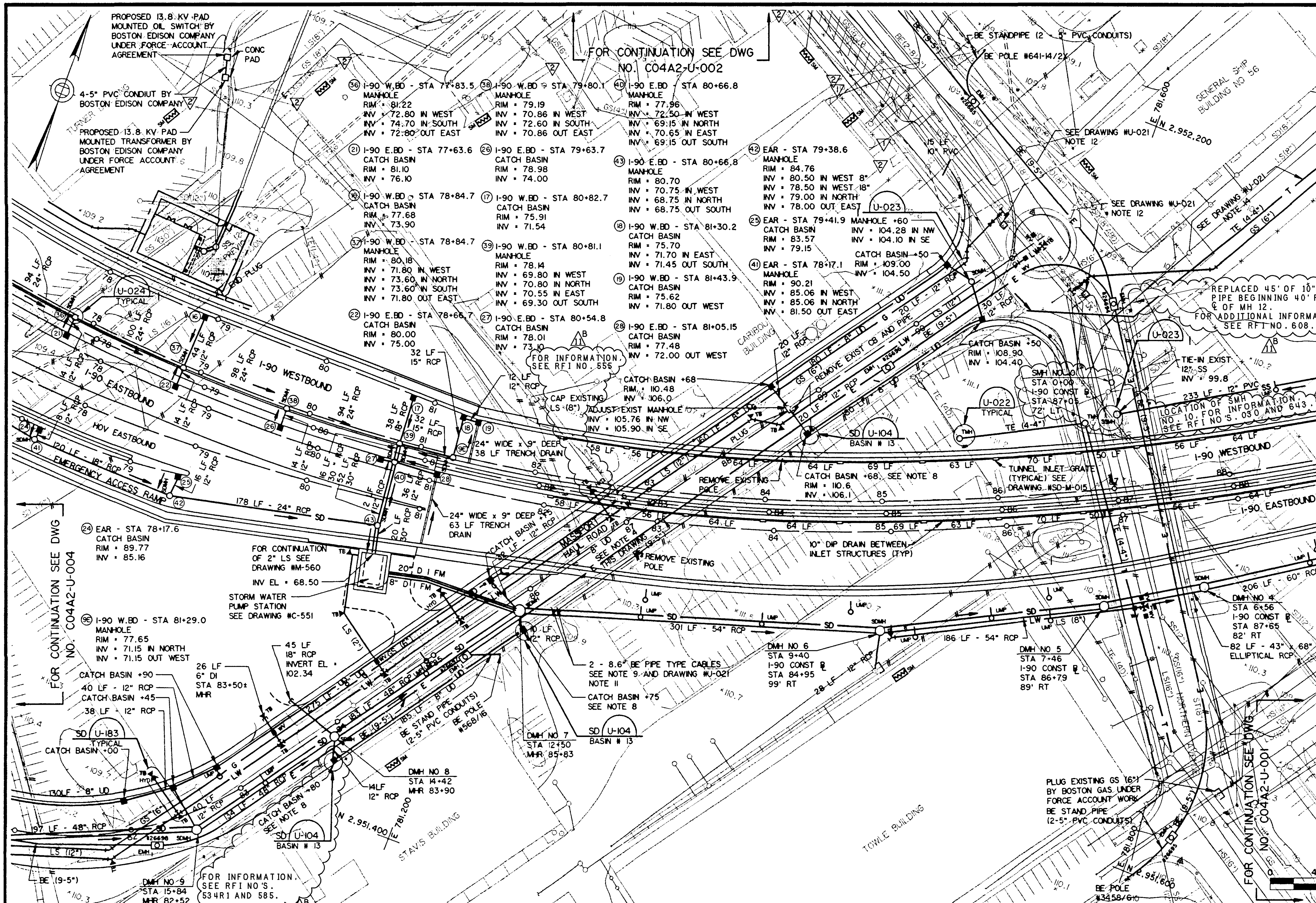
SCALE: 1" = 16' - 0"

BOSTON
INTERSTATE I-90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1991	155	881

SHEET 3 OF 15 , UTILITY

All elevations on this plan are based on the Central Artery Datum. To convert elevation data to Boston City Base, subtract 94.35.



PROPOSED 13.8 KV PAD MOUNTED OIL SWITCH BY BOSTON EDISON COMPANY UNDER FORCE ACCOUNT AGREEMENT
CONC PAD
4-5" PVC CONDUIT BY BOSTON EDISON COMPANY
PROPOSED 13.8 KV PAD MOUNTED TRANSFORMER BY BOSTON EDISON COMPANY UNDER FORCE ACCOUNT AGREEMENT
FOR CONTINUATION SEE DWG NO. C04A2-U-002
36 I-90 W.BD - STA 77+83.5 MANHOLE RIM = 81.22 INV = 72.80 IN WEST INV = 74.70 IN SOUTH INV = 72.80 OUT EAST
38 I-90 W.BD - STA 79+80.1 MANHOLE RIM = 79.19 INV = 70.86 IN WEST INV = 72.60 IN SOUTH INV = 70.86 OUT EAST
40 I-90 E.BD - STA 80+66.8 MANHOLE RIM = 77.96 INV = 72.50 IN WEST INV = 69.15 IN NORTH INV = 70.65 IN EAST INV = 69.15 OUT SOUTH
21 I-90 E.BD - STA 77+63.6 CATCH BASIN RIM = 81.10 INV = 76.10
26 I-90 E.BD - STA 79+63.7 CATCH BASIN RIM = 78.98 INV = 74.00
43 I-90 E.BD - STA 80+66.8 MANHOLE RIM = 80.70 INV = 70.75 IN WEST INV = 68.75 IN NORTH INV = 68.75 OUT SOUTH
42 EAR - STA 79+38.6 MANHOLE RIM = 84.76 INV = 80.50 IN WEST 8" INV = 78.50 IN WEST 18" INV = 79.00 IN NORTH INV = 78.00 OUT EAST
16 I-90 W.BD - STA 78+84.7 CATCH BASIN RIM = 77.68 INV = 73.90
17 I-90 W.BD - STA 80+82.7 CATCH BASIN RIM = 75.91 INV = 71.54
25 EAR - STA 79+41.9 CATCH BASIN RIM = 83.57 INV = 79.15
37 I-90 W.BD - STA 78+84.7 MANHOLE RIM = 80.18 INV = 71.80 IN WEST INV = 73.60 IN NORTH INV = 73.60 IN SOUTH INV = 71.80 OUT EAST
39 I-90 W.BD - STA 80+81.1 MANHOLE RIM = 78.14 INV = 69.80 IN WEST INV = 70.80 IN NORTH INV = 70.55 IN EAST INV = 69.30 OUT SOUTH
18 I-90 W.BD - STA 81+30.2 CATCH BASIN RIM = 75.70 INV = 71.70 IN EAST INV = 71.45 OUT SOUTH
41 EAR - STA 78+17.1 MANHOLE RIM = 90.21 INV = 85.06 IN WEST INV = 85.06 IN NORTH INV = 81.50 OUT EAST
19 I-90 W.BD - STA 81+43.9 CATCH BASIN RIM = 75.62 INV = 71.80 OUT WEST
22 I-90 E.BD - STA 78+66.7 CATCH BASIN RIM = 80.00 INV = 75.00
27 I-90 E.BD - STA 80+54.8 CATCH BASIN RIM = 78.01 INV = 73.10
28 I-90 E.BD - STA 81+05.15 CATCH BASIN RIM = 77.48 INV = 72.00 OUT WEST
U-023 MANHOLE +60 INV = 104.28 IN NW INV = 104.10 IN SE
CATCH BASIN +50 RIM = 109.00 INV = 104.50
FOR INFORMATION SEE RFI NO. 555
CATCH BASIN +68 RIM = 110.48 INV = 106.0
CAP EXISTING LS (8")
ADJUST EXIST MANHOLE INV = 105.76 IN NW INV = 105.90 IN SE
CATCH BASIN +50 RIM = 108.90 INV = 104.40
SMH NO. 10 STA 0+00 I-90 CONST STA 87+05 72' LT
TIE-IN EXIST 12" SS INV = 99.8
233 LF - 12" PVC SS
LOCATION OF SMH NO. 10, FOR INFORMATION, SEE RFI NO'S. 030 AND 643
REPLACED 45' OF 10" PVC PIPE BEGINNING 40' FROM CL OF MH 12. FOR ADDITIONAL INFORMATION, SEE RFI NO. 608.
SEE DRAWING #U-021 NOTE 12
BE STANDPIPE (2 - 5" PVC CONDUITS)
BE POLE #641-14/2X
GENERAL SHIP BUILDING NO. 56
E 781,600
N 2,952,200
I-90 WESTBOUND
I-90 EASTBOUND
HOV EASTBOUND
EMERGENCY ACCESS RAMP
MASSPORT HAUL ROAD
CARIBOU BUILDING
64 LF CATCH BASIN +68, SEE NOTE 8 RIM = 110.6 INV = 106.1
REMOVE EXISTING POLE
TUNNEL INLET GRATE (TYPICAL) SEE DRAWING #SD-M-015
24" WIDE x 9" DEEP 38 LF TRENCH DRAIN
24" WIDE x 9" DEEP 63 LF TRENCH DRAIN
24 EAR - STA 78+17.6 CATCH BASIN RIM = 89.77 INV = 85.16
FOR CONTINUATION OF 2" LS SEE DRAWING #M-560
INV EL = 68.50
STORM WATER PUMP STATION SEE DRAWING #C-551
10" DIP DRAIN BETWEEN INLET STRUCTURES (TYP)
9C I-90 W.BD - STA 81+29.0 MANHOLE RIM = 77.65 INV = 71.15 IN NORTH INV = 71.15 OUT WEST
FOR CONTINUATION SEE DWG NO. C04A2-U-004
45 LF 18" RCP INVERT EL = 102.34
26 LF 6" DI STA 83+50± MHR
CATCH BASIN +90
40 LF - 12" RCP
CATCH BASIN +45
38 LF - 12" RCP
SD U-183 TYPICAL
CATCH BASIN +00
2 - 8.6" BE PIPE TYPE CABLES SEE NOTE 9 AND DRAWING #U-021 NOTE 11
CATCH BASIN +75 SEE NOTE 8
SD U-104 BASIN # 13
301 LF - 54" RCP
DMH NO 6 STA 9+40 I-90 CONST STA 84+95 99' RT
186 LF - 54" RCP
DMH NO 5 STA 7+46 I-90 CONST STA 86+79 89' RT
DMH NO 4 STA 6+56 I-90 CONST STA 87+65 82' RT
206 LF - 60" RCP
82 LF - 43" x 68" ELLIPTICAL RCP
DMH NO 7 STA 12+50 MHR 85+83
DMH NO 8 STA 14+42 MHR 83+90
14LF 12" RCP
185 LF - 8" UD
BE STAND PIPE (2-5" PVC CONDUITS)
BE POLE #568/16
CATCH BASIN +80 SEE NOTE 8
N 2,951,400
E 781,200
STAV'S BUILDING
TOWLE BUILDING
197 LF - 48" RCP
130LF - 8" UD
BE (9-5")
DMH NO 9 STA 15+84 MHR 82+52
FOR INFORMATION, SEE RFI NO'S. 534R1 AND 585.
PLUG EXISTING GS (6") BY BOSTON GAS UNDER FORCE ACCOUNT WORK
BE STAND PIPE (2-5" PVC CONDUITS)
BE POLE #3458/6
N 2,951,600
E 781,800
FOR CONTINUATION SEE DWG NO. C04A2-U-001

NOTES:

1. REFER TO DRAWING #U-021 FOR LEGEND
2. REFER TO DRAWINGS #U-007 AND #U-008 FOR STORM DRAIN TRUNKLINE PROFILE
3. REFER TO DRAWING #U-10A FOR 12" SANITARY SEWER PROFILE
4. INSTALL 8" UNDERDRAIN FROM THE PORTAL PLANTING AREA TO CATCH BASIN ON MASSPORT HAUL ROAD AS SHOWN. SEE DRAWING # L-004 FOR CONTINUATION.
5. REFER TO DWG # U-024 FOR ELECTRICAL MANHOLE (EMH) SIZES.
7. ALL MANHOLES CONSTRUCTED IN THE BOAT SECTION SLAB SHALL HAVE BRICK INVERTS SIMILAR TO THAT SHOWN ON MDPW CONSTRUCTION STANDARD 202.4.0.
8. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE DEPTH OF BOSTON EDISON'S 2-8.6 115 KV PIPE-TYPE CABLES AND TO FIELD MODIFY THE 12" RCPS GOING TO THE DROP MAN HOLES FROM THE CATCH BASINS IF REQUIRED.
9. BOSTON EDISON COMPANY SHALL RELOCATE THEIR 2-8.6 115KV PIPE-TYPE CABLES VERTICALLY ALONG MASS HAUL ROAD TO CLEAR THE TUNNEL ROOF.

FOR INFORMATION, SEE RFI NO. 30, 32, 47, 169, 199, 423, 534R1, 555, 585, 608 AND 643.

FOR AS-BUILT LOCATION OF UTILITIES SEE ATTACHED KIEWIT/PAC DRAWING NO. AD-U-003 (SHT. 155a).

INSTRUMENT LEGEND

SYMBOL	INSTRUMENT
▽1	DMP TYPE 1
▽2	DMP TYPE 2
UMP	UTILITY MONITORING POINT
SM	SEISMOGRAPH

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

RECORD DRAWING

0 40 100 200 FEET
1" = 40'-0" HORIZONTAL

REV	DATE	BY	SUB	APP	DESCRIPTION
6	29JAN93	WED	GFE	RHB	CONST SERVICES BECO CHANGE
5	18JAN93	WED	GFE	RHB	REVISED STORM DRAIN
4	19OCT92	WED	BNY	RHB	MISC CHANGES
3	16OCT92	WED	GFE	RHB	BECO CHANGES
2	16JAN92	WED	GFE	RHB	MISC CHANGES
1	20DEC91	DAE	GFE	RHB	COMPLETE REV BE & MISC REV

REV	DATE	BY	SUB	APP	DESCRIPTION
12	11AUG98	CMG		KSS	INCORPORATED FIELD CONDITIONS
11	11AUG98	CMG		KSS	NOTES ADDED
10	20JAN95	JMH	JEM	RHB	ADD LS STUB/DEL CONC ENCASE
9	17DEC94	MVF	JEM	RHB	ADDED PUMP STATION
8	27MAY94	MVF	JEM	RHB	ADDED FM & REVISED SS
7	30APR93	WED	GFE	RHB	ROCK ANCHOR REDESIGN

DESIGNED BY G F EMDE
DRAWN BY W E DAVIS
CHECKED BY G F EMDE
IN CHARGE R H BRADLEY
DATE 14 OCT 91

MASSACHUSETTS HIGHWAY DEPARTMENT

Central Artery (I-93)/Tunnel (I-90) Project

HDR / HAYDEN-WEGMAN
SECTION DESIGNER-D004A
SUBMITTED: Stanley Reed

BECHTEL/PARSONS BRINCKERHOFF
MANAGEMENT CONSULTANTS
SUBMITTED FOR APPROVAL: C. M. Wiley

CENTRAL ARTERY TUNNEL

BOSTON MARINE INDUSTRIAL PARK
TUNNEL
UTILITY PLANS
SHEET 3 OF 6

SCALE: 1" = 40'
CONTRACT NO. C04A2
DRAWING NO. C04A2-U-003
REV. 12

BOSTON
INTERSTATE I - 90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1993	155a	881

SHEET 3 OF 15 , AS-BUILT UTILITY

All elevations on this plan are based on the Central Artery Datum.
To convert elevation data to Boston City Base, subtract 94.35.

FOR CONTINUATION SEE DWG NO. C04A2-U-002

FOR CONTINUATION SEE DWG NO. C04A2-U-004

FOR CONTINUATION SEE DWG NO. C04A2-U-001

RECORD DRAWING

NOTES:
1.) THESE PLANS REFLECT THE AS-BUILT LOCATIONS OF THE UTILITIES INSTALLED UNDER THE C04A2 CONTRACT ONLY. PRE-EXISTING UTILITIES AND UTILITIES INSTALLED UNDER OTHER CONTRACTS ARE NOT SHOWN.

2.) THESE AS-BUILT PLANS ARE BASED ON THE FIELD LOCATION OF UTILITIES BY THE CONTRACTOR AT THE TIME OF THEIR INSTALATION AND BY FIELD INSPECTION AND LOCATION OF SURFACE UTILITY STRUCUTRES.

RECORD PLAN
PLAN: R35-20
DATE: 3/28/2003

REV	DATE	BY	SUB	APP	DESCRIPTION
1	09JUL98	TRB		MAC	COORDINATE MANHOLES, ADDITIONAL RIM AND INVERT ELEVATIONS.
2	12AUG98	CMG		KSS	INCORPORATED FIELD CONDITIONS

DESIGNED BY D. COTE
DRAWN BY D. NICHOLSON
CHECKED BY J. NABSTEDT
IN CHARGE M. COLEMAN
DATE SEPTEMBER 16, 1996

COMMONWEALTH OF MASSACHUSETTS
MICHAEL A COLEMAN No. 37042 PROFESSIONAL ENGINEER

MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93)/Tunnel (I-90) Project

Kiewit/PAC A Joint Venture JMP Tunnel/Vent 6
GENERAL CONTRACTOR
APPROVED:

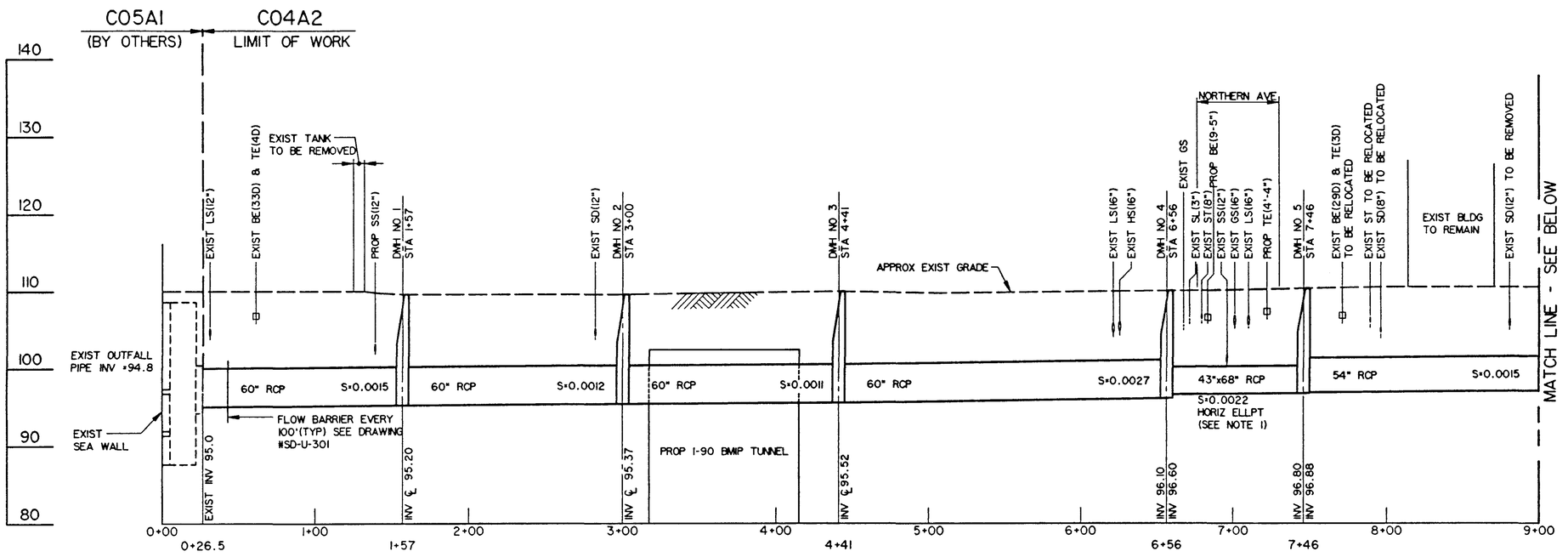
BECHTEL/PARSONS BRINCKERHOFF
MANAGEMENT CONSULTANT
SUBMITTED FOR APPROVAL: N/A

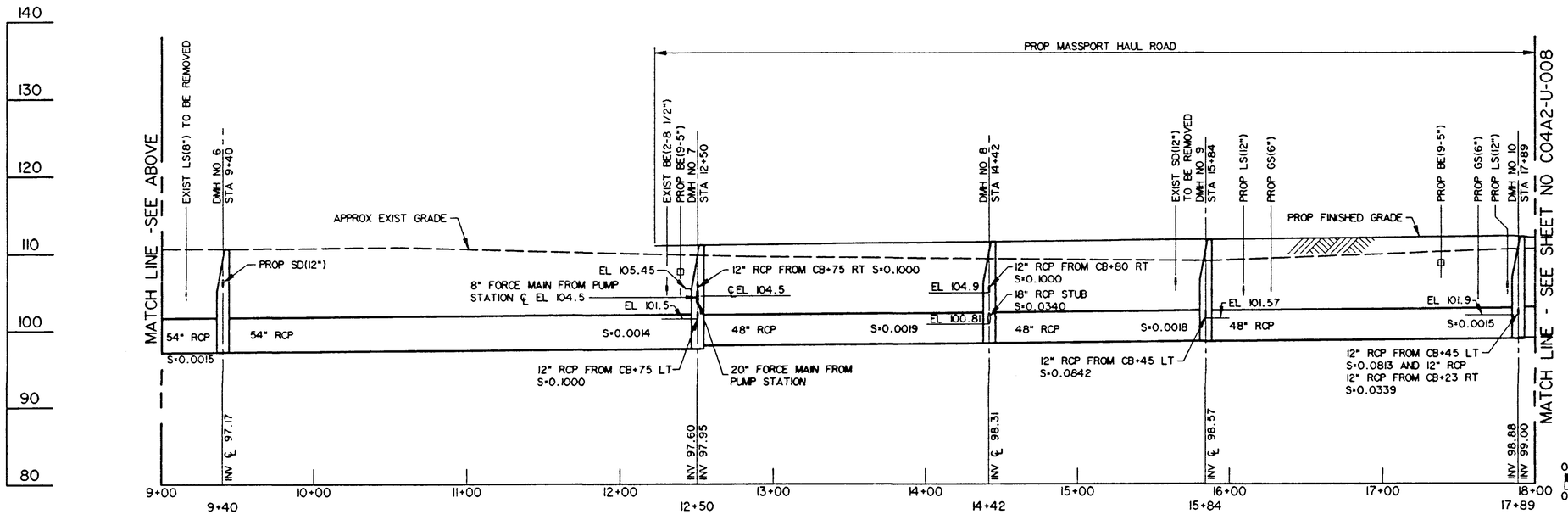
CENTRAL ARTERY TUNNEL

BOSTON MARINE INDUSTRIAL PARK
TUNNEL
AS-BUILT UTILITY PLANS
SHEET 3 OF 6

SCALE: 1" = 40'
CONTRACT NO. C04A2
DRAWING NO. AD-U-003
REV. 2

DRAWING PREPARED BY A-PLUS CONSTRUCTION SERVICES CORPORATION





BOSTON
INTERSTATE I-90

F.H.W.A. REGION NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	MASS	I-90-1(053)	1991	159	881

SHEET 7 OF 15 , UTILITIES

All elevations on this plan are based on the Central Artery Datum.
To convert elevation data to Boston City Base, subtract 94.35.

NOTES:

1. PROP 43"x68" ELLIPTICAL RCP (EQUIVALENT TO 54" CIRCULAR RCP) IS REQUIRED IN ORDER TO AVOID CONFLICT WITH EXISTING 12" SANITARY SEWER
2. CATCH BASINS ARE STATIONED FROM MASSPORT HAUL ROAD BASELINE
3. ALL RCP SHALL BE CLASS IV
4. PIPES 24"Ø AND SMALLER SHALL HAVE BELL-AND-SPIGOT TYPE JOINTS
5. PIPES GREATER THAN 24"Ø SHALL HAVE TONGUE-AND-GROOVE TYPE JOINTS

RECORD PLAN
PLAN # R35-29
DATE 3/28/2003

FOR INFORMATION, SEE RFI NO'S. 423, 550 AND 659.

FOR AS-BUILT LOCATION OF UTILITIES, SEE ATTACHED KIEWIT/ PAC DRAWING NO'S. AD-U-001(SHT. 153a), AD-U-002 (SHT. 154a), AD-U-003 (SHT. 155a), AD-U-004 (SHT. 156a), AD-U-005 (SHT. 157a), AD-U-006 (SHT. 158b) AND AD-U-016 (SHT. 158c). △B 5

ALL PLAN REFERENCES TO FUTURE WORK HAVE BEEN COMPLETED, UNLESS OTHERWISE NOTED

RECORD DRAWING

1" = 40'-0" HORIZONTAL
0 40 100 200 FEET
0 8 16 20 40
1" = 8'-0" VERTICAL

REV	DATE	BY	SUB	APP	DESCRIPTION
4	20JAN95	JMH	GFE	RHB	MISC REVISION
3	18JAN93	WED	GFE	RHB	REVISED STORM DRAIN, ADDED CROSSING BE LINES
2	16JAN92	QCS	GFE	RHB	REVISED SHEET NOTES
1	20DEC91	DAE	GFE	RHB	INVERT AND SLOPE REVISIONS
6	10AUG98	CMG		KSS	INCORPORATED FIELD CONDITIONS
5 △B	10AUG98	CMG		KSS	NOTES ADDED

DESIGNED BY G F EMDE
DRAWN BY G T WASS
CHECKED BY J C SCHWARZ
IN CHARGE R H BRADLEY
DATE 14 OCT 91

COMMONWEALTH OF MASSACHUSETTS — DONALD A. DEMERCHANT — REGISTERED PROFESSIONAL ENGINEER

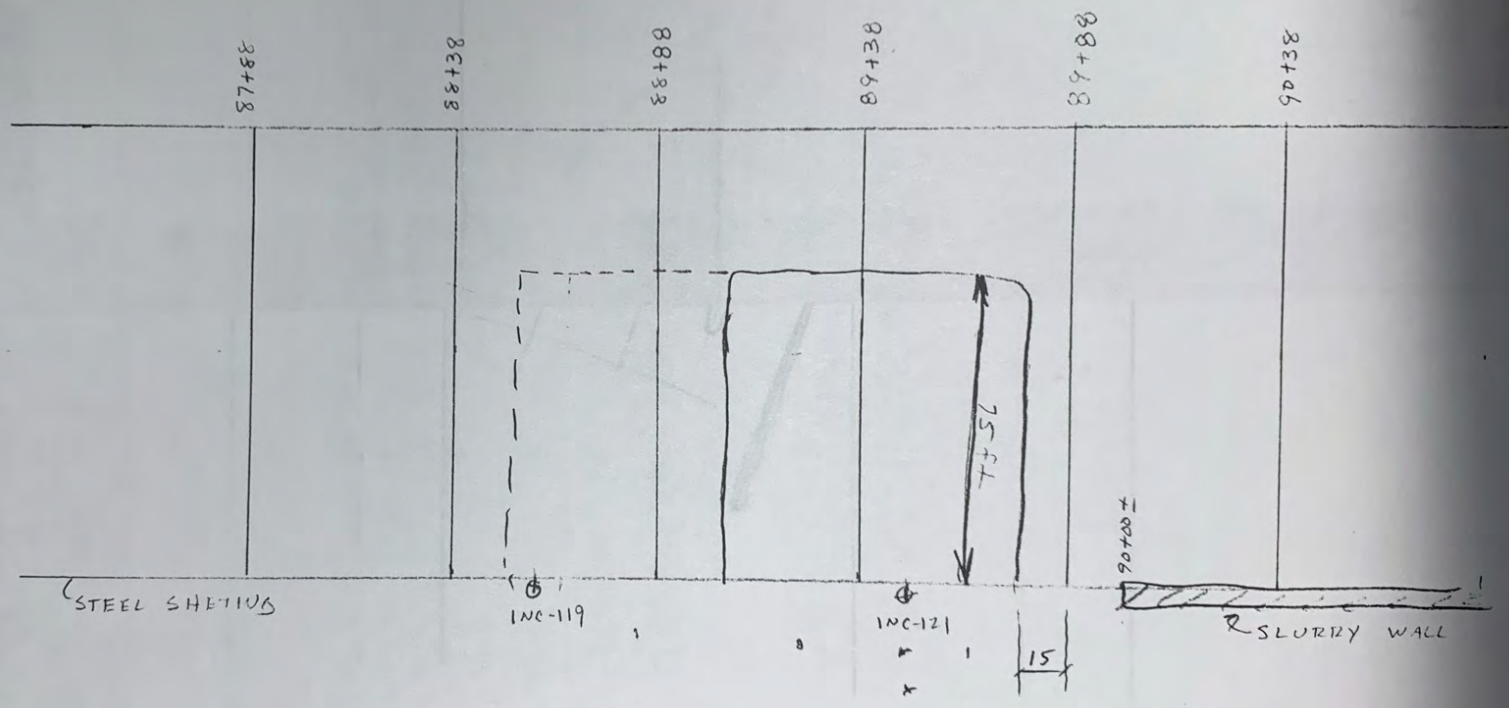
MASSACHUSETTS HIGHWAY DEPARTMENT
Central Artery (I-93) / Tunnel (I-90) Project
SECTION DESIGNER-D004A HDR / HAYDEN-WEGMAN SUBMITTED:
BECHTEL/ PARSONS BRINCKERHOFF MANAGEMENT CONSULTANTS SUBMITTED FOR APPROVAL: C.M. Wiley

CENTRAL ARTERY TUNNEL

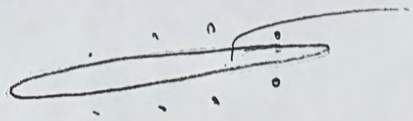
BOSTON MARINE INDUSTRIAL PARK
TUNNEL
STORM DRAIN TRUNK LINE PROFILE
STA 0+00 TO STA 18+00
SHEET 1 OF 2

SCALE: HOR 1"=40'
VERT 1"=8'
CONTRACT NO. C04A2
DRAWING NO. C04A2-U-007
REV. 6

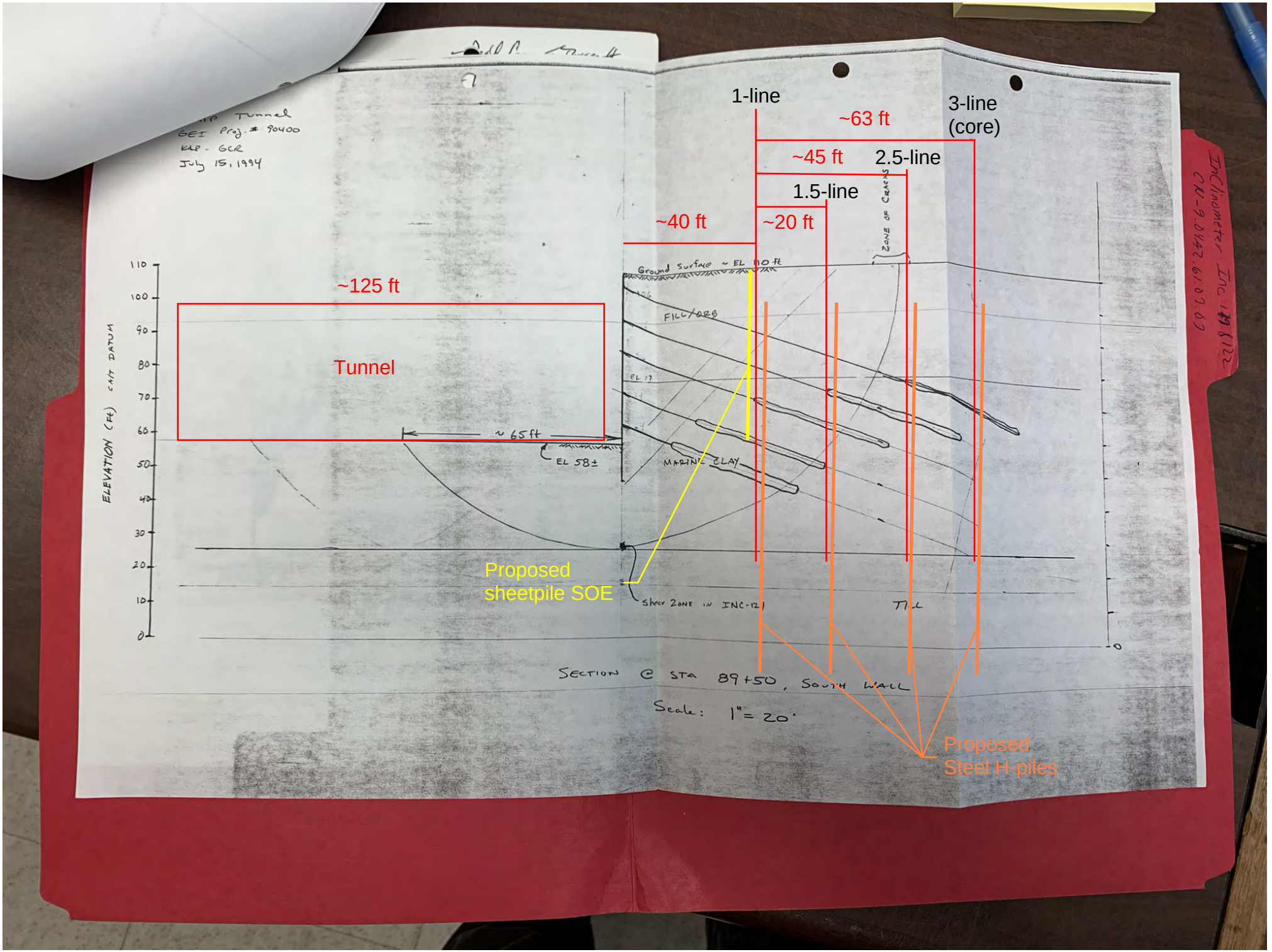
Plan View -
East Tunnel
Built Tunnel
KAP - GPR
7-15-94



SCALE 1 in ≃ 40 ft



Coral Area of Cracking
in Nagle Building Parking


1-line
~63 ft
3-line
(core)
~45 ft
2.5-line
1.5-line
~40 ft
~20 ft
~125 ft
Tunnel
Proposed
sheetpile SOE
Proposed
Steel H-piles
Ground Surface ~ EL 110 ft
FILL/ORG
MARINE CLAY
~ 65 ft
EL 58±
ELEVATION (FT) CAIT DATUM
110
100
90
80
70
60
50
40
30
20
10
0
Section @ Sta 89+50, South Wall
Scale: 1"= 20'

ELEVATION F-F
Scale 1/4" = 1'-0"

ELEV. F-F CONTINUED

SECTION D-D
Scale 1/4" = 1'-0"
For reint. of grade bms & platform bm see Secs A-A, G-G, H-H.

ELEVATION E-E
Scale 1/4" = 1'-0"

SEC. J-J

PLAN AT JAMB
for doors in bays 3-4, 6-7 9-10, 12-13 & 15-16

Floor reinf. ⅜ϕ 10" o.c. both ways supported ab't 2½" above bottom of 6" slab. Lengths arranged as shown on plan. 2×2 - #14 ga. welded galv. mesh at mid-depth of 1½" top finish. Slab & top finish to be placed in rectangular areas bounded by straight construction joints made with board form on center lines of all columns. Place in alternate rectangles to allow partial set. Vertical joint ½" thick full depth of slab along inside face of wall and around each pier, with asphalt exp. filler.

¾" SCALE DETAIL OF FLOOR AT PIER

SECTION G-G
same as H-H except as shown

SECTION H-H
Scale 1/4" = 1'-0"

405'-0" out to out grade bms.

200 lines in 9 lengths @ 41'-0" + 1 length @ 28'-0" + 1 length @ 20'-6" (lapped 15") sp. 10" o.c. in 28'-0" + 31'-0" bays between piers

3 lines 20'-3" long in each bay at col. lines B, C, D, E, F, and 1 each at lines A & G.

90 groups of 3 piles thus on B, C, D, E & F-lines at lines 1 to 18 incl.

38 groups of 2 piles thus on A & G-lines at Lines 1 to 19 incl.

38 single piles thus at Lines 1 to 19 incl. under platforms East & West sides.

18 bays @ 22'-6" = 405'-0"

PILE CUT-OFF GRADES.

	1	2	3 to 17	18	19
N. Platf.	113-6	115-8	117-8	115-8	113-6
G	"	113-10	113-10	113-10	113-6
F	"	115-0±	115-0±	115-0±	113-6
E	"	"	"	"	"
D	"	"	"	"	"
C	"	"	"	"	"
B	"	"	"	"	"
A	"	113-10	113-10	113-10	113-6
S. Platf.	"	115-8	117-8	115-8	113-6
At ELEV.	See Sec. B-B				

PILING AND FOUNDATION PLAN
Lay-out at 1/16" = 1'-0"; Detail at 1/8" = 1'-0"

SEC. A-A

LAY-OUT OF 3-PILE CAP AND ANCHOR BOLTS, INTERIOR COLS.

SEC. B-B

SEC. C-C

SEC. K-K
Scale 1/2" = 1'-0"

Revision	Date	Brief	By
	5-5-41	Add floor slab, reinf, finish, jointing	RWN

Drawn by RWN
Traced by
Checked by RWN

NAVY DEPARTMENT — BUREAU OF YARDS AND DOCKS
NAVAL DRYDOCK, SOUTH BOSTON, MASS.
BUILDING 19
TEMPORARY STOREHOUSE
PILING & FOUNDATION PLAN

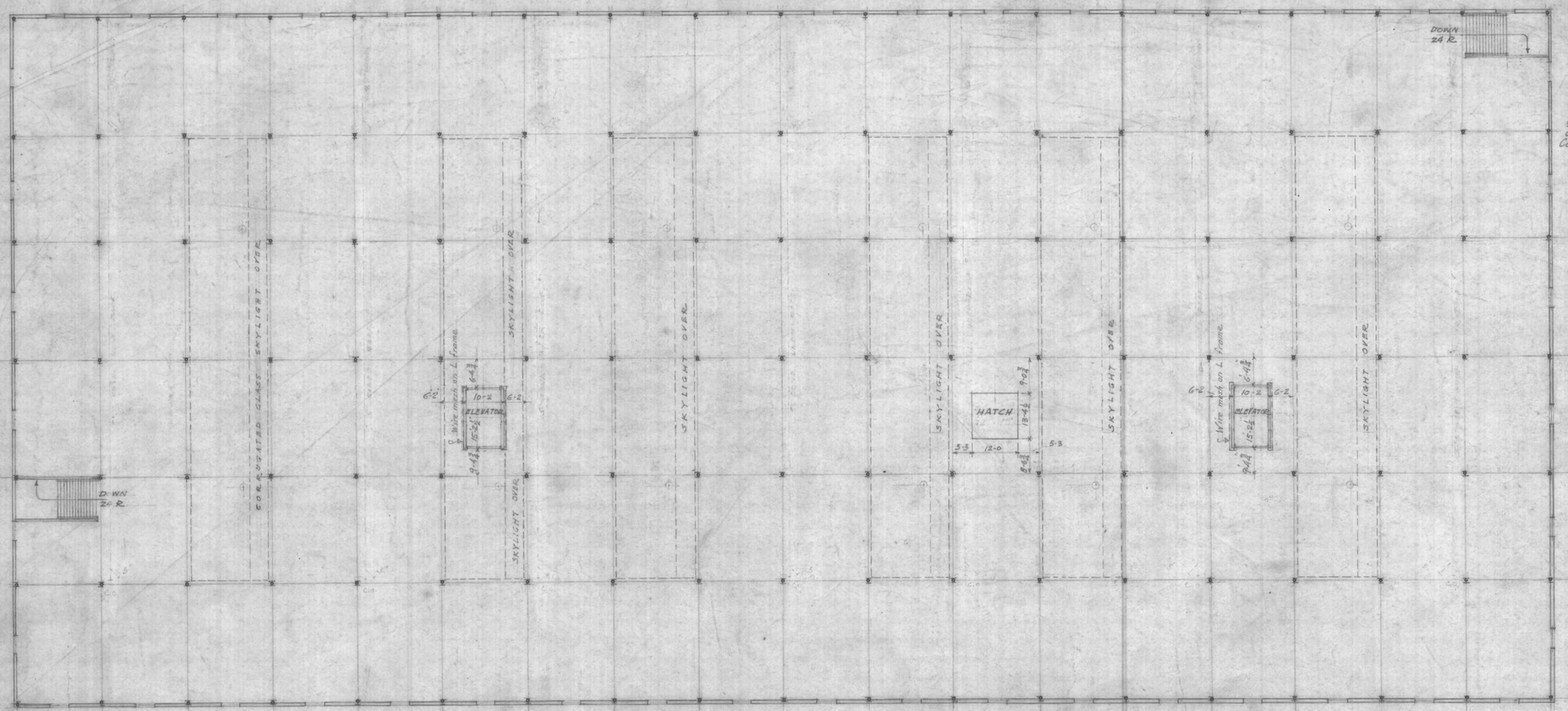
Approved subject to the conditions of the contract
Date 5/12 1941
H. E. WILSON
Commander (C.E.C.) U.S.N.
Officer-in-Charge

Drawing Number 981A-325

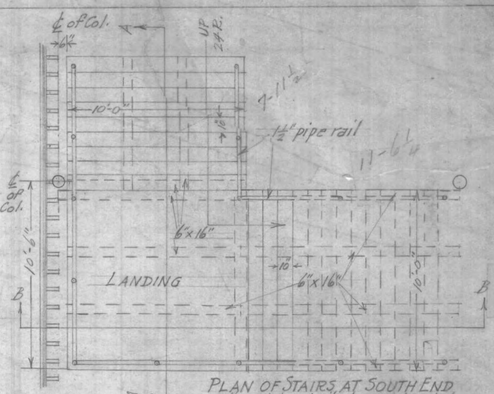
Sheet 1 of 7
Date April 2 - 1941

SAWYER CONSTRUCTION CO.
CONTRACTOR-CONTRACT NOy 4410

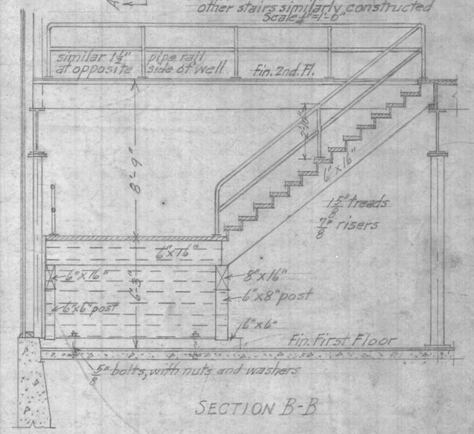
19
P-13



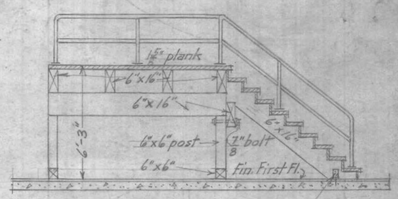
SECOND FLOOR PLAN
SCALE 1/16 IN. = 1'-0"



PLAN OF STAIRS AT SOUTH END
other stairs similarly constructed
Scale ¼"=1'-0"

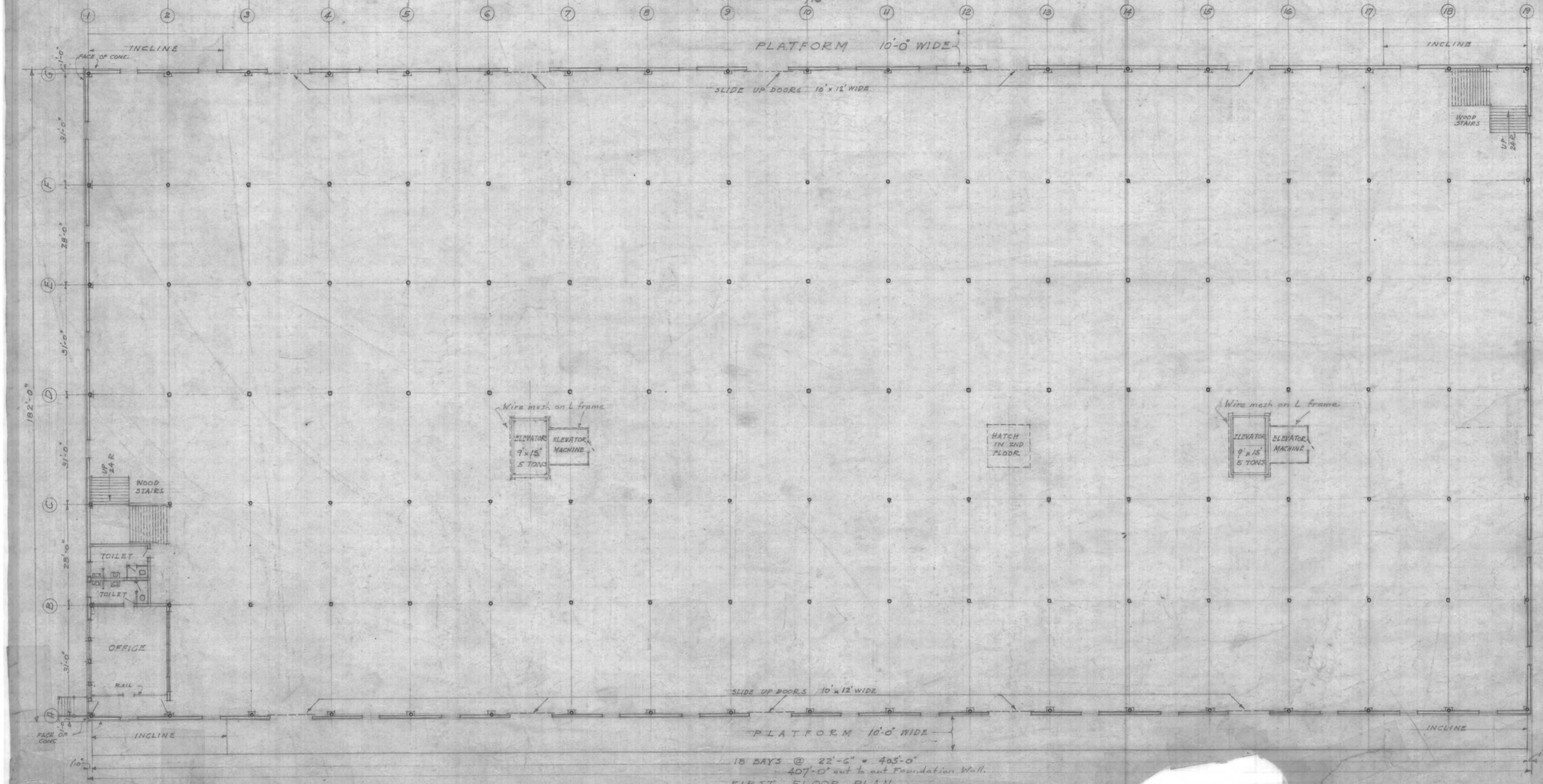


SECTION B-B



SECTION A-A

6"x6"x5' knees lagged to each stringer and secured to concrete slab with expansion bolts.



15 BAYS @ 22'-6" = 405'-0"
407'-0" out to out Foundation Wall.

FIRST FLOOR PLAN
SCALE 1/16 IN = 1'-0"

Revision	Date	Brief	By

Drawn by A.E.W.
Traced by
Checked by T.W.N.

NAVY DEPARTMENT — BUREAU OF YARDS AND DOCKS

NAVAL DRYDOCK, SOUTH BOSTON, MASS.

BUILDING 19

TEMPORARY STOREHOUSE

1ST & 2ND FLOOR PLAN

SCALE 1/16" = 1'-0"

Approved subject to the conditions of the contract
Date 4/2 1941

Drawing Number 981A-326

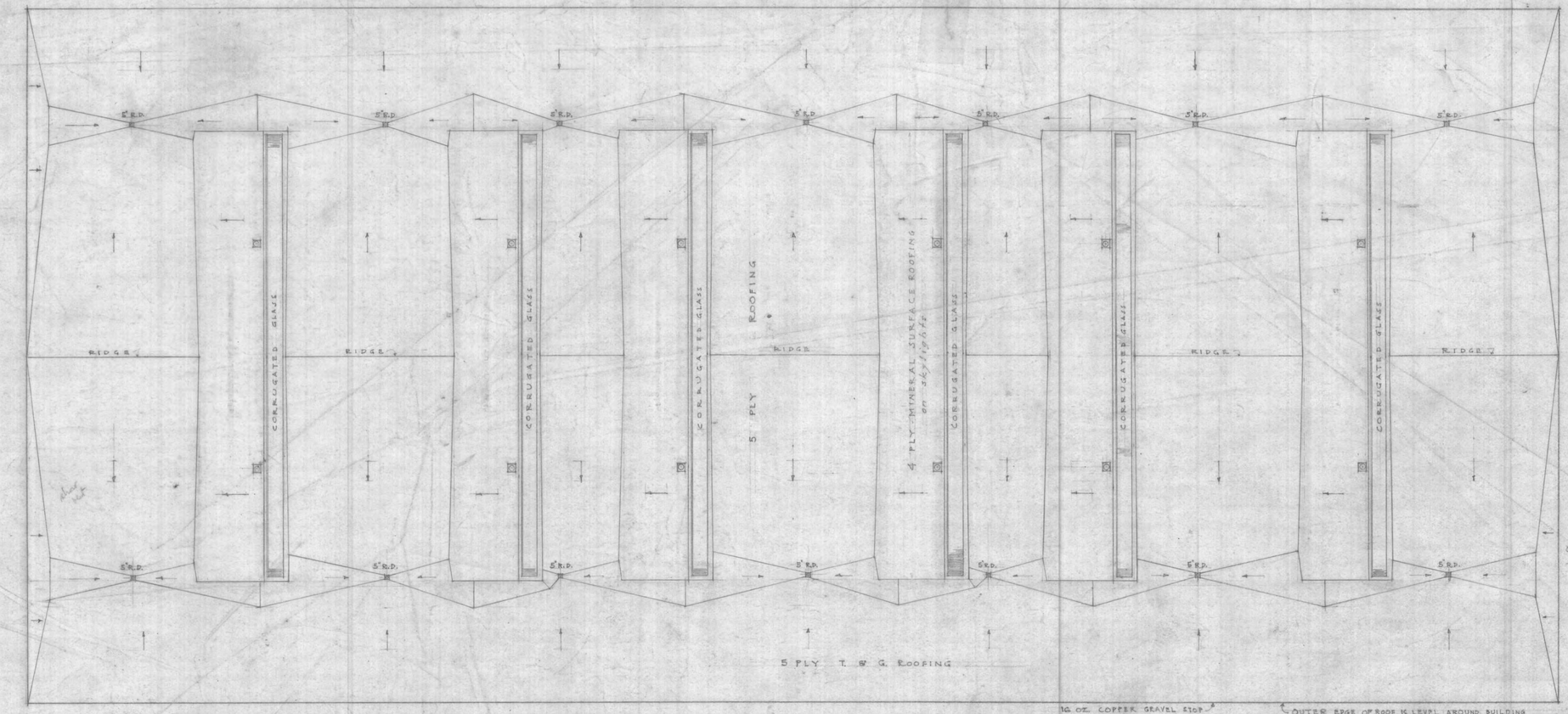
Sheet 2 of 7 Sheets

Date April 2, 1941

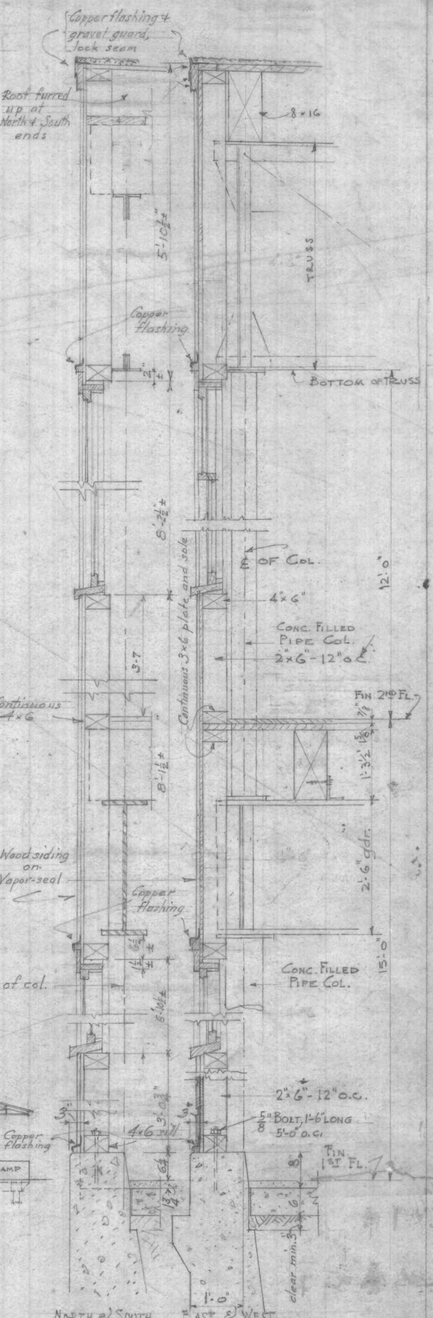
H. E. WILSON
Commander (C.E.C.) U.S.N.
Officer in Charge

SAWYER CONSTRUCTION CO.
CONTRACTOR CONTRACT NOY 4410

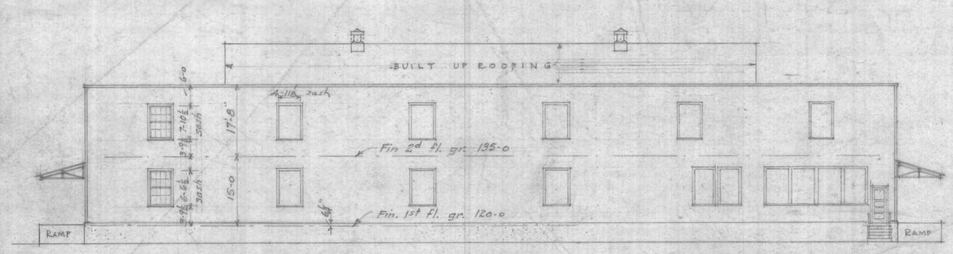
14
14-15



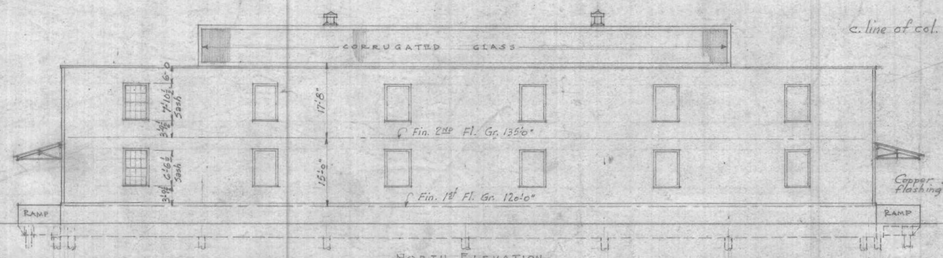
ROOF PLAN
SCALE 1/16"=1'0"



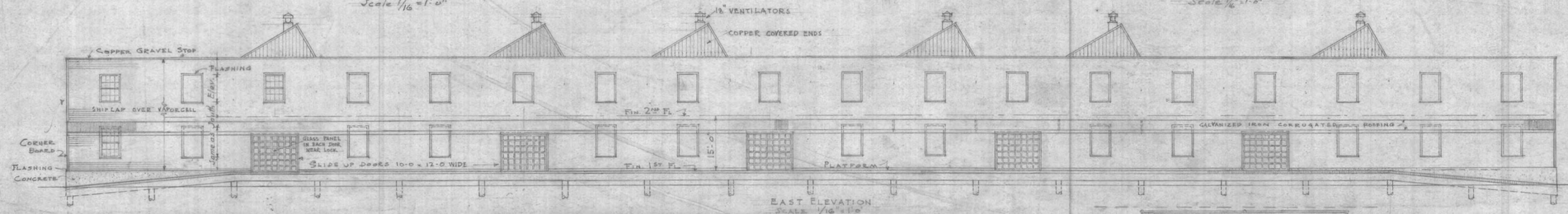
SECTIONS OF EXTERIOR WALL
SCALE 3/4"=1'0"



SOUTH ELEVATION
Scale 1/16"=1'0"

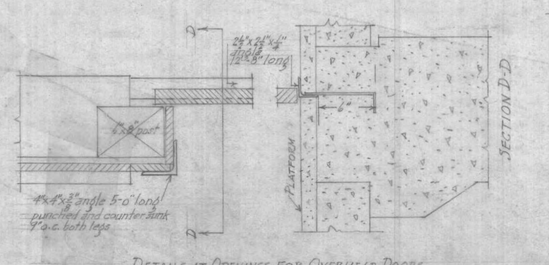


NORTH ELEVATION
Scale 1/16"=1'0"

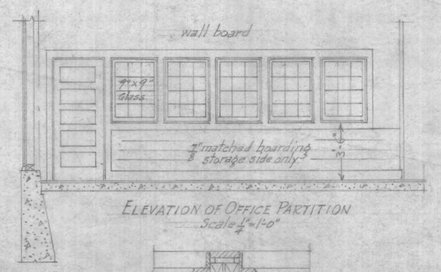


EAST ELEVATION
SCALE 1/16"=1'0"

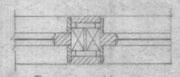
WEST ELEVATION SAME OPPOSITE HAND



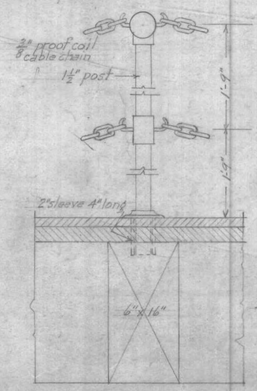
DETAILS AT OPENINGS FOR OVERHEAD DOORS
Scale 1½"=1'0"



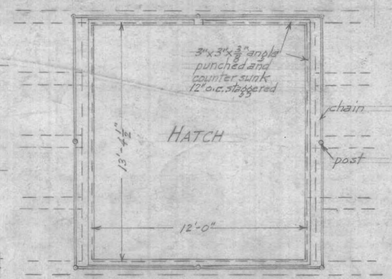
ELEVATION OF OFFICE PARTITION
Scale ¼"=1'0"



DETAIL OF MULLION
Scale 1½"=1'0"



DETAIL OF POST AND CHAIN AT HATCH
Scale 1½"=1'0"



POSTS, CHAINS AND ANGLE GUARDS AT HATCH
Scale ½"=1'-0"

Revision	Date	Brief	By

Drawn by C. B.
Traced by C. B.
Checked by [illegible]

NAVY DEPARTMENT — BUREAU OF YARDS AND DOCKS
NAVAL DRYDOCK, SOUTH BOSTON, MASS.

BUILDING 19
TEMPORARY STOREHOUSE
ROOF PLAN & ELEVATIONS

SCALE 1/16"=1'0"

Approved subject to the conditions of the contract
Date 4/1 1941
H. E. WILSON
Commander (C.E.C.) U.S.N.
Officer-in-Charge

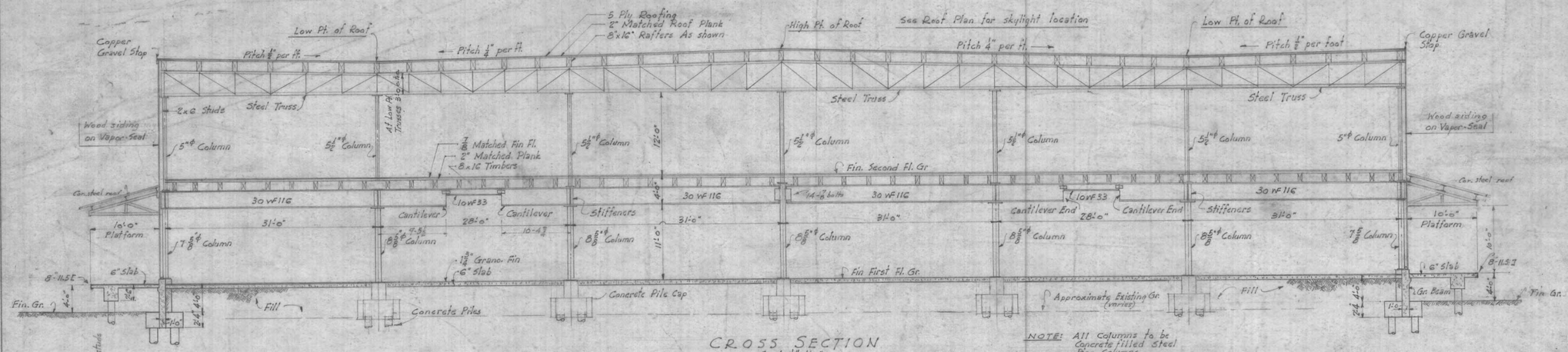
Drawing Number 981A-327

Sheet 3 of 7
Date: April 2, 1941

SAWYER CONSTRUCTION CO.
CONTRACTOR - CONTRACT NOY. 4410

19
19-16

File 981-19



CROSS SECTION
Scale ⅛"=1'-0"

NOTE: All Columns to be Concrete filled Steel Pipe Columns.

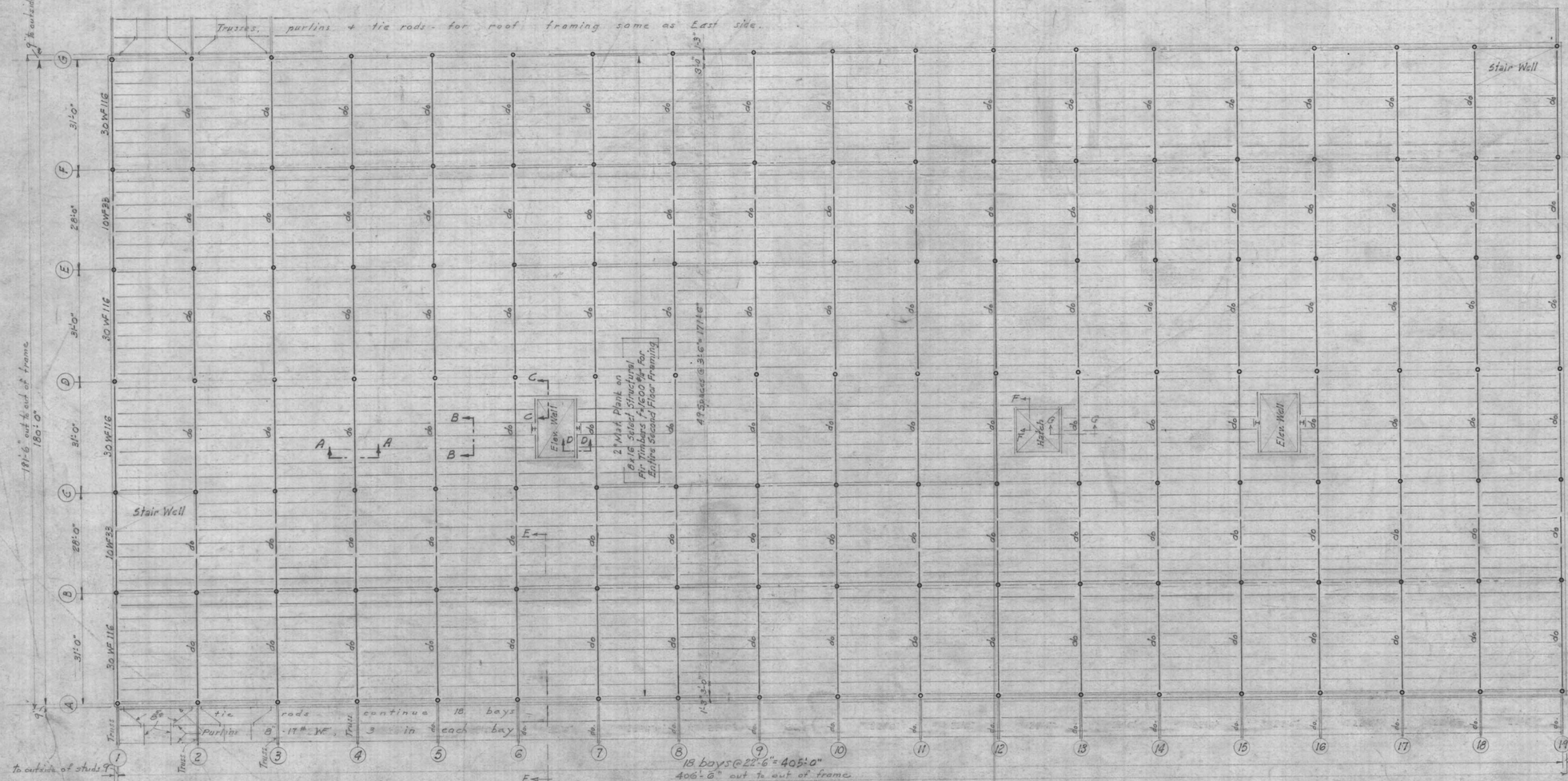
COLUMN SCHEDULE

All columns to be concrete filled pipe cols., welded steel caps and bases.

	A G (1 to 19)	B C E F (1 to 18)	D (1 to 18)	B C E F (19)	D (19)
Bot. of Truss					
	5	5½	5½	5	5
Fin. 2nd Floor					
	Galv.	Galv.		Galv.	2-6
	7⅝	8⅝	8⅝	7⅝	7⅝
Fin 1st Floor					
Base pl. (Cast on col)	14×14 ×1	18×18 ×⅝	18×18 ×⅝	14×14 ×1	14×14 ×1

Each col. to have 4-1¼ anchor bolts 2'-6" long with 3 nuts & 1 washer.

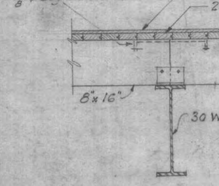
Trusses, purlins & tie rods for roof framing same as East side.



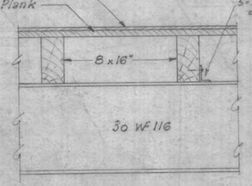
SECOND FLOOR FRAMING PLAN
Scale 1/16" = 1'-0"

SEC. G-G
Scale ½" = 1'-0"

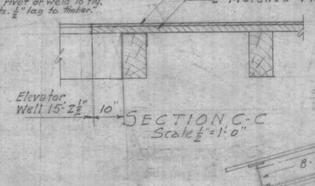
SEC. F-F
Scale ½" = 1'-0"



SECTION A-A
Scale ½" = 1'-0"



SECTION B-B
Scale ½" = 1'-0"



SECTION C-C
Scale ½" = 1'-0"

SECTION D-D
Scale ½" = 1'-0"

SECTION E-E
Scale ½" = 1'-0"

Revision	Date	Brief	By
Drawn by	C.W.O.		
Traced by			
Checked by			

NAVY DEPARTMENT — BUREAU OF YARDS AND DOCKS
NAVAL DRYDOCK SOUTH BOSTON, MASS.

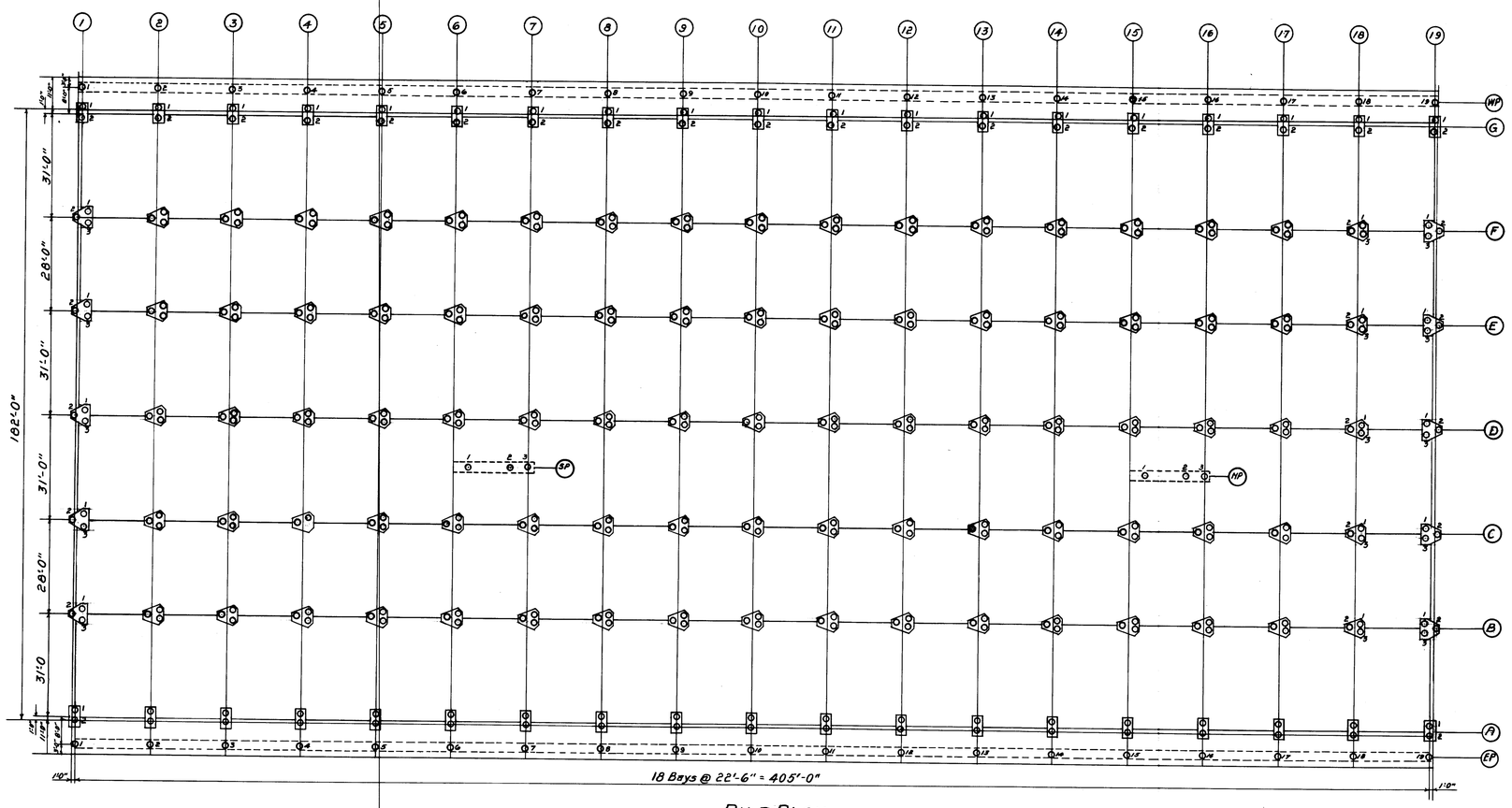
BUILDING 19
TEMPORARY STOREHOUSE
2ND FL. FRAMING PLAN & CROSS SECTION

Approved subject to the conditions of the contract
Date ____ 194
H. E. WILSON
Commander (C.E.C.) U.S.N.
Officer-In-Charge

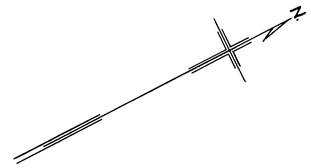
SCALE 1-AS SHOWN
Drawing Number 19 A-16

Sheet 5 of 7
Date April 2, 1941

SAWYER C...
CONTRACT...



PILE PLAN
Scale 1" = 20'



PILE NO.	ROW	WEIGHT OF HAMMER	LENGTH OF PILE	SIZE OF BUTT	SIZE OF POINT	TOTAL PENETRATION	LAST-BLOWS AVER-FALL	LAST-BLOWS PENETRATION	TOTAL BLOWS	AVER. HEIGHT	ELEV. OF CUTOFF	CARRYING CAPACITY IN TONS	REMARKS
1	E-1	5000 lbs.	60'-6"	16"	9"	60.5"	35"	1.20"	246		115.5'	12.15	Raymond Pile used
3	"	"	64'-6"	"	"	64.5	"	1.30	238		"	11.20	All Piles driven to
3	F-1	"	72'-6"	"	"	72.5	"	1.10	215		"	13.28	ground Elev. at head.
1	E-1	"						0.202	16			72.22	Redriven
3	"	"						0.166	15			87.86	"
3	F-1	"						0.266	"			54.85	"
2	D-1	"	64'-6"	16"	9"	64.5	35"	0.731	433		115.5'	19.95	
2	E-1	"	"	"	"	"	"	"	309		"	"	
3	D-1	"	"	"	"	"	"	0.85	254		"	17.03	
1	"	"	"	"	"	"	"	0.731	328		"	19.95	
1	F-1	"	"	"	"	"	"	0.747	360		"	19.50	
2	"	"	"	"	"	"	"	1.30	323		"	11.20	
2	G-1	"	"	"	"	"	"	1.43	236		"	10.15	
2	WP	"	"	"	"	"	"	1.10	343		"	12.15	
1	"	"	"	"	"	"	"	1.33	326		"	10.15	
1	G-1	"	60'-6"	"	"	60.5	"	1.81	259		"	7.81	
2	G-2	"	64'-6"	"	"	64.5	"	"	195		"	"	
3	F-2	"	"	"	"	"	"	1.30	209		"	11.20	
1	"	"	"	"	"	"	"	1.33	250		"	10.15	
1	D-1	"						0.213	15			68.50	Redriven
1	D-2	"	60'-6"	16"	9"	60.5	35"	0.747	295		115.5'	19.50	
2	"	"	"	"	"	"	"	1.02	252		"	14.30	
3	"	"	"	"	"	"	"	"	224		"	"	
1	E-2	"	"	"	"	"	"	1.30	225		"	11.20	
2	"	"	"	"	"	"	"	0.90	226		"	16.76	
3	"	"	"	"	"	"	"	1.10	285		"	14.60	
2	C-2	"	"	"	"	"	"	0.645	580		"	22.60	
1	"	"	"	"	"	"	"	0.671	409		"	21.75	
3	"	"	"	"	"	"	"	0.645	361		"	22.60	
1	C-1	"	"	"	"	"	"	0.85	342		"	17.03	
3	"	"	"	"	"	"	"	1.10	252		"	14.60	
2	"	"	"	"	"	"	"	1.20	183		"	12.15	
1	B-2	"	"	"	"	"	"	"	162		"	"	
3	"	"	"	"	"	"	"	1.30	154		"	11.20	
2	"	"	"	"	"	"	"	1.20	188		"	12.15	
1	B-1	"	"	"	"	"	"	0.85	244		"	17.03	
1	A-1	"	"	"	"	"	"	1.60	182		"	9.12	
2	"	"	"	"	"	"	"	"	174		"	"	
1	EP	"	"	"	"	"	"	1.30	154		"	11.20	
1	A-2	"	"	"	"	"	"	1.60	146		"	9.12	
2	"	"	"	"	"	"	"	1.43	109		"	10.20	
2	EP	"	"	"	"	"	"	2.10	103		"	7.00	
2	B-1	"	"	"	"	"	"	1.20	263		"	12.15	
3	"	"	"	"	"	"	"	1.30	276		"	11.20	
1	A-3	"	"	"	"	"	"	1.60	148		"	9.12	
1	A-4	"	"	"	"	"	"	1.30	105		"	11.20	
2	A-3	"	"	"	"	"	"	1.60	125		"	9.12	
2	A-4	"	"	"	"	"	"	1.81	107		"	7.81	

PILE NO.	ROW	WEIGHT OF HAMMER	LENGTH OF PILE	SIZE OF BUTT	SIZE OF POINT	TOTAL PENETRATION	LAST-BLOWS AVER-FALL	LAST-BLOWS PENETRATION	TOTAL BLOWS	AVER. HEIGHT	ELEV. OF CUTOFF	CARRYING CAPACITY IN TONS	REMARKS
3	EP	5000 lbs.	60'-6"	16"	9"	60.5"	35"	1.30"	148		115.5'	11.20	Raymond Pile used
4	"	"	"	"	"	"	"	1.60	106		"	9.12	All Piles driven to
2	B-4	"	"	"	"	"	"	1.20	208		"	12.15	ground Elev. at head
3	"	"	"	"	"	"	"	1.30	124		"	11.20	
1	"	"	"	"	"	"	"	"	168		"	"	
2	C-4	"	"	"	"	"	"	0.747	324		"	19.50	
2	B-3	"	"	"	"	"	"	1.02	206		"	14.30	
3	"	"	"	"	"	"	"	1.10	176		"	14.60	
1	C-4	"	"	"	"	"	"	1.30	269		"	11.20	
2	C-3	"	"	"	"	"	"	1.20	245		"	12.15	
1	"	"	"	"	"	"	"	"	224		"	"	
3	C-4	"	"	"	"	"	"	0.957	251		"	15.25	
1	B-3	"	"	"	"	"	"	1.02	205		"	14.30	
3	C-3	"	"	"	"	"	"	1.30	189		"	11.20	
2	A-3	"						0.425	15		"	35.00	Redriven
2	D-4	"	60'-6"	16"	9"	60.5"		0.747	270		115.5'	19.50	
3	"	"	"	"	"	"	"	0.90	335		"	16.76	
1	"	"	"	"	"	"	"	0.731	342		"	19.95	
2	D-3	"	"	"	"	"	"	0.957	225		"	15.25	
3	"	"	"	"	"	"	"	"	297		"	"	
2	F-3	"	"	"	"	"	"	0.85	218		"	17.03	
1	D-3	"	"	"	"	"	"	0.90	341		"	16.76	
3	E-4	"	"	"	"	"	"	0.957	186		"	15.25	
1	E-3	"	"	"	"	"	"	"	245		"	"	
1	E-4	"	"	"	"	"	"	"	"		"	"	
2	"	"	"	"	"	"	"	1.30	207		"	11.20	
3	F-4	"	"	"	"	"	"	1.02	261		"	14.30	
2	E-3	"	"	"	"	"	"	0.957	228		"	15.25	
3	F-3	"	"	"	"	"	"	"	306		"	"	
3	E-3	"	"	"	"	"	"	1.20	192		"	12.15	
1	F-4	"	"	"	"	"	"	0.76	234		"	20.00	
2	"	"	"	"	"	"	"	"	297		"	"	
1	F-3	"	"	"	"	"	"	"	385		"	"	
2	G-3	"	"	"	"	"	"	"	347		"	"	
2	G-4	"	"	"	"	"	"	1.02	263		"	16.76	
1	G-3	"	"	"	"	"	"	0.85	283		"	17.03	
1	G-4	"	"	"	"	"	"	1.10	246		"	14.60	
3	WP	"	"	"	"	"	"	0.747	253		"	19.50	
4	"	"	"	"	"	"	"	1.10	220		"	14.60	
2	G-6	"	"	"	"	"	"	"	206		"	"	
2	G-5	"	"	"	"	"	"	"	327		"	"	
1	"	"	"	"	"	"	"	"	217		"	"	
1	G-6	"	"	"	"	"	"	0.85	285		"	17.03	
5	EP	"	"	"	"	"	"	0.90	296		"	16.76	
6	"	"	"	"	"	"	"	"	307		"	"	
1	F-5	"	"	"	"	"	"	1.20	212		"	12.15	
1	F-6	"	"	"	"	"	"	1.43	153		"	10.15	
3	F-5	"	"	"	"	"	"	"	188		"	"	

PILE NO.	ROW	WEIGHT OF HAMMER	LENGTH OF PILE	SIZE OF BUTT	SIZE OF POINT	TOTAL PENETRATION	LAST-BLOWS AVER-FALL	LAST-BLOWS PENETRATION	TOTAL BLOWS	AVER. HEIGHT	ELEV. OF CUTOFF	CARRYING CAPACITY IN TONS	REMARKS
2	F-5	5000 lbs.	60'-6"	16"	9"	60.5"	35"	1.02"	289		115.5'	14.30	Raymond Pile used
2	F-6	"	"	"	"	"	"	1.30	178		"	11.20	All Piles driven to
3	"	"	"	"	"	"	"	1.43	149		"	10.15	ground Elev. at head
1	E-5	"	"	"	"	"	"	"	197		"	"	
2	E-6	"	"	"	"	"	"	"	188		"	"	
1	"	"	"	"	"	"	"	1.20	177		"	12.15	
2	E-5	"	"	"	"	"	"	"	219		"	"	
3	"	"	"	"	"	"	"	1.10	168		"	14.60	
3	E-6	"	"	"	"	"	"	1.20	214		"	12.15	
1	D-5	"	"	"	"	"	"	"	282		"	"	
2	D-6	"	"	"	"	"	"	1.33	176		"	10.15	
1	D-6	"	"	"	"	"	"	1.60	201		"	9.12	
3	D-5	"	"	"	"	"	"	1.20	295		"	12.15	
2	"	"	"	"	"	"	"	1.02	292		"	14.30	
3	D-6	"	"	"	"	"	"	1.43	188		"	10.20	
1	SP	"	"	"	"	"	"	0.90	277		"	16.76	
1	C-5	"	"	"	"	"	"	1.30	262		"	11.20	
2	C-6	"	"	"	"	"	"	1.02	355		"	14.30	
1	"	"	"	"	"	"	"	0.85	358		"	17.03	
3	C-5	"	"	"	"	"	"	1.02	278		"	14.30	
2	"	"	"	"	"	"	"	1.20	306		"	12.15	
3	C-6	"	"	"	"	"	"	0.76	389		"	20.00	
1	B-6	"	"	"	"	"	"	1.20	297		"	12.15	
2	"	"	"	"	"	"	"	"	304		"	"	
3	"	"	"	"	"	"	"	1.30	323		"	11.20	
1	B-5	"	"	"	"	"	"	"	274		"	"	
2	"	"	"	"	"	"	"	1.33	276		"	10.15	
3	"	"	"	"	"	"	"	1.30	301		"	11.20	
1	A-6	"	"	"	"	"	"	1.02	239		"	14.30	
1	A-5	"	"	"	"	"	"	1.30	152		"	11.20	
2	A-6	"	"	"	"	"	"	1.20	196		"	12.15	
2	A-5	"	"	"	"	"	"	1.33	184		"	10.15	
6	WP	"	"	"	"	"	"	1.30	228		"	11.20	
5	"	"	"	"	"	"	"	1.33	170		"	10.15	
1	A-7	"	"	"	"	"	"	1.43	199		"	"	
1	A-8	"	"	"	"	"	"	"	231		"	"	
2	A-7	"	"	"	"	"	"	"	197		"	"	
2	A-8	"	"	"	"	"	"	"	259		"	"	
7	EP	"	"	"	"	"	"	"	200		"	"	
8	"	"	"	"	"	"	"	"	203		"	"	
3	B-8	"	"	"	"	"	"	1.30	277		"	11.20	
1	"	"	"	"	"	"	"	"	213		"	"	
2	B-7	"	"	"	"	"	"	"	211		"	"	
1	"	"	"	"	"	"	"	"	224		"	"	
2	B-8	"	"	"	"	"	"	1.20	262		"	12.15	
3	B-7	"	"	"	"	"	"	1.02	219		"	14.30	
3	C-7	"	"	"	"	"	"	0.76	459		"	20.00	
2	C-8	"	"	"	"	"	"	0.731	352		"	19.95	

PILE NO.	ROW	WEIGHT OF HAMMER	LENGTH OF PILE	SIZE OF BUTT	SIZE OF POINT	TOTAL PENETRATION	LAST-BLOWS AVER-FALL	LAST-BLOWS PENETRATION	TOTAL BLOWS	AVER. HEIGHT	ELEV. OF CUTOFF	CARRYING CAPACITY IN TONS	REMARKS
3	C-8	5000 lbs.	60'-6"	16"	9"	60.5"	35"	0.747	408		115.5'	19.50	Raymond Pile used
1	C-7	"	"	"	"	"	"	0.85	351		"	17.03	All Piles driven to
2	"	"	"	"	"	"	"	0.671	436		"	21.75	ground Elev. at head.
1	C-8	"	"	"	"	"	"	1.10	268		"	14.60	
3	SP	"	"	"	"	"	"	1.20	195		"	12.15	
2	"	"	"	"	"	"	"	1.02	272		"	14.30	
3	D-7	"	"	"	"	"	"	1.20	236		"	12.15	
2	D-8	"	"	"	"	"	"	1.30	240		"	11.20	
3	"	"	"	"	"	"	"	"	212		"	"	
1	D-7	"	"	"	"	"	"	1.43	192		"	10.20	
2	"	"	"	"	"	"	"	1.30	210		"	11.20	
1	D-8	"	"	"	"	"	"	1.43	206		"	10.20	
3	E-7	"	"	"	"	"	"	"	213		"	"	
2	E-8	"	"	"	"	"	"	1.10	224		"	14.60	
3	"	"	"	"	"	"	"	1.30	164		"	11.20	
1	E-7	"	"	"	"	"	"	"	165		"	"	
2	E-7	"	"	"	"	"	"	"	196		"	"	
1	E-8	"	"	"	"	"	"	0.90	290		"	16.76	
3	F-7	"	"	"	"	"	"	1.30	237		"	11.20	
2	F-8	"	"	"	"	"	"	"	180		"	"	
1	F-7	"	"	"	"	"	"	"	282		"	"	
2	"	"	"	"	"	"	"	"	204		"	"	
2	G-7	"	"	"	"	"	"	"	236		"	"	
2	G-8	"	"	"	"	"	"	"	240		"	"	
1	G-7	"	"	"	"	"	"	1.10	260		"	14.60	
1	G-8	"	"	"	"	"	"	"	264		"	"	
8	WP	"	"	"	"	"	"	0.645	417		"	22.60	
7	"	"	"	"	"	"	"	0.85	338		"	17.03	
1	F-8	"	"	"	"	"	"	1.30	284		"	11.20	
3	"	"	"	"	"	"	"	"	196		"	"	
2	G-10	"	"	"	"	"	"	1.10	264		"	14.60	
2	G-9	"	"	"	"	"	"	1.30	169		"	11.20	

Drawn by
Traced by H.F.B.
Checked by
Supervised by
In Charge

Sheet 1 of 2

P.W. Drawing No.
981-19-3

U.S. NAVY YARD BOSTON, MASS.
NAVAL DRY DOCK 50. BOSTON

BUILDING NO. 19.
TEMPORARY STOREHOUSE
PILE RECORD PLAN

Approved 1942

Public Works Officer

Copied from Pile Record Cards March & April 1941

PILE NO.	PILE ROW	WEIGHT OF HAMMER	LENGTH OF PILE	SIZE OF BUTT	SIZE OF POINT	TOTAL PENETRATION	LAST-BLOWS AVER. FALL	LAST-BLOWS PENETRATION	LAST-BLOWS TOTAL BLOWS	AVER. HEIGHT	ELEV. OF CUTOFF	CARRYING CAPACITY IN TONS	REMARKS
1	G-10	5000 lbs.	60'-6"	16"	9"	60.5'	35"	1.30"	205		115.5±	11.20	Raymond Pile used
1	G-9	"	"	"	"	"	"	0.957	251		"	15.25	All Piles driven to ground Elev. at head.
10	WP	"	"	"	"	"	"	1.30	192		"	11.20	
9	"	"	"	"	"	"	"	0.85	296		"	17.03	
1	F-9	"	"	"	"	"	"	1.20	229		"	12.15	
1	F-10	"	"	"	"	"	"	1.30	189		"	11.20	
3	F-9	"	"	"	"	"	"	"	244		"	"	
3	F-10	"	"	"	"	"	"	"	157		"	"	
2	"	"	"	"	"	"	"	"	216		"	"	
2	F-9	"	"	"	"	"	"	1.10	256		"	14.60	
2	E-10	"	"	"	"	"	"	1.30	207		"	11.20	
1	"	"	"	"	"	"	"	"	182		"	"	
2	E-9	"	"	"	"	"	"	"	180		"	"	
3	E-10	"	"	"	"	"	"	"	230		"	"	
1	D-9	"	"	"	"	"	"	1.20	"		"	12.15	
1	E-9	"	"	"	"	"	"	1.43	181		"	10.20	
2	D-10	"	"	"	"	"	"	0.85	294		"	17.03	
1	"	"	"	"	"	"	"	0.957	262		"	15.25	
2	D-9	"	"	"	"	"	"	1.30	205		"	11.20	
3	"	"	"	"	"	"	"	0.957	283		"	15.25	
3	E-9	"	"	"	"	"	"	1.30	215		"	11.20	
3	D-10	"	"	"	"	"	"	"	257		"	"	
1	C-9	"	"	"	"	"	"	1.02	229		"	14.30	
2	C-10	"	"	"	"	"	"	1.20	227		"	12.15	
1	"	"	"	"	"	"	"	0.957	289		"	15.25	
3	C-9	"	"	"	"	"	"	0.85	390		"	17.03	
2	"	"	"	"	"	"	"	0.957	381		"	15.25	
3	C-10	"	"	"	"	"	"	0.514	580		"	28.50	
1	E-9												Redriven
1	B-9	5000 lbs.	60'-6"	16"	9"	60.5'	35"	1.30"	249		115.5±	11.20	
2	B-10	"	"	"	"	"	"	"	225		"	"	
3	"	"	"	"	"	"	"	"	208		"	"	
3	B-9	"	"	"	"	"	"	"	220		"	"	
1	B-10	"	"	"	"	"	"	1.43	270		"	10.20	
2	B-9	"	"	"	"	"	"	1.30	299		"	11.20	
2	A-9	"	"	"	"	"	"	"	183		"	"	
2	A-10	"	"	"	"	"	"	1.43	196		"	10.20	
1	"	"	"	"	"	"	"	"	188		"	"	
1	A-9	"	"	"	"	"	"	"	182		"	"	
10	EP	"	"	"	"	"	"	1.60	203		"	9.12	
9	"	"	"	"	"	"	"	1.20	186		"	12.15	
1	A-11	"	"	"	"	"	"	1.43	207		"	10.20	
1	A-12	"	"	"	"	"	"	"	152		"	"	
2	"	"	"	"	"	"	"	1.60	186		"	9.12	
2	A-11	"	"	"	"	"	"	"	151		"	"	
11	EP	"	"	"	"	"	"	0.671	157		"	"	
12	"	"	"	"	"	"	"	"	168		"	"	
3	B-11	"	"	"	"	"	"	1.20	245		"	12.15	
2	B-12	"	"	"	"	"	"	1.30	226		"	11.20	
3	"	"	"	"	"	"	"	"	251		"	"	
2	B-11	"	"	"	"	"	"	"	322		"	"	
1	"	"	"	"	"	"	"	0.85	283		"	17.03	
1	B-12	"	"	"	"	"	"	0.90	294		"	16.22	
3	C-11	"	"	"	"	"	"	0.76	387		"	19.20	
2	C-12	"	"	"	"	"	"	1.30	276		"	11.20	
1	"	"	"	"	"	"	"	"	232		"	"	
1	C-11	"	"	"	"	"	"	0.60	384		"	24.40	
2	"	"	"	"	"	"	"	0.747	"		"	19.50	
3	C-12	"	"	"	"	"	"	1.10	211		"	14.60	

PILE NO.	PILE ROW	WEIGHT OF HAMMER	LENGTH OF PILE	SIZE OF BUTT	SIZE OF POINT	TOTAL PENETRATION	LAST-BLOWS AVER. FALL	LAST-BLOWS PENETRATION	LAST-BLOWS TOTAL BLOWS	AVER. HEIGHT	ELEV. OF CUTOFF	CARRYING CAPACITY IN TONS	REMARKS
3	D-11	5000 lbs.	60'-6"	16"	9"	60.5'	35"	1.10"	207		115.5±	14.60	Raymond Pile used
2	D-12	"	"	"	"	"	"	1.60	150		"	9.12	All Piles driven to ground Elev. at head
3	"	"	"	"	"	"	"	1.20	199		"	12.15	
1	D-11	"	"	"	"	"	"	0.90	323		"	16.76	
2	"	"	"	"	"	"	"	1.02	275		"	14.30	
1	D-12	"	"	"	"	"	"	1.30	194		"	11.20	
3	E-11	"	"	"	"	"	"	1.10	229		"	14.60	
3	E-12	"	"	"	"	"	"	1.30	244		"	11.20	
2	"	"	"	"	"	"	"	0.90	251		"	16.76	
1	E-11	"	"	"	"	"	"	1.10	235		"	14.60	
2	"	"	"	"	"	"	"	1.30	242		"	11.20	
1	E-12	"	"	"	"	"	"	0.957	306		"	15.25	
3	F-11	"	"	"	"	"	"	1.30	237		"	11.20	
3	F-12	"	"	"	"	"	"	1.60	195		"	9.12	
2	"	"	"	"	"	"	"	"	179		"	"	
2	F-11	"	"	"	"	"	"	0.957	284		"	15.25	
1	"	"	"	"	"	"	"	1.30	282		"	11.20	
1	F-12	"	"	"	"	"	"	0.957	247		"	15.25	
2	G-12	"	"	"	"	"	"	1.30	268		"	11.20	
2	G-11	"	"	"	"	"	"	1.00			"	14.60	
1	G-12	"	"	"	"	"	"	"	234		"	"	
1	G-11	"	"	"	"	"	"	0.86	285		"	15.30	
12	W.P	"	"	"	"	"	"	1.33	164		"	10.20	
11	"	"	"	"	"	"	"	1.50	201		"	9.10	
1	C-14	"	"	"	"	"	"	0.50	511		"	23.00	
13	EP	"	"	"	"	"	"	1.43	166		"	10.20	
14	"	"	"	"	"	"	"	1.60	188		"	9.12	
2	A-13	"	"	"	"	"	"	1.43	205		"	10.20	
2	A-14	"	"	"	"	"	"	1.81	130		"	7.81	
1	A-13	"	"	"	"	"	"	1.43	185		"	10.20	
1	A-14	"	"	"	"	"	"	1.60	183		"	9.12	
3	B-14	"	"	"	"	"	"	1.10	263		"	14.60	
3	B-13	"	"	"	"	"	"	1.30	182		"	11.20	
1	C-14	"	"	"	"	"	"	0.85	308		"	17.03	
1	B-13	"	"	"	"	"	"	1.30	273		"	11.20	
2	"	"	"	"	"	"	"	"	216		"	"	
2	C-14	"	"	"	"	"	"	0.957	501		"	15.25	
3	"	"	"	"	"	"	"	0.90	442		"	16.76	
3	C-13	"	"	"	"	"	"	1.30	217		"	11.20	
1	"	"	"	"	"	"	"	"	267		"	"	
2	"	"	"	"	"	"	"	0.70	393		"	20.00	
2	A-14												Redriven
2	B-14	5000 lbs.	60'-6"	16"	9"	60.5'	35"	1.30"	396		"	11.20	
1	"	"	"	"	"	"	"	"	298		"	"	
3	D-13	"	"	"	"	"	"	"	167		"	"	
2	D-14	"	"	"	"	"	"	"	183		"	"	
3	"	"	"	"	"	"	"	1.43	148		"	10.20	
1	D-13	"	"	"	"	"	"	1.30	172		"	11.20	
1	D-14	"	"	"	"	"	"	1.10	273		"	14.60	
2	D-13	"	"	"	"	"	"	1.43	176		"	10.20	
3	E-13	"	"	"	"	"	"	0.96	237		"	15.30	
2	E-14	"	"	"	"	"	"	1.30	265		"	11.20	
3	"	"	"	"	"	"	"	"	196		"	"	
1	E-13	"	"	"	"	"	"	1.40	232		"	10.20	
2	"	"	"	"	"	"	"	0.90	336		"	16.80	
1	E-14	"	"	"	"	"	"	0.92	289		"	14.30	
3	E-13	"	"	"	"	"	"	0.85	293		"	15.30	
2	F-14	"	"	"	"	"	"	1.00	266		"	14.20	
3	"	"	"	"	"	"	"	0.92	256		"	14.30	

PILE NO.	PILE ROW	WEIGHT OF HAMMER	LENGTH OF PILE	SIZE OF BUTT	SIZE OF POINT	TOTAL PENETRATION	LAST-BLOWS AVER. FALL	LAST-BLOWS PENETRATION	LAST-BLOWS TOTAL BLOWS	AVER. HEIGHT	ELEV. OF CUTOFF	CARRYING CAPACITY IN TONS	REMARKS
1	F-13	5000 lbs.	60'-6"	16"	9"	60.5'	35"	0.85"	363		115.5±	15.30	Raymond Pile used
2	"	"	"	"	"	"	"	0.75	351		"	17.00	All Piles driven to ground Elev. at head
1	F-14	"	"	"	"	"	"	0.92	255		"	14.30	
2	G-14	"	"	"	"	"	"	0.75	343		"	17.00	
2	G-13	"	"	"	"	"	"	1.00	259		"	14.20	
1	"	"	"	"	"	"	"	0.85	360		"	15.30	
1	G-14	"	"	"	"	"	"	0.80	332		"	16.60	
1	W.P.13	"	"	"	"	"	"	0.92	298		"	14.30	
1	W.P.14	"	"	"	"	"	"	1.00	259		"	14.20	
1	W.P.16	"	"	"	"	"	"	0.40	988		"	36.50	
1	W.P.15	"	"	"	"	"	"	0.70	430		"	20.80	
1	G-16	"	"	"	"	"	"	0.76	387		"	20.00	
1	G-15	"	"	"	"	"	"	0.96	358		"	15.20	
1	F-15	"	"	"	"	"	"	1.60	324		"	9.10	
2	G-16	"	"	"	"	"	"	0.85	699		"	17.00	
2	G-15	"	"	"	"	"	"	1.30	379		"	11.20	
2	F-16	"	"	"	"	"	"	1.20	286		"	12.20	
1	"	"	"	"	"	"	"	0.90	280		"	16.70	
3	F-15	"	"	"	"	"	"	"	365		"	"	
2	"	"	"	"	"	"	"	1.10	319		"	14.60	
3	F-16	"	"	"	"	"	"	0.67	401		"	21.70	
1	E-15	"	"	"	"	"	"	0.95	290		"	15.30	
2	E-16	"	"	"	"	"	"	0.85	266		"	17.00	
1	"	"	"	"	"	"	"	0.70	437		"	20.20	
3	E-15	"	"	"	"	"	"	1.30	281		"	11.20	
2	"	"	"	"	"	"	"	0.90	283		"	16.70	
3	E-16	"	"	"	"	"	"	0.95	315		"	15.30	
1	D-15	"	"	"	"	"	"	1.10	264		"	14.60	
2	D-16	"	"	"	"	"	"	"	285		"	"	
1	"	"	"	"	"	"	"	0.95	323		"	15.30	
3	D-15	"	"	"	"	"	"	1.10	333		"	14.60	
2	"	"	"	"	"	"	"	"	367		"	"	
3	D-16	"	"	"	"	"	"	0.70	442		"	20.20	
1	NP	"	"	"	"	"	"	0.95	399		"	15.30	
2	"	"	"	"	"	"	"	1.10	375		"	14.60	
3	"	"	"	"	"	"	"	0.85	438		"	17.00	
1	C-15	"	"	"	"	"	"	0.63	557		"	19.95	
1	C-16	"	"	"	"	"	"	1.09	220		"	12.20	
3	"	"	"	"	"	"	"	0.75	399		"	17.00	
2	"	"	"	"	"	"	"	0.80	318		"	9.00	
3	C-15	"	"	"	"	"	"	0.40	642		"	30.00	
2	"	"	"	"	"	"	"	0.41	585		"	28.50	
1	B-15	"	"	"	"	"	"	0.92	284		"	14.30	
2	B-16	"	"	"	"	"	"	1.09	242		"	12.20	
1	"	"	"	"	"	"	"	1.20	216		"	11.20	
3	B-15	"	"	"	"	"	"	1.00	294		"	14.60	
2	"	"	"	"	"	"	"	"	279		"	"	
3	B-16	"	"	"	"	"	"	1.09	228		"	12.20	
1	A-15	"	"	"	"	"	"	1.71	156		"	7.80	
1	A-16	"	"	"	"	"	"	"	139		"	"	
2	A-15	"	"	"	"	"	"	"	149		"	"	
2	A-16	"	"	"	"	"	"	2.00	118		"	7.00	
1	ERIS	"	"	"	"	"	"	1.71	146		"	7.80	
1	EP-16	"	"	"	"	"	"	"	149		"	"	
18	WP	"	"	"	"	"	"	0.60	421		"	24.30	
1	G-18	"	"	"	"	"	"	0.85	326		"	17.00	
1	G-17	"	"	"	"	"	"	1.10	309		"	14.60	
17	WP	"	"	"	"	"	"	0.65	457		"	22.60	
2	G-18	"	"	"	"	"	"	0.90	428		"	16.80	

PILE NO.	PILE ROW	WEIGHT OF HAMMER	LENGTH OF PILE	SIZE OF BUTT	SIZE OF POINT	TOTAL PENETRATION	LAST-BLOWS AVER. FALL	LAST-BLOWS PENETRATION	LAST-BLOWS TOTAL BLOWS	AVER. HEIGHT	ELEV. OF CUTOFF	CARRYING CAPACITY IN TONS	REMARKS
2	G-17	5000 lbs.	60'-6"	16"	9"	60.5'	35"	0.65"	422		115.5±	22.60	Raymond Pile used
1	F-17	"	"	"	"	"	"	0.90	396		"	16.80	All Piles driven to ground Elev. at head
3	"	"	"	"	"	"	"	"	282		"	"	
2	"	"	"	"	"	"	"	"	349		"	"	
3	F-18	"	"	"	"	"	"	0.70	370		"	20.20	
1	E-17	"	"	"	"	"	"	0.90	330		"	16.80	
1	F-18	"	"	"	"	"	"	"	367		"	"	
2	E-18	"	"	"	"	"	"	1.10	292		"	12.20	
1	"	"	"	"	"	"	"	0.70	508		"	20.20	
3	E-17	"	"	"	"	"	"	0.90	347		"	16.80	
2	"	"	"	"	"	"	"	0.96	364		"	15.30	
2	F-18	"	"	"	"	"	"	0.70	564		"	20.20	
3	E-18	"	"	"	"	"	"	"	415		"	"	
1	D-17	"	"	"	"	"	"	"	429		"	"	
2	D-18	"	"	"	"	"	"	1.30	313		"	11.20	
1	"	"	"	"	"	"	"	0.90	383		"	16.80	
3	D-17	"	"	"	"	"	"	1.10	326		"	14.60	
2	"	"	"	"	"	"	"	0.85	407		"	17.00	
3	D-18	"	"	"	"	"	"	0.70	474		"	20.20	
1	C-17	"	"	"	"	"	"	0.73	554		"	19.95	
2	C-18	"	"	"	"	"	"	1.30	228		"	11.20	
3	C-17	"	"	"	"	"	"	0.487	981		"	29.97	
2	"	"	"	"	"	"	"	0.70	535		"	20.20	
1	C-18	"	"	"	"	"	"	0.58	620		"	25.20	
3	"	"	"	"	"	"	"	0.73	358		"	19.95	
1	B-17	"	"	"	"	"	"	1.20	256		"	12.20	
1	B-18	"	"	"	"	"	"	1.40	258		"	10.20	
2	"	"	"	"	"	"	"	1.30	256		"	11.20	
3	B-17	"	"	"	"	"	"	1.60	219		"	9.20	
3	B-18	"	"	"	"	"	"	"	192		"	"	
2	B-17	"	"	"	"	"	"	1.80	184		"	7.80	
1	A-17	"	"	"	"	"	"	1.30	191		"	11.20	
1	A-18	"	"	"	"	"	"	"	146		"	"	
2	"	"	"	"	"	"	"	1.60	151		"	9.20	
2	A-17	"	"	"	"	"	"	1.30	150		"	11.20	
18	EP	"	"	"	"	"	"	1.80	134		"	7.80	
17	"	"	"	"	"	"	"	1.60	167		"	9.20	
2	A-19	"	"	"	"	"	"	1.10	225		"	14.60	
1	"	"	"	"	"	"	"	1.30	237		"	11.20	
19	EP	"	"	"	"	"	"	"	136		"	"	
3	B-19	"	"	"	"	"	"	"	408		"	"	
1	"	"	"	"	"	"	"	"	193		"	"	
2	"	"	"	"	"	"	"	"	184		"	"	
3	C-19	"	"	"	"	"	"	0.96	330		"	15.30	
1	"	"	"	"	"	"	"	0.65	419		"	22.60	
2	"	"	"	"	"	"	"	0.40	706		"	30.00	
1	B-19												Redriven
3	D-19	5000 lbs.	60'-6"	16"	9"	60.5'	35"	0.90	384		115.5±	16.80	
1	"	"	"	"	"	"	"	0.58	535		"	19.00	
2	"	"	"	"	"	"	"	0.50	739		"	30.00	
3	E-19	"	"	"	"	"	"	0.73	485		"	19.95	
1	"	"	"	"	"	"	"	0.90	390		"	16.80	
2	"	"	"	"	"	"	"	0.67	506		"	21.80	
3	F-19	"	"	"	"	"	"	0.70	440		"	20.20	
1	"	"	"	"	"	"	"	0.76	381		"	19.80	
2	"	"	"	"	"	"	"	0.70	501		"	20.20	
2	G-19	"	"	"	"	"	"	0.75	358		"	19.05	
1	"	"	"	"	"	"	"	0.65	476		"	22.60	
19	WP	"	"	"	"	"	"	0.67	463		"	21.80	

Drawn By H.F.B.
Traced By
Checked By
Supervised By
In Charge

Sheet 2 of 2

P W Drawing No.

981-19-4

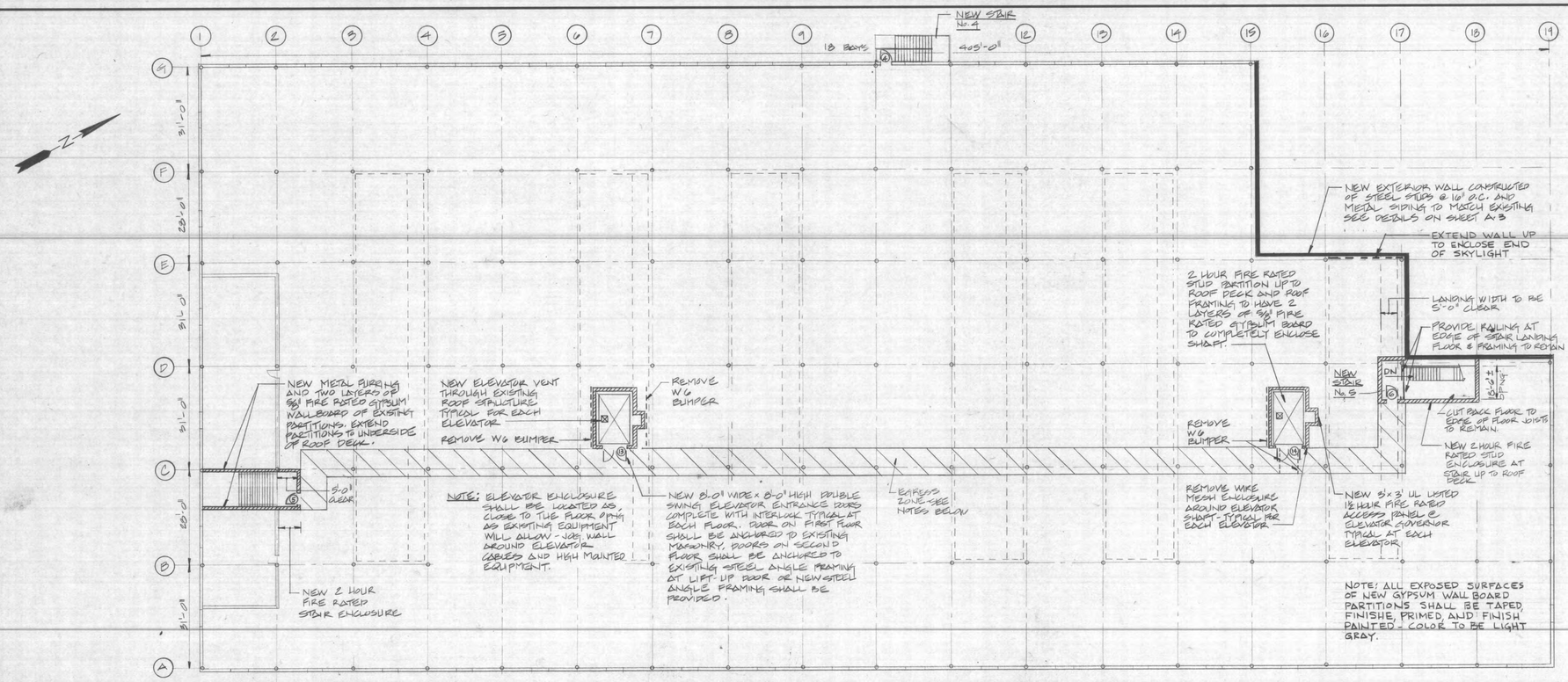
U.S. NAVY YARD BOSTON, MASS.
NAVAL DRY DOCK SO. BOSTON

BUILDING NO. 19
TEMPORARY STOREHOUSE
PILE RECORD PLAN

Approved 1942

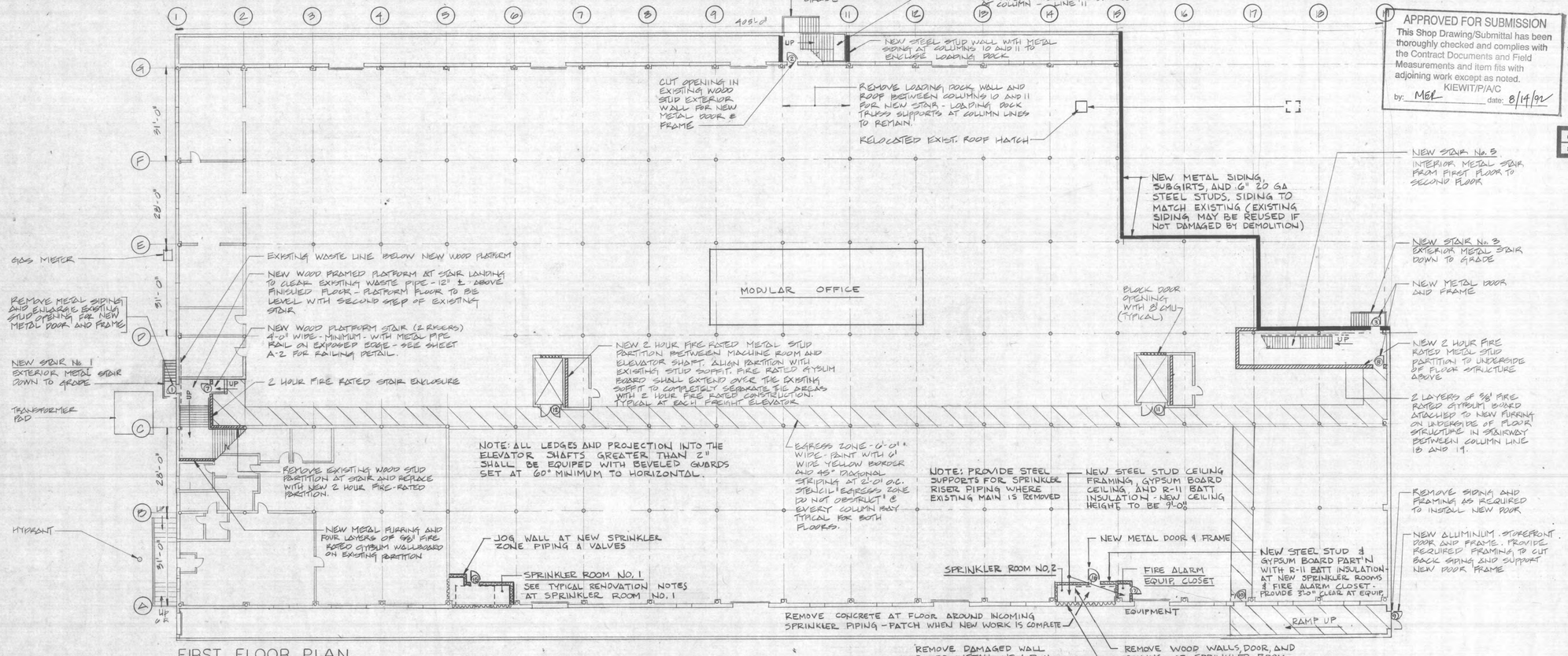
Public Works Officer

Copied from Pile Record Cards March & April 1941



SECOND FLOOR PLAN

SCALE: 1/16" = 1'-0"



FIRST FLOOR PLAN

SCALE: 1/16" = 1'-0"

DOOR NOTES AND HARDWARE SCHEDULE

1. ALL STEEL DOORS AND FRAMES SHALL BE FABRICATED IN ACCORDANCE WITH THE STEEL DOOR INSTITUTE SDOI-100 STANDARD STEEL DOORS AND FRAMES."
2. FIRE LABELED DOORS FRAMES AND HARDWARE SHALL BE FABRICATED AND INSTALLED IN ACCORDANCE WITH NFPA 80.
3. ALL STEEL DOORS SHALL BE 3⅝" WIDE & FLUSH DOORS
4. DOOR No. 9 SHALL BE A FULL GLAZED ALUMINUM FRAME STOREFRONT DOOR WITH GLAZED TRANSOM PANEL. TOP OF TRANSOM SHALL BE 9'-6" FROM SILL AND SHALL ATTACH TO EXISTING FRAMING. ADDITIONAL FRAMING SHALL BE PROVIDED AT DOOR JAMBS PER DOOR MANUFACTURERS RECOMANDATIONS. GLAZING SHALL BE ¼" TEMPERED WIRE GLASS.
5. DOOR SCHEDULE: DOORS SHALL RECEIVE THE FOLLOWING HARDWARE.

DOORS 1, 2, 3, AND 4
3'-2" WIDE x 7'-0" HIGH STEEL DOORS
1½ PAIR HINGES A111
1 EXIT DEVICE FUNCTION 04
1 DOOR CLOSER
1 ALUMINUM THRESHOLD

DOORS 5, 6, 7, 8, 10
3'-2" WIDE x 7'-0" HIGH STEEL DOORS
1½ HOUR U.L. LISTED RATING
1½ PAIR HINGES A111
1 EXIT DEVICE FUNCTION 04
1 DOOR CLOSER
1 DOOR STOP

DOOR 9
2'-5'-0" WIDE x 7'-0" HIGH
ALUMINUM STOREFRONT
2 EXIT DEVICES 04
2 DOOR CLOSERS
1 ALUMINUM THRESHOLD

DOORS 11, 12, 13, AND 14
2-4'-0" WIDE x 8'-0" HIGH
1½ HOUR UL. LISTED RATING
3 PAIR HINGES A111
1 LATCHSET WITH INTERLOCK
1 DOOR CLOSER

DOORS 15, 16, AND 17
3'-2" WIDE x 7'-0" HIGH
STEEL DOOR AND FRAME
1½ PAIR HINGES
1 LATCHSET
1 DOORSTOP

CENTRAL ARTERY/TUNNEL
Permission To Proceed Does Not Constitute Acceptance Or Approval Of Design Details, Calculations, Analysis, Test Methods Or Materials Developed Or Selected By The Contractor/Supplier And Does Not Relieve The Contractor/Supplier From Full Compliance With Contractual Requirements.

1.	WORK MAY PROCEED
2R.	WORK MAY PROCEED SUBJECT TO THE CHANGES INDICATED, RESUBMITTAL - NOT REQUIRED
3R.	WORK MAY PROCEED SUBJECT TO THE CHANGES INDICATED, RESUBMITTAL - REQUIRED
3.	REVISE AND RESUBMIT, WORK MAY NOT PROCEED
4.	FOR INFORMATION ONLY

REVIEWER: _____ Signature _____ Date _____ Company

NOTE: NEW TWO HOUR PARTITIONS TO BE CONSTRUCTED OF 3½" STEEL STUDS WITH TWO LAYERS OF 5/8" FIRE-RATED GYPSUM BOARD ON EACH SIDE WITH JOINTS STAGGERED AND ALL OPENINGS, PENETRATIONS, AND EDGES SEALED WITH FIRE-RATED SEALANT. FOLLOW MANUFACTURER'S REQUIREMENTS FOR 2 HOUR FIRE-RATED PARTITIONS.

APPROVED FOR SUBMISSION
This Shop Drawing/Submittal has been thoroughly checked and complies with the Contract Documents and Field Measurements and item fits with adjoining work except as noted.
KIEWIT/P/A/C
by: MBR date: 8/14/92

MAXIMUM OCCUPANCY
200 PEOPLE

Contract No. 92533-C04A2 | Submittal 0018
Specification Section 748 -000 | Paragraph 748.06C

REV	DESCRIPTION	DR BY	CKD BY	APPD BY	DATE

ABR alonzo b. reed, inc
architects – engineers – planners
boston massachusetts

SUBMITTED

KIEWIT EASTERN CO.

TOWLE BUILDING RENOVATIONS

FLOOR PLANS

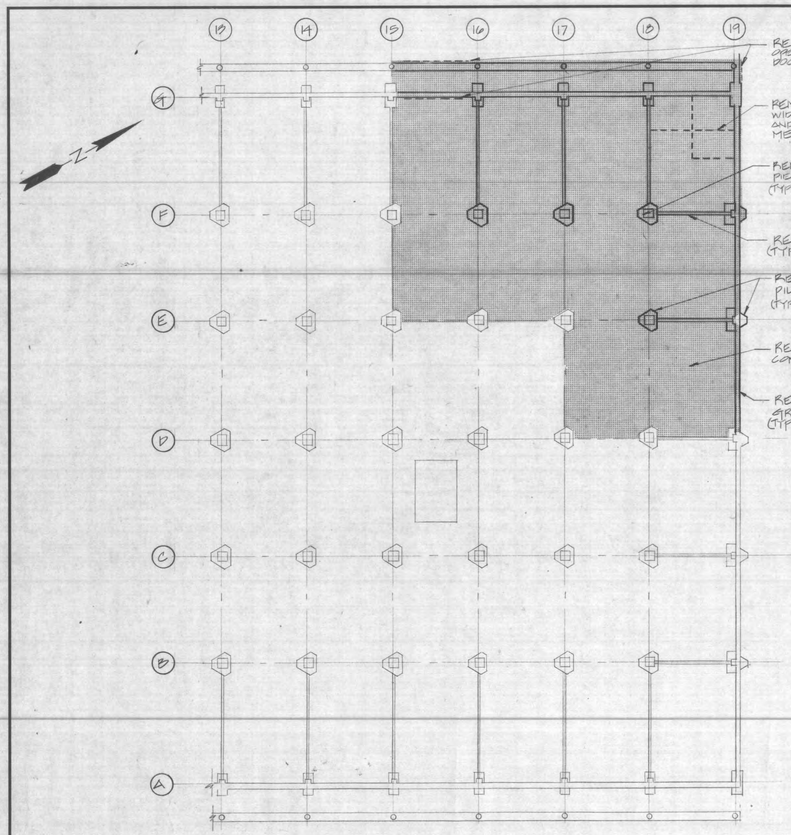
ARCHITECTURAL

SCALE	PROJECT NO.	DRAWING NO.
AS NOTED	850-1	A-1
DATE 15 JUNE 1992		
DES. BY RPB / DR. BY RDD / CHKD BY RPB	SHEET 2 OF 9	

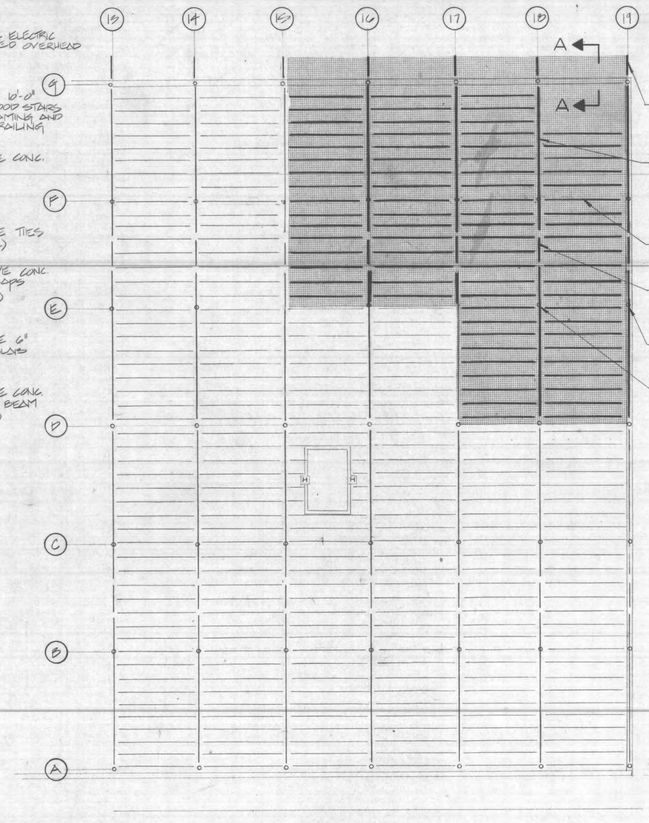
PLOT ORIGIN = 0,0 DRAWING SCALE = FULL

ZZABROOE.DWG

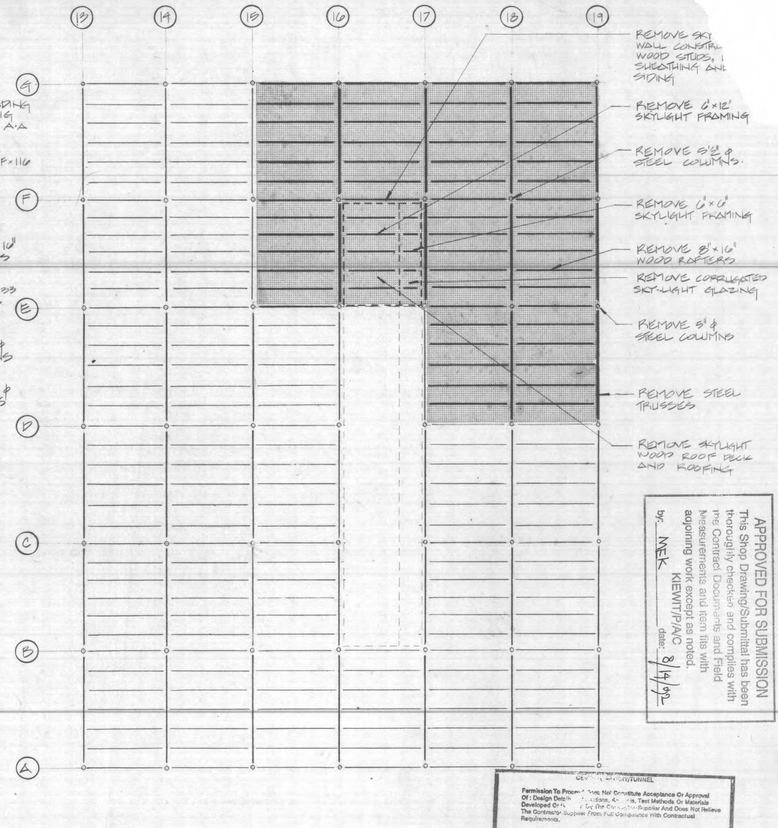
B19
2 of 9



FOUNDATION PART PLAN
SCALE: 1/16" = 1' - 0"



SECOND FLOOR FRAMING PART PLAN
SCALE 1/16" = 1' - 0"



ROOF FRAMING PART PLAN
SCALE: 1/16" = 1' - 0"

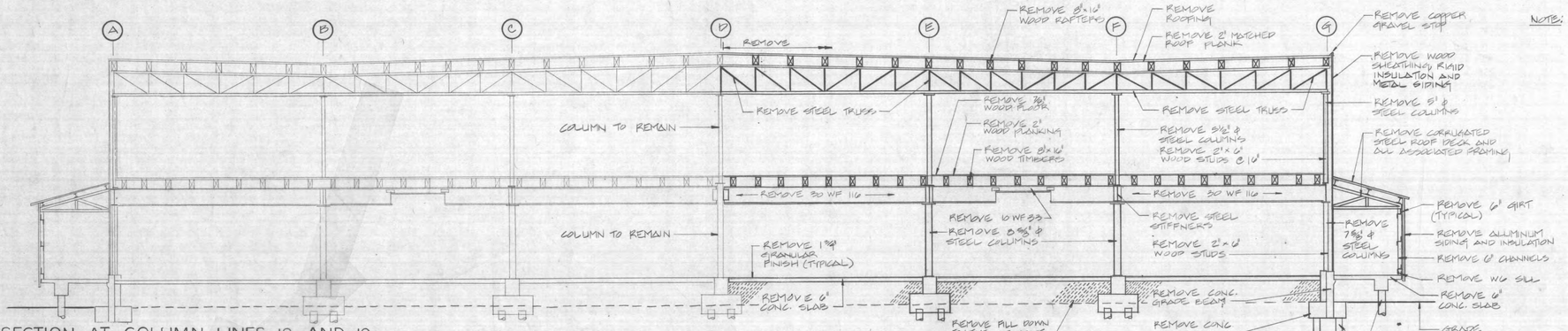
APPROVED FOR SUBMISSION
This Shop Drawing/Submittal has been thoroughly checked and complies with the Contract Documents and Field Measurements and item fits with adjoining work except as noted.
by: MEK KIEWIT/P&C date: 8/14/92

Permission To Proceed Does Not Constitute Acceptance Or Approval Of Design Details, Calculations, Test Methods Or Materials Developed Or Selected By the Contractor-Supplier And Does Not Relieve The Contractor-Supplier From Full Compliance With Contractual Requirements.

1. REVISE AND RESUBMIT AS NOTED. PROCEED TO FABRICATE OR INSTALL AS NOTED. RESUBMIT AS NOTED. DO NOT PROCEED.
2. REVISE AND RESUBMIT. DO NOT PROCEED.
3. REJECTED. SEE REMARKS.
4. FOR INFORMATION ONLY.

REMARKS: Signature Date Company

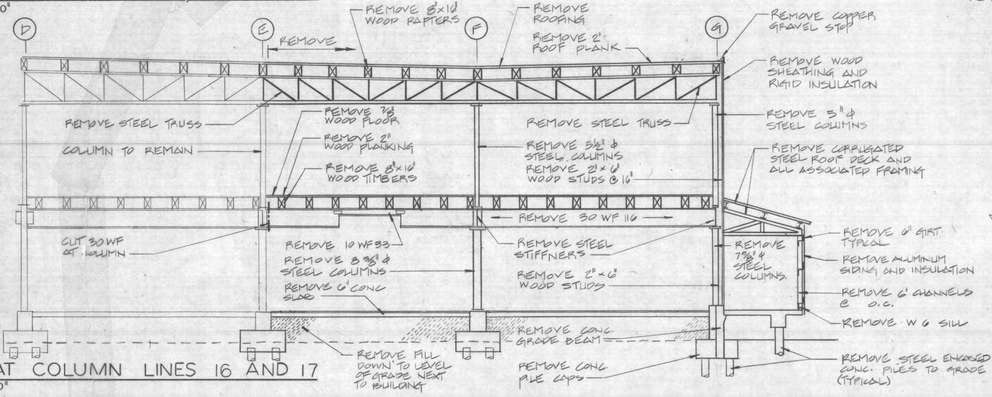
Contract No. 92533-C0A2 Submittal 001B
Specification Section 748 - 000 Paragraph 746 EOC



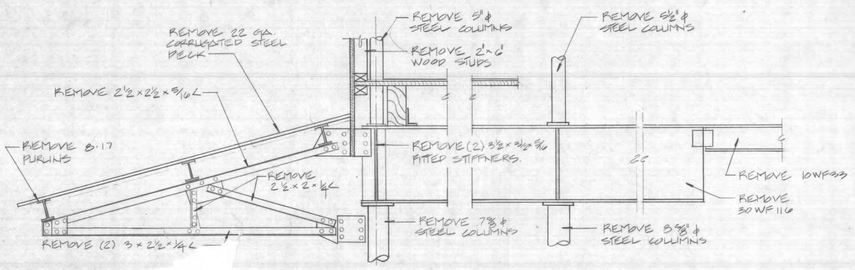
SECTION AT COLUMN LINES 18 AND 19
SCALE 1/8" = 1' - 0"

NOTE: TOP OF PILES AT ELEVATION 113.5 ±

NOTE: STEEL ROOF TRUSSES HAVE RIVETED CONNECTIONS. 30 WF FLOOR FRAMING MEMBERS HAVE BOLTED CONNECTION



SECTION AT COLUMN LINES 16 AND 17
SCALE 1/8" = 1' 0"



SECTION A-A
SCALE: 1/2" = 1' - 0"

REV.	DESCRIPTION	DR BY	CKD BY	APPD BY	DATE

ABR alonzo b. reed, inc
architects – engineers – planners
boston massachusetts

SUBMITTED

KIEWIT EASTERN CO.

TOWLE BUILDING RENOVATIONS

ARCHITECTURAL/STRUCTURAL

DEMOLITION

SCALE AS NOTED	PROJECT NO. 850-1	DRAWING NO. D-1
DATE 15 JUNE 1992		
DES. BY RPB / DR. BY RDD / CHKD BY RPB	SHEET 1 OF 9	

PLOT ORIGIN = 0,0 - DRAWING SCALE = FULL

ZZABRODE.DWG

819 / 89

APPENDIX C

Previous Explorations by Others

Haley & Aldrich, Inc. — TEST BORING LOG — BORING **SB2-70 OW**

PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA
CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS
CONTRACTOR: GZA DRILLING, INC.

CONTRACT : 89374
SHEET NO. : 1 of 5
LOCATION N: 2951487
E : 781395
ELEVATION : 110.3
DATE START: 13-3-90
END : 26-3-90
DRILLER : B. Wordell
INSPECTOR : C. Nowak

GROUNDWATER		DEPTH (ft) OF:			EQUIPMENT	CASING	SAMPLER	CORE
Date	Time	Water	Casing	Hole	Type	HW/NW	S	NV-2
03-14-90	0630	7.0	12.0	12.0	Size I.D.:	4"/3"	1 3/8"	2"
03-15-90	0600	4.5	20.0	80.0	Hammer Wt.:	300#	140#	----
03-23-90	0600	11.65	104.0	114.0	Hammer Fall:	24"	30"	----

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			16 14 9 9	S1	0.5 2.5	12"	110.0 0.3	-BITUMINOUS ASPHALT- Dry, medium dense, brown black COARSE TO FINE SAND, little fine gravel, cinder particles, trace clay, silt. -MISCELLANEOUS FILL-
							106.3 4.0	
5			8 5 3 5	S2	5.0 7.0	12"		Wet, medium stiff, gray SILT and fine sand, some clay, trace brick particles, peat. -COHESIVE FILL-
							103.3 7.0	
10			3 3 1 1	S3	10.0 12.0	11"		Wet, loose, gray FINE SAND, trace shell fragments, peat, clay. -GRANULAR FILL-
							97.8 12.5	
15			2 2 4 6	S4	15.0 17.0	11"		Wet, medium stiff, gray black CLAY and silt, some fine sand, trace brick, shell fragments. -COHESIVE FILL-
20			2 3 3 4	S5	20.0 22.0	18"		Wet, medium stiff, gray CLAY and silt, trace fine sand in occasional partings.
							86.8 23.5	-ORGANIC DEPOSITS-

25 MAY 91

SIT

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY
Overburden: 103.0'
Rock: 11.0'
Samples: S20 C2

BORING **SB2-70 OW**

Haley & Aldrich, Inc.	TEST BORING LOG	BORING **SB2-70 OW**
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 2 of 5

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			4 2 2 3	S6	25.0 27.0	11"		Wet, soft, gray ORGANIC SILT, little clay, trace fine gravel, fine sand, shell fragments, peat. PP = 0.5 TSF.
30			2 1 2 3	S7	30.0 32.0	24"		Wet, soft, gray ORGANIC SILT and clay, trace shell fragments, peat. PP = 1.5 TSF. -ORGANIC DEPOSITS-
							76.8 33.5	
35			4 5 10 18	S8	35.0 37.0	20"		Wet, very stiff, gray CLAY and silt, trace shell fragments, peat. PP = 4.0 TSF.
40			12 13 15 16	S9	40.0 42.0	22"		Wet, very stiff, yellow gray CLAY and silt, trace peat, fine sand in occasional partings. -MARINE DEPOSITS-
45			5 5 4 6	S10	45.0 47.0	4"		Wet, stiff, gray CLAY and silt. PP < 0.25 TSF.
50			3 3 4 6	S11	50.0 52.0	24"		Wet, medium stiff, gray, laminated CLAY and silt, trace fine gravel. NOTE: concretion found in sample.

25 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION

- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY

Overburden:	103.0'
Rock:	11.0'
Samples:	S20 C2

BORING **SB2-70 OW**

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-70 OW
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 3 of 5

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			3 4 4 5	NR	55.0 57.0	0"		No recovery.
60			4 5 5 6	S12	60.0 62.0	18"		Wet, stiff, gray CLAY and silt. PP = 0.25 TSF. -MARINE DEPOSITS-
65			4 4 5 6	S13	65.0 67.0	24"		Wet, stiff, gray CLAY and silt. PP = 0.75 TSF.
70			4 5 7 7	S14	70.0 72.0	24"		DO. except trace fine gravel.
75			WOR 4 4 6	S15	75.0 77.0	24"		Wet, stiff, gray CLAY and silt. PP = 0.5 TSF.
80			2 3 4 4	S16	80.0 82.0	24"		DO. except medium stiff.

25 MAY 91

STP

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION

- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY

Overburden:	103.0'
Rock:	11.0'
Samples:	S20 C2

BORING SB2-70 OW

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-70 OW
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 4 of 5

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			WOR " 6 6	S17	85.0 87.0	24"		Wet, medium stiff, gray CLAY and silt. PP = 0.5 TSF.
90			WOR 5 4 5	S18	90.0 92.0	24"		DO. except stiff.
								-MARINE DEPOSITS-
95			WOR " 26 37	S19	95.0 97.0	24"	14.3 96.0	Wet, very soft, gray CLAY and silt, trace silt in occasional laminae. PP = 0.5 TSF.
								Wet, hard, gray SILT, some fine gravel, little coarse to fine sand, clay.
							10.3	-GLACIOMARINE DEPOSITS-
100			70 61 54 48	S20	100.0 102.0	13"	100.0	Wet, very dense, gray FINE GRAVEL and coarse to fine sand, some silt, little clay.
								-GLACIAL TILL DEPOSITS-
							7.3 103.0	TOP OF BEDROCK 103.0'
105		6 6 5 6 7	100/0" 24%	NR C1	104.0 104.0 104.1 109.0	0" 41"		No recovery. Moderately hard, slightly weathered, moderately fractured, gray, aphanitic ARGILLITE. Bedding very thin, dipping at 45 degrees. Joints close, tight, smooth, planar, dipping parallel to bedding planes. Joint surfaces generally fresh, occasionally oxidized, with frequent calcite coated joints. Occasional high angle to vertical joints.
110		7 6 6 6 6	44%	C2	109.0 114.0	54"		DO. -CAMBRIDGE FORMATION-
							-3.7 114.0	BOTTOM OF EXPLORATION 114.0'

25 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY

Overburden:	103.0'
Rock:	11.0'
Samples:	S20 C2

BORING SB2-70 OW

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-70 OW
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 5 of 5

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
								BOREHOLE GROUTED UPON COMPLETION BPF = BLOWS PER FOOT RQD = ROCK QUALITY DESIGNATION PP = AVERAGE POCKET PENETROMETER READING PNEUMATIC/VIBRATING WIRE PIEZOMETER INSTALLED AT 106.9' 2.0" ID PVC OBSERVATION WELL INSTALLED IN AN ADJACENT SUPPLEMENTAL BOREHOLE AT 20.0'

26 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION

- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY

Overburden: 103.0'
Rock: 11.0'
Samples: S20 C2

BORING SB2-70 OW

Haley & Aldrich, Inc. — TEST BORING LOG — BORING SB2-72

PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA
CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS
CONTRACTOR: GZA DRILLING, INC.

CONTRACT : 89374
SHEET NO. : 1 of 4
LOCATION N: 2951756
E : 781414
ELEVATION : 111.4
DATE START: 14-11-89
END : 15-11-89
DRILLER : P. Wordell
INSPECTOR : J. Gaquin

GROUNDWATER		DEPTH (ft) OF:		
Date	Time	Water	Casing	Hole
NO	READING			

EQUIPMENT	CASING	SAMPLER	CORE
Type	HW	S	----
Size I.D.:	4"	1 3/8"	----
Hammer Wt.:	300#	140#	----
Hammer Fall:	24"	30"	----

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			8 18 24 32	S1	0.3 2.3	18"	111.1 0.3	-BITUMINOUS ASPHALT- Dry, dense, gray COARSE TO FINE SAND and silt, some fine gravel, trace cinders, brick. -GRANULAR FILL-
5			15 8 9 10	S2	5.0 7.0	18"		Moist, medium dense, gray COARSE TO FINE SAND and silt.
							102.9 8.5	
10			1 2 1 2	S3	10.0 12.0	18"		Moist, soft, gray CLAY and silt, trace fine sand in frequent partings. -COHESIVE FILL-
15		4 7	1 WOH 1 1	S4	15.0 17.0	20"		Moist, very soft, gray ORGANIC CLAY and silt, trace organic fibers, fine gravel, fine sand in occasional partings.
		8 8 10						
20		8 22	3 4 5 7	S5	20.0 22.0	1"		Moist, stiff, gray CLAY and silt, trace coarse to fine sand, fine gravel, organic fibers.
		23 20 21					87.9 23.5	-ORGANIC DEPOSITS-

25 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY
Overburden: 107.0'
Rock: 3.6'
Samples: S23

BORING SB2-72

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-72
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 2 of 4

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
		16	1	S6	25.0	18"		Moist, very soft, gray ORGANIC SILT, little fine sand, trace shells, organic fibers.
		28	WOH		27.0			
		27	1					-ORGANIC DEPOSITS-
		28	1					
		29						
30		19	1	S7	30.0	20"		DO.
		26	WOH		32.0			
		26	1					
		35	2				78.4 33.0	
		42						-ORGANIC DEPOSITS-
35		41	3	S8	35.0	22"	75.9	Moist, soft, brown PEAT.
		62	4		37.0		35.5	Moist, stiff, gray CLAY and silt.
		69	8					
			11					-MARINE DEPOSITS-
40			8	S9	40.0	23"		Moist, very stiff, yellow gray, mottled CLAY and silt, trace fine gravel, fine sand in occasional partings.
			11		42.0			
			12					
			13					
45			4	S10	45.0	24"		Moist, stiff, yellow gray, mottled CLAY and silt, trace fine gravel, fine sand in occasional partings.
			4		47.0			
			6					
			6					
50			2	S11	50.0	24"		Moist, medium stiff, gray CLAY and silt, trace fine sand in occasional partings.
			2		52.0			
			3					
			3					

25 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY
Overburden: 107.0'
Rock: 3.6'
Samples: S23

BORING SB2-72

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-72
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 3 of 4

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			3 3 3 5	S12	55.0 57.0	20"		Moist, medium stiff, gray CLAY and silt.
								-MARINE DEPOSITS-
60			2 3 3 5	S13	60.0 62.0	18"		DO.
65			2 2 3 5	S14	65.0 67.0	21"		Moist, medium stiff, gray CLAY and silt, trace fine sand in occasional partings.
70			WOR 2 3 5	S15	70.0 72.0	24"		DO.
75			WOR 2 6 5	S16	75.0 77.0	24"		DO.
80			WOR 2 3 5	S17	80.0 82.0	23"		DO.

26 MAY 91

SNP

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION

- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY

Overburden: 107.0'
Rock: 3.6'
Samples: S23

BORING SB2-72

Haley & Aldrich, Inc. | TEST BORING LOG | BORING **SB2-72**

PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA
CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS

CONTRACT : 89374
SHEET NO. : 4 of 4

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			WOR " 3 3	S18	85.0 87.0	18"		Moist, soft, gray CLAY and silt. -MARINE DEPOSITS-
90			WOR " 2 5	S19	90.0 92.0	24"		DO.
95			WOR " " 5	S20	95.0 97.0	24"		DO. except very soft.
100			4 9 16 21	S21	100.0 102.0	24"	10.4 101.0	Moist, stiff, gray CLAY and silt. Moist, hard, gray CLAY and silt, some coarse to fine sand, trace fine gravel, with cobbles. -GLACIOMARINE DEPOSITS-
105			31 15 21 21	S22	104.6 106.6	2"	7.4 104.0	Moist, dense, gray COARSE GRAVEL. -GLACIAL TILL DEPOSITS- TOP OF BEDROCK 107.0'
110			77 110 122 99/1	S23	109.0 110.6	16"	4.4 107.0 0.8 110.6	-DECOMPOSED BEDROCK- Moist, dense, gray COARSE TO FINE GRAVEL, little coarse to fine sand (angular argillite fragments). BOTTOM OF EXPLORATION 110.6' BOREHOLE GROUTED UPON COMPLETION WOR = WEIGHT OF RODS WOH = WEIGHT OF HAMMER BPF = BLOWS PER FOOT PP = AVERAGE POCKET PENETROMETER READING

25 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY
Overburden: 107.0'
Rock: 3.6'
Samples: S23

BORING **SB2-72**

Haley & Aldrich, Inc. — TEST BORING LOG — BORING SB2-73

PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA
CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS
CONTRACTOR: GZA DRILLING, INC.

CONTRACT : 89374
SHEET NO. : 1 of 5
LOCATION N: 2951847
E : 781477
ELEVATION : 111.4
DATE START: 15-11-89
END : 18-11-89
DRILLER : P. Wordell
INSPECTOR : J. Gaquin

GROUNDWATER		DEPTH (ft) OF:			EQUIPMENT	CASING	SAMPLER	CORE
Date	Time	Water	Casing	Hole	Type	HW/NW	S	NV-2
11-17-89	0605	14.9	38.0	80.0	Size I.D.:	4"/3"	1 3/8"	2"
					Hammer Wt.:	300#	140#	----
					Hammer Fall:	24"	30"	----

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			16 30 26 22	S1	0.3 2.3	16"	111.1 0.3	-BITUMINOUS ASPHALT- Dry, dense, brown COARSE TO FINE SAND and silt, trace cinders, brick, fiberglass. NOTE: Auger refusal on probable steel obstruction at 4.0'. -GRANULAR FILL-
5			6 4 4 4	S2	5.0 7.0	9"	105.9 5.5	Dry, loose, gray FINE SAND. Moist, medium stiff, gray CLAY and silt, little fine sand in occasional partings and layers. -COHESIVE FILL-
10			1 1 WOR 1	S3	10.0 12.0	12"		DO. except very soft.
15		4 7	1 WOR 4 6	S4	15.0 17.0	22"		DO. except medium stiff, trace fine gravel, fine sand in occasional pockets.
		8 8 10						
20		8 22 23 20 21	1 2 2 2	S5	20.0 22.0	11"		DO. except soft, trace organic silt.

25 MAY 91

SB2

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY
Overburden: 95.0'
Rock: 19.5'
Samples: S19 C4

BORING SB2-73

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-73
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 2 of 5

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
		16	5	S6	25.0	4"		Wet, medium stiff, gray CLAY and silt, little fine gravel.
		28	4 3 2		27.0			-COHESIVE FILL-
		27					83.4	
		28					28.0	
		29						
30		19	8	S7	30.0	4"		Moist, soft, gray ORGANIC SILT, trace clay, shell fragments.
		26	2 2 5		32.0			-ORGANIC DEPOSITS-
		26					78.9	
		35					32.5	
		32						
35		41	7	S8	35.0	24"		Moist, very stiff, gray CLAY and silt.
		62	9 9 14		37.0			-MARINE DEPOSITS-
		69						
40			6	S9	40.0	24"		DO. except stiff.
			5 8 9		42.0			
45			5	S10	45.0	24"		DO. except trace fine sand in occasional partings.
			5 6 9		47.0			
50			4	S11	50.0	24"		DO. except no fine sand.
			4 6 8		52.0			

25 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION

- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY

Overburden: 95.0'
Rock: 19.5'
Samples: S19 C4

BORING SB2-73

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-73
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 3 of 5

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			4 3 5 5	S12	55.0 57.0	24"		Moist, stiff, gray CLAY and silt. -MARINE DEPOSITS-
60			3 4 5 5	S13	60.0 62.0	24"		DO.
65			3 4 6 7	S14	65.0 67.0	24"		DO.
70			2 4 6 5	S15	70.0 72.0	24"		DO.
75			3 4 5 5	S16	75.0 77.0	24"		DO.
80			2 4 4 5	S17	80.0 82.0	24"		DO.
							28.4 83.0	-GLACIOMARINE DEPOSITS-

26 MAY 91

STP

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION

- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY

Overburden: 95.0'
Rock: 19.5'
Samples: S19 C4

BORING SB2-73

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-73
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 4 of 5

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			10 8 7 8	S18	85.0 87.0	6"		Moist, very stiff, gray SILT, little fine gravel, clay, trace coarse gravel, coarse to fine sand, with cobbles and boulders. -GLACIOMARINE DEPOSITS-
90							20.9	
			100*/1"	S19	90.5 90.6	1"	90.5	Moist, very dense, dark gray COARSE TO FINE GRAVEL, little coarse sand, trace fine sand, silt, clay. -GLACIAL TILL DEPOSITS- TOP OF BEDROCK 95.0'
95		2 2 2 3 3	40%	C1	95.0 100.0	39"	16.4 95.0	Hard, very slightly weathered, moderately fractured to sound, gray, fine grained to aphanitic arenaceous ARGILLITE. Bedding very thin, moderately dipping, joints close to moderately close, tight, smooth, planar and occasionally stepped, dipping at moderate to steep angles. Joint surfaces generally fresh, frequently calcite coated, and occasionally discolored with silt infilling.
100		5 5 4 5	65%	C2	100.0 104.5	45"		C2: DO. except joints planar, frequent thin and irregular steeply dipping calcite veins. Slightly discernible slickensides on calcite coated joint surface at 102.4' roughly parallel to strike of joint surface. -CAMBIDGE FORMATION-
105		5 3 2 3	78%	C3	104.5 109.5	59"		C3: DO. except core interbedded with very thin tuffaceous layers. NOTE: Core divided roughly down center by light gray aphanitic TUFF starting at 106.9'.
110		4 3 2 3 4 3	17%	C4	109.5 114.5	25"	-3.1 114.5	C4: DO. except joints stepped.

25 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY

Overburden:	95.0'
Rock:	19.5'
Samples:	S19 C4

BORING SB2-73

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-73
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 5 of 5

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS

BOTTOM OF EXPLORATION 114.5'
BOREHOLE GROUTED UPON COMPLETION
WOR = WEIGHT OF RODS
RQD = ROCK QUALITY DESIGNATION
BPF = BLOWS PER FOOT
* = USED 300# HAMMER TO DRIVE SAMPLER

SUMMARY OF REFUSAL TEST BORINGS

NO.	DEPTH (ft)	DISTANCE* (ft)	BEARING (degrees)
SB2-73A	4.0'	5.0'	N

* DISTANCE MEASURED FROM SB2-73

25 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY
Overburden: 95.0'
Rock: 19.5'
Samples: S19 C4

BORING SB2-73

Haley & Aldrich, Inc. — **TEST BORING LOG** — BORING **SB2-74**

PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA
CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS
CONTRACTOR: GZA DRILLING, INC.

CONTRACT : 89374
SHEET NO. : 1 of 4
LOCATION N: 2951830
E : 781635
ELEVATION : 111.2
DATE START: 29-11-89
END : 8-12-89
DRILLER : P. Wordell
INSPECTOR : J. Gaquin

GROUNDWATER		DEPTH (ft) OF:			EQUIPMENT	CASING	SAMPLER	CORE
Date	Time	Water	Casing	Hole	Type	HW	S	NV-2
11-29-89	1000	9.0	15.0	17.0	Size I.D.:	4"	1 3/8"	2"
12-07-89	0630	14.5	93.3	98.3	Hammer Wt.:	300#	140#	----
					Hammer Fall:	24"	30"	----

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			8 19 21 29	S1	0.0 2.0	20"		Dry, dense, brown COARSE TO FINE SAND and fine gravel, trace brick fragments.
								-GRANULAR FILL-
5			2 10 10 8	S2	5.0 7.0	16"		Moist, medium dense, brown COARSE TO FINE SAND, trace fine gravel.
10			3 5 4 7	S3	10.0 12.0	17"		Wet, loose, gray FINE SAND, trace silt.
							96.7 14.5	
15		3 13	1 WOR 3 3	S4	15.0 17.0	20"		Moist, soft, gray ORGANIC CLAY and silt, trace organic fibers, shells. Peat layer interbedded with gray fine sand and silt.
		8 8 12						-COHESIVE FILL-
20		55 34	PUSH " "	U1	20.0 22.0	11"	90.2 21.0	Pushed 3" diameter undisturbed tube sample in from 20.0' to 22.0'. Recovered 11". (CL/CH)
		34 39 34						-ORGANIC DEPOSITS-

25 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY
Overburden: 93.3'
Rock: 18.5'
Samples: S12U6C4

BORING **SB2-74**

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-74
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 2 of 4

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
		44	1	S5	25.0	24"		Moist, soft, gray ORGANIC SILT and clay, little fine sand, trace shell fragments.
		36	1 2 1		27.0			
		21						-ORGANIC DEPOSITS-
		29						
		25						
30			PUSH	NA	30.0	5"		Attempted 3" diameter undisturbed tube sample in organic silt from 30.0' to 31.0'. Recovered 5": Tube rejected.
			"		31.0		80.2 31.0	
35			6	S6	35.0	24"		Moist, stiff, yellow CLAY and silt.
			7 8 12		37.0			
								-MARINE DEPOSITS-
40			5	S7	40.0	24"		DO.
			5 9 10		42.0			
45			PUSH	U2	45.0	11"		Pushed 3" diameter undisturbed tube sample in marine clay from 45.0' to 46.0'. Recovered 11". (CL/CH)
			"		46.0			
			5	S8	46.0			Moist, stiff, yellow CLAY and silt.
			5 6 7		48.0			
50			PUSH	U3	50.0	13"		NOTE: Pushed 3" diameter undisturbed tube sample in marine clay from 50.0' to 51.5'. Recovered 13". (CH)
			" "		51.5			

26 MAY 91

STP

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION

- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY

Overburden:	93.3'
Rock:	18.5'
Samples:	S12U6C4

BORING SB2-74

Haley & Aldrich, Inc.	TEST BORING LOG	BORING SB2-74
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 3 of 4

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			2 2 3 4	S9	55.0 57.0	24"		Moist, medium stiff, yellow CLAY and silt.
								-MARINE DEPOSITS-
60			PUSH " "	NR	60.0 62.0	0"		Attempted 3" diameter undisturbed tube sample in marine deposits from 60.0' to 62.0'. No recovery.
65			PUSH " "	NR	64.0 66.0	0"		Attempted 3" diameter undisturbed tube sample in marine deposits from 60.0' to 62.0'. No recovery.
			PUSH "	U4	67.0 68.5	15"		Pushed 3" diameter undisturbed tube sample in marine clay from 67.0' to 68.5'. Recovered 15". (CH)
70			2 3 2 3	S10	70.0 72.0	24"		Wet, medium stiff, gray CLAY and silt.
75			PUSH " "	U5	74.5 76.5	19"		Pushed 3" diameter undisturbed tube sample in marine clay from 74.5' to 76.5'. Recovered 19". (CH/CL)
80			3 3 3 3	S11	80.0 82.0	24"		DO.

25 MAY 91

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION

- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- - See Remarks

SUMMARY

Overburden: 93.3'
Rock: 18.5'
Samples: S12U6C4

BORING SB2-74

Haley & Aldrich, Inc.	TEST BORING LOG	BORING **SB2-74**
PROJECT: CENTRAL ARTERY/TUNNEL PROJECT, BOSTON MA CLIENT : MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS		CONTRACT : 89374 SHEET NO. : 4 of 4

Depth in Feet	Strata Change	Case BPF (Drill) (min/ft)	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range (ft)	Sample Recovery (in)	Elevation/ Depth (ft)	FIELD CLASSIFICATION AND REMARKS
			PUSH " "	U6	85.0 86.5	14"		Pushed 3" diameter undisturbed tube sample in marine clay from 85.0' to 86.5'. Recovered 14". (CL)
								-MARINE DEPOSITS-
							22.7 88.5	-PROBABLE GLACIOMARINE DEPOSITS-
90			14 13 52 92	S12	90.0 92.0	10"	21.2 90.0	Moist, hard, gray SILT, some fine gravel, little coarse to fine sand, clay, with cobbles.
								-GLACIAL TILL DEPOSITS-
							17.9	TOP OF BEDROCK 93.3'
		3	43%	C1	93.3 98.3	31"	93.3	Hard, very slightly weathered, sound, green gray, coarse to fine grained DIORITE fragments.
		4					16.5 94.7	
95		3					15.7 95.5	Hard, slightly weathered, slightly fractured, light gray, medium to fine grained DIABASE fragments.
		2						-BASALT DIKE-
		3						Hard, slightly weathered, slightly fractured, gray, aphanitic ARGILLITE. Joints moderately close, open, rough, and dipping at steep to vertical angles. Joint surfaces slightly discolored.
		4	38%	C2	98.3 101.8	24"		C2: DO. except with distinct, very thin bedding dipping at 54 degrees.
100		3						
		2						
		3						
		4	0%	C3	101.8 106.8	13"		C3: DO. except extremely fractured.
		2						
		3						-CAMBRIDGE FORMATION-
105		4						
		5						
		2	13%	C4	106.8 111.8	28"		C4: DO. except moderately to extremely fractured. Diabase dike present from 107.0' to 107.1'. Open, rough, undulating clay infilled horizontal joint from 108.3' to 108.4'.
		3						NOTE: Poor recovery of core from C1 to C4. Lost core assigned to bottom of runs.
		3						
110		3						
							-0.6 111.8	BOTTOM OF EXPLORATION 111.8' BOREHOLE GROUTED UPON COMPLETION WOR = WEIGHT OF RODS RQD = ROCK QUALITY DESIGNATION BPF = BLOWS PER FOOT PUSH = PRESSED WITH DRILL RIG HYDRAULICS

25 MAY 91

SIP

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION

- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample
- See Remarks

SUMMARY

Overburden:	93.3'
Rock:	18.5'
Samples:	S12U6C4

BORING **SB2-74**

37 LINDEN STREET P.O. BOX 321 MEDFORD, MASSACHUSETTS 02155 Telephone 391-4500

To GEOTECHNICAL ENGINEERS, INC., WINCHESTER, MA. Date MAY 30, 1984 Job. No. 84203

Location M.P.A. PROJECT, BOSTON, MA. (GEI FILE NO. 84323) Scale 1" = 4 ft.

BORING 201

GROUND SURFACE

0'4" ASPHALT

FILL	21 18 10 22	S#1, FROM 0'6" TO 2'6" RECOVERED 15"
	2 2 1 2	S#2, FROM 5'0" TO 7'0" RECOVERED 14"
SAND, GRAVEL, CLAY, WOOD	5 2 2 6	S#3, FROM 10'0" TO 12'0" RECOVERED 6"
	2 5 2 2	S#4, FROM 15'0" TO 17'0" RECOVERED 10"
	5 7 2 4	S#5, FROM 20'0" TO 22'0" RECOVERED 14"
24'0"		
ORGANIC SILT, WITH SHELLS	2 1 2 1	S#6, FROM 25'0" TO 27'0" RECOVERED 18"
	2 1 1 2	S#7, FROM 30'0" TO 32'0" RECOVERED 18"
34'6"		

(CONTINUED ON SHEET NO. 2)

P.O. BOX 321 MEDFORD, MASSACHUSETTS 02155 Telephone 391-4500

To GEOTECHNICAL ENGINEERS, INC., WINCHESTER, MA. Date MAY 30, 1984 Job. No. 84203

Location M.P.A. PROJECT, BOSTON, MA. (GEI FILE NO. 84323) Scale 1" = 4 ft.

BORING 201 (CONTINUED)

S#8, FROM 35'0" TO 36'6"
RECOVERED 13"

S#8A, FROM 36'6" TO 37'0"
RECOVERED 4"

S#9, FROM 40'0" TO 42'0"
RECOVERED 12"

WATER LEVEL 6'0"

SIZE OF CASING NW, LENGTH 25'0"

NUMBER OF DRIVE SAMPLES (S), 10

DRILLER: J. DESIMONE, INSPECTOR: R. BREWER

DATE STARTED & COMPLETED: 5-29-84

OBSERVATION WELL INSTALLED (1-1/2" PVC PIPE, 10'0" SLOTTED, 10'0"SOLID) 20'0" BELOW GROUND SURFACE, INCLUDING ROADWAY BOX.

All samples have been visually classified by DRILLER Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in right hand column indicate number of blows required to drive _____ inches using 140 lb. weight falling 30 inches ±. Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches ±.

Bechtel/Parsons Brinckerhoff — TEST BORING LOG — HOLE NO. SB1-1

PROJECT: PRELIM. GEOTECH. SUBSURFACE INVESTIGATIONS
CLIENT : MDPW
CONTRACTOR: GUILD DRILLING CO.

CONTRACT : SC-88418-103
SHEET NO. : 1 of 4
LOCATION N:
E:
ELEVATION :
DATE START: 11-23-88
END : 11-23-88
DRILLER : M. Fisher
INSPECTOR : H. Senapathy

GROUNDWATER		DEPTH OF:			EQUIPMENT	CASING	SAMPLER	CORE
Date	Time	Water	Casing	Hole	Type	HW & NW	SPT	NB2
11-18-88	7:00	10'			Size I.D.:	4 & 3"	1 3/8"	2"
					Hammer Wt.:	#300	#140	----
					Hammer Fall:	18"	30"	----

Scale in Feet	Strata Change	Casing Blows Per Foot	Sampler Blows Per 6" (ROD%)	Sample Number/ Type	Sample Depth Range	Sample Recovery	Layer Elevation/ Depth	FIELD CLASSIFICATION AND REMARKS
								6" Asphalt and base fill
		30	54 36 27 21	S-1	0.5 2.5	9"	0.5	Moist very dense, brown-black, SAND, little gravel.
		46						
		73						
			98 36 18 17	S-2	4.0 6.0	14"		Wet very dense, gray-brown, SAND and GRAVEL, trace of silt.
5							5.0	<FILL>
								Gray brown, wet dense, SAND, little silt and shell fragments.
			WOH/ 12" 1 2	S-3	9.0 11.0	6"		Wet, very soft gray, ORGANIC SILT, little fine sand and clay. Stopped HW casing at 9'
10								
							13.5	<ORGANIC SILT>
			WOH/ 12" 1 1	S-4	14.0 16.0	20"		Wet, very soft gray, CLAY and SILT, trace of fine sand and gravel. PP < 0.2 tsf.
15								
			1 2 2 2	S-5	19.0 21.0	20"		Wet, soft gray, SILT and FINE SAND, little fiberous organics. Organic odor.
20								
			1/ 12"	S-6	24.0 26.0	24"		Wet, very soft gray, SILT, little fine sand and clay, trace of peat and shell fragments. Organic odor.

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION: S - Split Spoon; T - Thin Wall Tube; U - Undisturbed Piston; C - Diamond Core; W - Wash Sample

SUMMARY
Overburden: 114' 3"
Rock: 0'
Samples: 24S

HOLE NO. SB1-1

Dvirka and Bartilucci Consulting Engineers / Parsons Brinckerhoff	TEST BORING LOG	HOLE NO. SB1-1
PROJECT: PRELIM. GEOTECH. SUBSURFACE INVESTIGATIONS CLIENT : MDPW		CONTRACT : SC-88418-103 SHEET NO. : 2 of 4

Scale in Feet	Strata Change	Casing Blows Per Foot	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range	Sample Recovery	Layer Elevation/ Depth	FIELD CLASSIFICATION AND REMARKS
			1 1					
30			1 1 2 1	S-7	29.0 31.0	20"		Wet, soft gray, SILT, little fine sand and clay, trace of peat and shell fragments. Organic odor. <SILT>
							33.0	Fiberous PEAT from 33' to 34'
35			4 10 17 21	S-8	34.0 36.0	24"	34.0	Moist very stiff, gray SILTY CLAY. PP > 4.5tsf.
40			6 6 7 11	S-9	39.0 41.0	24"		PP = 2.0 tsf.
45			4 5 7 9	S-10	44.0 46.0	24"		PP = 0.75 tsf.
50			3 4 6 6	S-11	49.0 51.0			PP = 1.0 tsf.
			1 2	S-12	54.0 55.5	18"		Wet, medium stiff, gray, SILTY CLAY. PP = 0.5 tsf.

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample

SUMMARY
Overburden: 114' 3"
Rock: 0'
Samples: 24S

HOLE NO. SB1-1

Bechtel/Parsons Brinckerhoff	TEST BORING LOG	HOLE NO. SB1-1
PROJECT: PRELIM. GEOTECH. SUBSURFACE INVESTIGATIONS CLIENT : MDPW		CONTRACT : SC-88418-103 SHEET NO. : 3 of 4

Scale in Feet	Strata Change	Casing Blows Per Foot	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range	Sample Recovery	Layer Elevation/ Depth	FIELD CLASSIFICATION AND REMARKS
			3					
60			1 1 3	S-13	59.0 60.5	18"		Wet, medium stiff, gray, SILTY CLAY. PP = 0.8 tsf.
65			WOH 3 4	S-14	64.0 65.5	18"		PP = 0.6 tsf.
70			WOH 5 6	S-15	69.0 70.5	18"		PP = 0.6 tsf.
75			WOR WOH 5	S-16	74.0 75.5	18"		PP = 0.3 tsf.
80			WOH 3 5	S-17	79.0 80.5	18"		PP = 0.25 tsf.
			WOH/6 3	S-18	84.0 85.5	18"		PP = 0.5 tsf.

BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample

SUMMARY
Overburden: 114' 3"
Rock: 0'
Samples: 24S

HOLE NO. SB1-1

Bechtel/Parsons Brinckerhoff	TEST BORING LOG	HOLE NO. SB1-1
PROJECT: PRELIM. GEOTECH. SUBSURFACE INVESTIGATIONS CLIENT : MDPW		CONTRACT : SC-88418-103 SHEET NO. : 4 of 4

Scale in Feet	Strata Change	Casing Blows Per Foot	Sampler Blows Per 6" (RQD%)	Sample Number/ Type	Sample Depth Range	Sample Recovery	Layer Elevation/ Depth	FIELD CLASSIFICATION AND REMARKS
			4					
90			3 3 3	S-19	89.0 90.5	18"		Wet, medium stiff, gray, SILTY CLAY. PP = 0.6 tsf
95			WOH 6 4	S-20	94.0 95.5	18"		PP = 0.6 tsf
100			WOR WOH 5	S-21	99.0 100.5	18"		PP = 0.4 tsf. <CLAY>
105			13 13 34	S-22	104.0 105.5	5"	104.0	Wet, dense, gray, SAND and angular GRAVEL, (argillite fragments), little silt and clay.
110			35 34 57	S-23	109.0 110.5	7"		Wet, very dense, gray SAND and angular GRAVEL, little silt. <TILL>
			100/3"	S-24	114.0 114.3	3"	114.2	Bottom of hole at 114' 3" Backfilled hole with peastone.

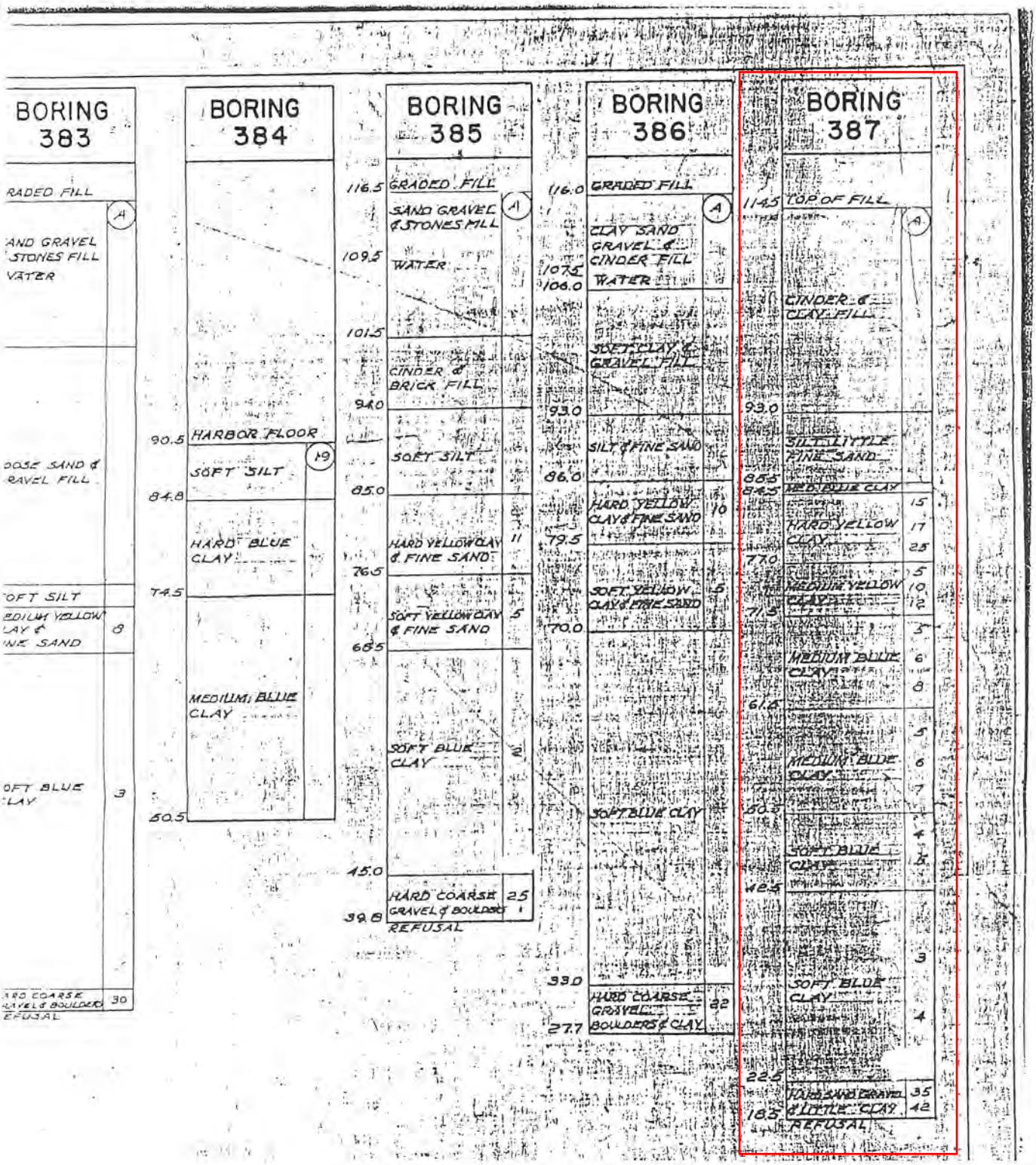
BLOWS/FT.	DENSITY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

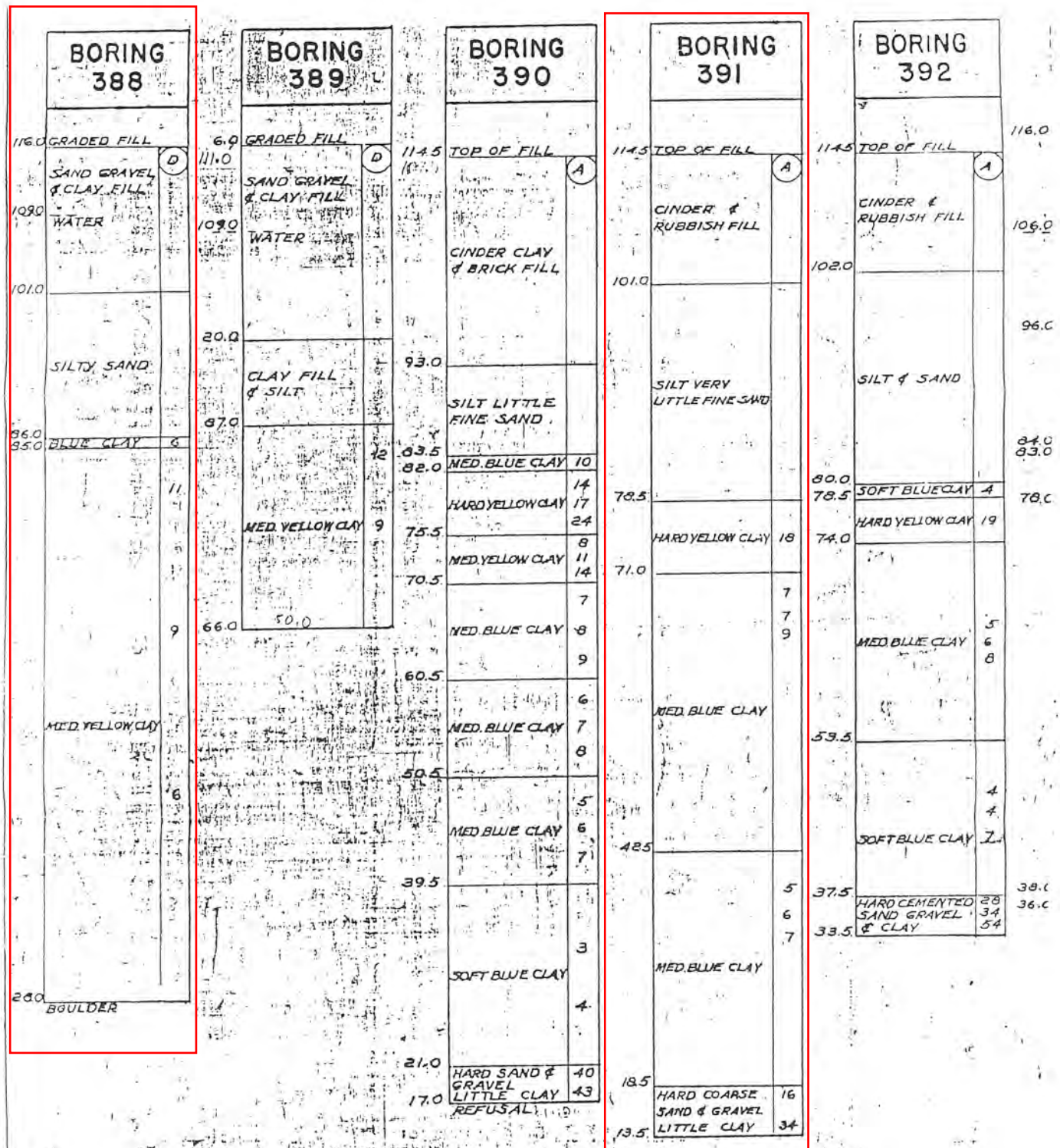
BLOWS/FT.	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium Stiff
8-15	Stiff
15-30	Very Stiff
30+	Hard

SAMPLE IDENTIFICATION
- S - Split Spoon
- T - Thin Wall Tube
- U - Undisturbed Piston
- C - Diamond Core
- W - Wash Sample

SUMMARY
Overburden: 114' 3"
Rock: 0'
Samples: 24S

HOLE NO. SB1-1


BORING 383
RADED FILL
A
AND GRAVEL STONES FILL
VATER
OOSE SAND & RAVEL FILL
OFT SILT
EDIUM YELLOW LAY & NE SAND
8
OFT BLUE LAY
3
RD COARSE RAVEL & BOULDERS EFUSAL
30
BORING 384
90.5 HARBOR FLOOR
19
SOFT SILT
84.8
HARD BLUE CLAY
74.5
MEDIUM BLUE CLAY
50.5
BORING 385
116.5 GRADED FILL
A
SAND GRAVEL & STONES FILL
109.5 WATER
101.5
CINDER & BRICK FILL
94.0
SOFT SILT
85.0
HARD YELLOW CLAY & FINE SAND
11
76.5
SOFT YELLOW CLAY & FINE SAND
5
68.5
SOFT BLUE CLAY
2
15.0
HARD COARSE GRAVEL & BOULDERS
25
39.8 REFUSAL
BORING 386
116.0 GRADED FILL
A
CLAY SAND GRAVEL & CINDER FILL
107.5
WATER
106.0
SOFT CLAY & GRAVEL FILL
93.0
SILT & FINE SAND
86.0
HARD YELLOW CLAY & FINE SAND
10
79.5
SOFT YELLOW CLAY & FINE SAND
5
70.0
SOFT BLUE CLAY
33.0
HARD COARSE GRAVEL BOULDERS & CLAY
32
27.7
BORING 387
114.5 TOP OF FILL
A
CINDER & CLAY FILL
93.0
SILT LITTLE FINE SAND
89.5
MED. BLUE CLAY
15
HARD YELLOW CLAY
17
25
77.0
MEDIUM YELLOW CLAY
5
10
12
71.5
3
MEDIUM BLUE CLAY
6
8
61.5
5
MEDIUM BLUE CLAY
6
7
50.5
SOFT BLUE CLAY
4
4
42.5
3
SOFT BLUE CLAY
4
22.5
HARD SAND GRAVEL & LITTLE CLAY
35
42
18.5 REFUSAL


BORING 388
116.0 GRADED FILL
SAND GRAVEL & CLAY FILL
D
109.0 WATER
101.0
SILTY SAND
96.0
95.0 BLUE CLAY
6
11
9
MED. YELLOW CLAY
6
28.0 BOULDER
BORING 389
6.0 GRADED FILL
111.0
SAND GRAVEL & CLAY FILL
D
109.0 WATER
20.0
CLAY FILL & SILT
87.0
12
MED. YELLOW CLAY
9
66.0
50.0
BORING 390
114.5 TOP OF FILL
A
CINDER CLAY & BRICK FILL
93.0
SILT LITTLE FINE SAND
83.5
82.0 MED. BLUE CLAY
10
14
HARD YELLOW CLAY
17
24
75.5
8
MED. YELLOW CLAY
11
14
70.5
7
MED. BLUE CLAY
8
9
60.5
6
MED. BLUE CLAY
7
8
50.5
5
MED. BLUE CLAY
6
7
39.5
3
SOFT BLUE CLAY
4
21.0
HARD SAND & GRAVEL LITTLE CLAY
40
43
17.0 REFUSAL
BORING 391
114.5 TOP OF FILL
A
CINDER & RUBBISH FILL
101.0
SILT VERY LITTLE FINE SAND
78.5
HARD YELLOW CLAY
18
71.0
7
7
9
MED. BLUE CLAY
42.5
5
6
7
MED. BLUE CLAY
18.5
HARD COARSE SAND & GRAVEL LITTLE CLAY
16
34
13.5
BORING 392
116.0
114.5 TOP OF FILL
A
CINDER & RUBBISH FILL
106.0
102.0
96.0
SILT & SAND
84.0
83.0
80.0
78.5 SOFT BLUE CLAY
4
78.0
HARD YELLOW CLAY
19
74.0
5
MED. BLUE CLAY
6
8
59.5
4
4
SOFT BLUE CLAY
7
38.0
37.5
HARD CEMENTED SAND GRAVEL & CLAY
28
34
54
36.0
33.5

BORING AND WELL CONSTRUCTION LOG

ESS Group, Inc.
Engineers
Scientists
Consultants

888 Worcester Street
Suite 240
Wellesley
Massachusetts
02482

p 781.431.0500
f 781.431.7434

Site: Boston Frieght Terminals
Client Name: Cargo Ventures
Date(s): 1/10/05
Drilling Company: Carr-Dee
Drilling Method: HSA
Sampling Method: 2' Split Spoon
ESS Observer: V. Boyd

Boring/Well No: B-203
Depth to Water (ft): N/A
Well Diameter (inches): N/A
Well Screen Slot Size: N/A
Measuring Point: N/A
Measuring Point Elevation: N/A
Ground Surface Elevation: N/A

Depth bgs (ft.)	Sample or Run Designation	Sample Type	Blows per 6 inches or Core Run (time/ft.)	Recovery/Penetration (ft)	Rock Quality Designation	Screening Data PID (ppm)	Screening Data FID (ppm)	Elevation (ft.)	Materials Description	Graphical Log	Well Construction
0	B-203 0-2	D		10/24		15		0	tan/black, medium to fine SAND and gravel, 6" coal ash		
5	B-203 5-7	D		24/24		5		-5	dark brown/black, medium to fine SAND and medium gravel, trace broken brick		
10	B-203 10-12	D		12/24		ND		-10	gray, SILT, trace broken brick, black organic banding, trace shells		
									Bottom of Boring @ 12		
15								-15			
20								-20			

Materials Description
Soils: moisture, density[1], color, size, major and minor constituents[2]
Rock: color, rock type, hardness, major mineral types, weathering, and degree of fracturing

Well Construction: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

LEGEND:
ND: not detected
N/A: not applicable
bgs: below ground surface
NM: not measured

SAMPLE TYPES:
D: drive
W: washed
TP: test pit
ST: Shelby Tube
A: auger
HA: hand auger
C: cored
RC: rotasonic core

ROCK
ROCK QUALITY DESIGNATION (RQD):
reported in % = [length of core in pieces 4" and longer/length of run] x 100

SOIL
[1] Density designation based on blow counts for each 12" of penetration using a 140 lb. wt x 30" drop on a 2" O.D. spilt spoon sampler. If blow counts are not taken then density may be estimated

MOISTURE:
dry
damp
moist
wet

[2] PROPORTIONS USED:
Trace: <10%
Little: 10-20%
Some: 20-35%
And: 35-50%

[1] PLASTIC SOILS DENSITY:
0-2: very soft
3-4: soft
5-8: medium stiff
9-15: stiff
16-30: very stiff
>30: hard

[1] GRANULAR SOILS DENSITY:
0-4: very loose
5-9: loose
10-29: medium dense
30-49: dense
50+: very dense

NOTES:

BORING AND WELL CONSTRUCTION LOG

ESS Group, Inc.
888 Worcester Street
Suite 240
Wellesley
Massachusetts
02482
Engineers
Scientists
Consultants
p 781.431.0500
f 781.431.7434

Site: Boston Frieght Terminals
Client Name: Cargo Ventures
Date(s): 12/30/04
Drilling Company: Carr-Dee
Drilling Method: HSA
Sampling Method: 2' Split Spoon
ESS Observer: V. Boyd

Boring/Well No: B-204
Depth to Water (ft): N/A
Well Diameter (inches): N/A
Well Screen Slot Size: N/A
Measuring Point: N/A
Measuring Point Elevation: N/A
Ground Surface Elevation: N/A

Depth bgs (ft.)	Sample or Run Designation	Sample Type	Blows per 6 inches or Core Run (time/ft.)	Recovery/Penetration (ft)	Rock Quality Designation	Screening Data PID (ppm)	Screening Data FID (ppm)	Elevation (ft.)	Materials Description	Graphical Log	Well Construction
0	B-204 0-2	D		12/24		ND		0	grey/black, medium to fine SAND, some silty sand, some broken brick and concrete		
5	B-204 5-7	D		14/24		ND		-5	grey/black, medium to fine SAND, some silty sand, some broken brick and concrete		
10	B-204 10-12	D				ND		-10	grey, SILTY SAND, trace medium to fine gravel		
									Bottom of Boring @ 12		
15								-15			
20								-20			

Materials Description
Soils: moisture, density[1], color, size, major and minor constituents[2]
Rock: color, rock type, hardness, major mineral types, weathering, and degree of fracturing

Well Construction: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

LEGEND:
ND: not detected
N/A: not applicable
bgs: below ground surface
NM: not measured

SAMPLE TYPES:
D: drive
W: washed
TP: test pit
ST: Shelby Tube
A: auger
HA: hand auger
C: cored
RC: rotasonic core

ROCK
ROCK QUALITY DESIGNATION (RQD):
reported in % = [length of core in pieces 4" and longer/length of run] x 100

SOIL
[1]Density designation based on blow counts for each 12" of penetration using a 140 lb wt x 30" drop on a 2" O.D. spilt spoon sampler. If blow counts are not taken then density may be estimated

MOISTURE:
dry
damp
moist
wet

[2]PROPORTIONS USED:
Trace: <10%
Little: 10-20%
Some: 20-35%
And: 35-50%

[1]GRANULAR SOILS DENSITY:
0-4: very loose
5-9: loose
10-29: medium dense
30-49: dense
50+: very dense

[1]PLASTIC SOILS DENSITY:
0-2: very soft
3-4: soft
5-8: medium stiff
9-15: stiff
16-30: very stiff
>30: hard

NOTES:

BORING AND WELL CONSTRUCTION LOG

ESS Group, Inc.
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02482
Engineers
Scientists
Consultants
p 781.431.0500
f 781.431.7434

Site: Boston Frieght Terminals
Client Name: Cargo Ventures
Date(s): 12/14/04
Drilling Company: Carr-Dee
Drilling Method: HSA
Sampling Method: 2' Split Spoon
ESS Observer: V. Boyd

Boring/Well No: B-205
Depth to Water (ft): N/A
Well Diameter (inches): N/A
Well Screen Slot Size: N/A
Measuring Point: N/A
Measuring Point Elevation: N/A
Ground Surface Elevation: N/A

Depth bgs (ft.)	Sample or Run Designation	Sample Type	Blows per 6 inches or Core Run (time/ft.)	Recovery/Penetration (ft)	Rock Quality Designation	Screening Data PID (ppm)	Screening Data FID (ppm)	Elevation (ft.)	Materials Description	Graphical Log	Well Construction
0	B-205 0-2	D		8/24				0	black/orange, fine SAND, trace coal ash		
5	B-205 5-7	D		6/24				-5	grey/green, fine SAND, trace silt		
10	B-205 10-12	D						-10	gret, SILTY CLAY, wet		
									Bottom of Boring @ 12		
15								-15			
20								-20			

Materials Description
Soils: moisture, density[1], color, size, major and minor constituents[2]
Rock: color, rock type, hardness, major mineral types, weathering, and degree of fracturing

Well Construction: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

LEGEND:
ND: not detected
N/A: not applicable
bgs: below ground surface
NM: not measured

SAMPLE TYPES:
D: drive
W: washed
TP: test pit
ST: Shelby Tube
A: auger
HA: hand auger
C: cored
RC: rotasonic core

ROCK
ROCK QUALITY DESIGNATION (RQD):
reported in % = [length of core in pieces 4" and longer/length of run] x 100

SOIL
[1] Density designation based on blow counts for each 12" of penetration using a 140 lb wt x 30" drop on a 2" O.D split spoon sampler. If blow counts are not taken then density may be estimated

[1]PLASTIC SOILS DENSITY:
0-2: very soft
3-4: soft
5-8: medium stiff
9-15: stiff
16-30: very stiff
>30: hard

MOISTURE:
dry
damp
moist
wet

[2]PROPORTIONS USED:
Trace: <10%
Little: 10-20%
Some: 20-35%
And: 35-50%

[1]GRANULAR SOILS DENSITY:
0-4: very loose
5-9: loose
10-29: medium dense
30-49: dense
50+: very dense

NOTES:

APPENDIX D

2019 Test Boring Logs and Observation Well Installation Report

TEST BORING REPORT

Boring No. HA19-B1

Project	SOUTH BOSTON INNOVATION, 329 NORTHERN AVE., BOSTON, MA
Client	CARGO VENTURES
Contractor	GEOLOGIC-EARTH EXPLORATION, INC.

File No. 132753-006
Sheet No. 1 of 5
Start June 24, 2019
Finish June 28, 2019
Driller D. Sheldon/R. Eastwood
H&A Rep. A. Fleming
Elevation 16.2 (est.)
Datum Boston City Base
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW/NW	S	NX	Rig Make & Model: B57 Mobile Drill Truck
Inside Diameter (in.)	4/3	1 3/8	3	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Drive to 69.0 ft, NW Spun to 114.0 ft
				Hoist/Hammer: Cat-Head Doughnut Hammer
				PID Make & Model: Ion Science Tiger

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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						15.6	-BITUMINOUS CONCRETE-										
					SM	0.6	Black silty SAND with gravel (SM), mps 4.0 in., no structure, no odor, moist, trace concrete and brick	10	10	10	30	20	20				
							Note: Location precleared with vac truck to 6.0 ft.										
							-FILL-										
5	17 12 10 10	S1 12	6.0 8.0		SM		Gray silty SAND (SM), mps 0.3 in., no structure, no odor, wet				20	65	15				
	8 11 12 6	S2 4	8.0 10.0		SM		Gray silty SAND (SM), mps 0.2 in., no structure, no odor, wet, 10% - 15% pockets of organic silt, trace shells										
10	3 2 1 2	S3 10	10.0 12.0	ND	SP-SM		Loose gray poorly graded SAND with silt (SP-SM), mps < 1.0 in., no structure, no odor, wet, trace shell specs					90	10				
	2 1 2 2	S4 16	12.0 14.0	ND	SP-SM		Similar to above					90	10				
	2 2 3 1	S5 10	14.0 16.0	ND	SM		Loose gray silty SAND (SM), mps < 1.0 in., no structure, no odor, wet					85	15				
15	1 3 11 7	S6 12	16.0 18.0	ND	SM		Medium dense gray silty SAND (SM), mps < 1.0 in., no structure, no odor, wet					85	15				
	1 1 4 5	S7 20	18.0 20.0	ND	CL		Medium stiff gray lean CLAY (CL), mps < 1.0 in., no structure, no odor, wet, 10% - 15% pockets of organic silt					5	95				
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
6/27/19	0715	16.0	34.0	71.0	11.43

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Splitspoon Sample
G - Geoprobe

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

Summary
Overburden (ft) 108.0
Rock Cored (ft) 5.0
Samples 25S, 1C

Boring No. HA19-B1

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.

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA19-B1
File No. 132753-006
Sheet No. 2 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
							-FILL-										
						-7.8											
25	2 3 4 5	S8 20	24.0 26.0	ND	OL/ OH	24.0	Medium stiff gray sandy ORGANIC SOIL (OL/OH), mps < 0.1 in., no structure, faint organic odor, wet, trace peat fibers					30	70				
							-ORGANIC DEPOSITS-										
30	3 3 4 4	S9 2	29.0 31.0	ND	OL/ OH		Medium stiff gray ORGANIC SOIL (OL/OH), mps 0.1 in., no structure, faint organic odor, wet, trace shells						100				
	5 6 10 13	S10 7	34.0 36.0	ND ND	PT CL	-18.8 35.0	Stiff dark brown to brown PEAT (PT), mps < 0.1 in., no structure, faint organic odor, wet Very stiff gray lean CLAY (CL), mps < 0.1 in., no structure, faint organic odor, wet, trace peat fibers						100 100				
40	8 10 14 17	S11 22	39.0 41.0	ND	CL		Very stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 2.75 - 3.25 tsf						100	S	H	M	
							-MARINE DEPOSITS-										
45	4 4 6 7	S12 24	44.0 46.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 1.5 tsf						100	S	M	M	
50	WOR 2 3 5	S13 20	49.0 51.0	ND	CL		Medium stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 - 0.75 tsf						100	S	M	M	

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

Boring No. HA19-B1

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
55	WOR 2 4 5	S14 24	54.0 56.0	ND	CL		Medium stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.0 - 0.25 tsf						100	S	M	H	
60	3 3 6 7	S15 24	59.0 61.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.0 - 0.25 tsf						100	S	M	H	
							-MARINE DEPOSITS-										
65	WOR 4 4 6	S16 24	64.0 66.0	ND	CL		Medium stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf						100	S	M	H	
70	2 3 6 5	S17 24	69.0 71.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 tsf						100	S	M	H	
75	WOR 4 5 9	S18 24	74.0 76.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 tsf						100	S	M	H	
80	WOR 2 5 7	S19 24	79.0 81.0	ND	CL		Medium stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 tsf						100	S	M	H	

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA19-B1
File No. 132753-006
Sheet No. 4 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color, GROUP NAME, max. particle size†, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Sand % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
85	WOR 2 3 6	S20 24	84.0 86.0	ND	CL		Medium stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 tsf						100	S	M	H	
90	WOR 4 5 7	S21 24	89.0 91.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf						100	S	M	H	
							-MARINE DEPOSITS-										
95	WOR 5 7 9	S22 21	94.0 96.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.5 - 0.75 tsf						100	S	M	H	
100	WOR/ 5" - 1 6 9 9	S23 24	99.0 101.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf						100	S	M	H	
105	WOR 13 100/ 2"	S24 11	104.0 105.2	ND ND	CL CL	-88.7 104.9	Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf Hard gray sandy lean CLAY (CL), mps 0.5 in., no structure, no odor, wet		15	10	15	10	50	S	M	M	
							Note: Drill action indicates boulder from 105.2 ft - 106.5 ft. -GLACIOMARINE DEPOSITS- Note: Drill action indicates potential top of weathered bedrock. TOP OF BEDROCK 108.0 FT										
110	80 100/ 2"	S25 4	109.0 109.7			-91.8 108.0	-BEDROCK- Very dense gray weathered ARGILLITE, mps 1.0 in., rock fabric structure, no odor, wet -BEDROCK- Note: Advance roller bit to 114.0 ft. Drill action indicates more competent bedrock at 114.0 ft. SEE CORE BORING REPORT FOR ROCK DETAILS										

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

Boring No. HA19-B1

HALEY ALDRICH

CORE BORING REPORT

Boring No. **HA19-B1**
File No. 132753-006
Sheet No. 5 of 5

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
115	3.5	C1	114.0 119.0	54 45	90 75			Moderately hard to hard, fresh, gray, aphanitic ARGILLITE. Bedding extremely thin to thin, joints moderately dipping, close to wide, planar, smooth to rough, fresh, tight.
	2							
	2							-BEDROCK-
	2							
	2						-102.8 119.0	BOTTOM OF EXPLORATION 119.0 FT
120								
125								
130								
135								
140								
145								

TEST BORING REPORT

Boring No. HA19-B2 (OW)

Project	SOUTH BOSTON INNOVATION, 329 NORTHERN AVE., BOSTON, MA
Client	CARGO VENTURES
Contractor	GEOLOGIC-EARTH EXPLORATION, INC.

File No. 132753-006
Sheet No. 1 of 5
Start June 24, 2019
Finish July 8, 2019
Driller P. Fischer
H&A Rep. A. Fleming
Elevation 16.8 (est.)
Datum Boston City Base
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW/NW	S	NX	Rig Make & Model: B57 Mobile Drill Truck
Inside Diameter (in.)	4/3	1 3/8	3	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Drive to 34.0 ft, NW Spin to 109.0 ft
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: Ion Science Tiger

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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						16.3	-BITUMINOUS CONCRETE-										
					SP	0.5	Tan to light brown poorly graded SAND (SP), mps 0.5 in., no		5	5	65	25					
					SM	16.0	structure,, no odor, moist	10	10	10	30	20	20				
						0.8	-FILL-										
							Black silty SAND with gravel (SM), mps 3.0 in., no structure, no odor, moist, 5% - 10% concrete, trace brick, trace cinders										
							Note: Location precleared with vac truck to 6.0 ft.										
							-FILL-										
5	25 18 25 28	S1 10	6.0 8.0	ND	SP		Dense gray to light brown poorly graded SAND (SP), mps 0.3 in., no structure, no odor, moist				15	80	5				
	19 13 12 14	S2 9	8.0 10.0	ND	SP		Medium dense gray poorly graded SAND (SP), mps 0.3 in., no structure, no odor, wet, trace pockets of lean clay, trace pockets of silt				15	80	5				
10	7 4 5 16	S3 13	10.0 12.0	ND	SM		Loose gray silty SAND (SM), mps 0.2 in., no structure, no odor, wet, trace shells				25	60	15				
	14 4 8 13	S4 15	12.0 14.0	ND	SM		Medium dense gray silty SAND (SM), mps 0.1 in., no structure, no odor, wet				20	60	20				
	4 3 6 4	S5 12	14.0 16.0	ND	SM		Loose gray silty SAND (SM), mps 0.2 in., no structure, no odor, wet, trace pockets of organics, trace shells				20	60	20				
15	2 3 5 7	S6 16	16.0 18.0	ND	CL		Medium stiff gray lean CLAY with sand (CL), mps 0.3 in., no structure, no odor, wet, trace shells				5	15	80	S	M	M	
	7 8 10 12	S7 16	18.0 20.0	ND	SP		Medium dense gray poorly graded SAND (SP), mps 0.2 in., no structure, no odor, wet, trace shells, trace pockets of organics			5	60	30	5				
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
7/2/19	0710	16.0	34.0	109	7.79
7/12/19	0715		OW	20.0	9.78
7/5/19	0820		OW	20.0	9.81

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Splitspoon Sample
G - Geoprobe

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

Summary
Overburden (ft) 104.0
Rock Cored (ft) 5.0
Samples 25S, 1C

Boring No. HA19-B2 (OW)

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.

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
							-FILL-										
						-7.2											
25	2 3 2 4	S8 24	24.0 26.0	ND	OL/ OH	24.0	Medium stiff gray ORGANIC SOIL (OL/OH), mps 0.1 in., no structure, organic odor, wet, trace shells					5	95				
							-ORGANIC DEPOSITS-										
30	1 3 4 7	S9 7	29.0 31.0	ND	OL/ OH		Medium stiff gray ORGANIC SOIL (OL/OH), mps 0.1 in., no structure, organic odor, wet, trace shells						100				
						-17.2											
35	8 11 18 18	S10 21	34.0 36.0	ND	CL	34.0	Very stiff tan lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 2.5 - 3.5 tsf						100	S	H	M	
40	5 7 9 9	S11 23	39.0 41.0	ND	CL		Very stiff tan lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 1.0 - 1.75 tsf						100	S	H	M	
							-MARINE DEPOSITS-										
45	5 5 6 9	S12 24	44.0 46.0	ND	CL		Stiff olive brown to gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.5 - 1.0 tsf						100	S	M	M	
50	3 4 6 6	S13 23	49.0 51.0	ND	CL		Stiff olive brown to gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf						100	S	M	H	

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA19-B2 (OW)
File No. 132753-006
Sheet No. 3 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
55	3 4 5 7	S14 24	54.0 56.0	ND	CL		Stiff gray to olive brown lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.5 tsf						100	S	M	H	
60	3 4 6 7	S15 24	59.0 61.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf						100	S	M	H	
							-MARINE DEPOSITS-										
65	3 6 6 9	S16 24	64.0 66.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf										
70	2 4 6 7	S17 24	69.0 71.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.0 - 0.25 tsf						100	S	M	H	
75	2 3 4 7	S18 24	74.0 76.0	ND	CL		Medium stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 tsf						100	S	M	H	
80	3 6 6 6	S19 24	79.0 81.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.25 - 0.75 tsf						100	S	M	H	

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

Boring No. HA19-B2 (OW)

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA19-B2 (OW)
File No. 132753-006
Sheet No. 4 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
85	3 5 8 10	S20 24	84.0 86.0		CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.5 - 0.75 tsf						100	S	M	H	
90	WOH 3 7 7	S21 24	89.0 91.0		CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.0 - 0.25 tsf						100	S	M	H	
							-MARINE DEPOSITS-										
95	4 6 9 9	S22 24	94.0 96.0		CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.0 - 0.25 tsf						100	S	M	H	
100	WOR 4" WOH 2" 19 22 19	S23 18	99.0 101.0		CL CL	-82.7 99.5	Very soft gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.0 - 0.25 tsf Hard gray lean CLAY with gravel (CL), mps 0.2 in., no structure, no odor, wet		15			5	100 80	S S	M M	H H	
						-85.2 102.0	-MARINE DEPOSITS- Note: Drill action indicates change in material and density at 102.0 ft.										
105	29 14 32 39	S24 11	104.0 106.0		SC		Dense gray clayey SAND with gravel (SC), mps 1.0 in., no structure, no odor, wet	10	10	10	15	30	25				
							-GLACIAL TILL- Note: Very high water loss from 104.0 ft - 109.0 ft.										
110	38 63 81 100/ 3"	S25 13	109.0 110.7		SM	-93.7 110.5	Very dense gray silty SAND with gravel (SM), mps 0.7 in., no structure, no odor, wet, weathered argillite in spoon tip -GLACIAL TILL- TOP OF BEDROCK 110.5 FT Note: Drill action indicates top of potential bedrock at 110.5 ft. -BEDROCK- Note: Advanced roller bit to 114.0 ft. Drill action indicates competent rock at 114.0 ft. SEE CORE BORING REPORT FOR ROCK DETAILS	10	15	5	15	40	15				

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

Boring No. HA19-B2 (OW)

H&A-TEST BORING WITH PERM PID COLUMN HA-LIB09-BOS.GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\132753 - 2 HARBOR STREET\GINT\132753-006 TB_C_OW.GPJ Aug 2, 19

HALEY ALDRICH

CORE BORING REPORT

Boring No. HA19-B2 (OW)
File No. 132753-006
Sheet No. 5 of 5

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
115	4 3 3 3 3	C1	114.0 117.0	36 22	100 61			Hard to moderately hard, fresh, gray, aphanitic ARGILLITE. Bedding extremely thin to thin, joints moderately to high angle dipping, moderate spacing, planar to undulating, smooth, fresh, tight to open. Note: C1 stopped at 117.0 ft due to core barrel jam. -BEDROCK-
		C2	117.0 119.0	18 18	75 75			Hard to moderately hard, fresh, gray, aphanitic ARGILLITE. Bedding extremely thin to thin, joints moderately dipping, moderate spacing, planar to undulating, smooth, fresh, tight.
							-102.2 119.0	BOTTOM OF EXPLORATION 119.0 FT
120								
125								
130								
135								
140								
145								

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

HALEY ALDRICH

Well No. HA19-B2 (OW)

Project SOUTH BOSTON INNOVATION
Location 329 NORTHERN AVE., BOSTON, MA
Client CARGO VENTURES
Contractor GEOLOGIC-EARTH EXPLORATION, INC.
Driller P. Fischer

Initial Water Level (depth bgs) 10.0 ft

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

File No. 132753-006
Date Installed 8 Jul 2019
H&A Rep. A. Fleming
Location See Plan

Ground El. 16.8 (est.)
Datum Boston City Base

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	16.8
BITUMINOUS CONCRETE	0.5			0.8	16.0
FILL				7.0	9.8
				9.0	7.8
				10.0	6.8
	20.0			20.0	-3.2

WELL CONSTRUCTION DETAILS

Type of protective cover: Compression - pent. bolt
Depth of Roadway Box below ground surface: 0.0 ft
Depth of top of riser below ground surface: 0.1 ft
Type of protective casing: Roadway Box
- Length: 0.9 ft
- Inside diameter: 6.0 in.
- Depth of bottom of Roadway Box: 0.9 ft

Type of riser pipe: Schedule 40 PVC
- Inside diameter of riser pipe: 2.0 in.
- Depth of bottom of riser pipe: 10.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Concrete	0.0	0.8
Bentonite	7.0	2.0
	-	-

Diameter of borehole: 4.5 in.
Depth to top of well screen: 10.0 ft
- Type of screen: Machine slotted Sch 40 PVC
- Screen gauge or size of openings: 0.010 in.
- Diameter of screen: 2.0 in.
- Type of Backfill around Screen: Filter Sand
- Depth to bottom of well screen: 20.0 ft

Bottom of silt trap:
Depth of bottom of borehole: 20.0 ft

COMMENTS:

TEST BORING REPORT

Boring No. HA19-B3

Project	SOUTH BOSTON INNOVATION, 329 NORTHERN AVE., BOSTON, MA
Client	CARGO VENTURES
Contractor	GEOLOGIC-EARTH EXPLORATION, INC.

File No. 132753-006
Sheet No. 1 of 5
Start June 24, 2019
Finish July 10, 2019
Driller P. Fischer
H&A Rep. A. Fleming
Elevation 16.9 (est.)
Datum Boston City Base
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW/NW	S	NX	Rig Make & Model: B57 Mobile Drill Truck
Inside Diameter (in.)	4/3	1 3/8	3	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Drive to 29.0 ft, NW Spun to 104.0 ft
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: Ion Science Tiger

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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						16.4	-BITUMINOUS CONCRETE-										
					SP	0.5	Tan to light brown poorly graded SAND (SP), mps 0.6 in., no	5	5	5	65	20					
					SM	16.0	structure, no odor, moist	10	10	10	30	20	20				
						0.9	-FILL-										
							Black silty SAND with gravel (SM), mps 2.5 in., no structure, no odor, moist, trace concrete and brick										
					SP		Tan to light brown poorly graded SAND (SP), mps 0.3 in., no structure, no odor, moist				75	25					
5							Note: Location precleared with vac truck to 6.0 ft.										
	7 10 12 10	S1 10	6.0 8.0	ND	SP		Medium dense tan to gray poorly graded SAND (SP), mps 0.3 in., no structure, no odor, moist			5	35	55	5				
	3 1 3 3	S2 11	8.0 10.0	ND	SP		Loose gray poorly graded SAND (SP), mps 0.1 in., no structure, no odor, wet, trace shells				30	70					
							-FILL-										
10	2 2 2 1	S3 14	10.0 12.0	ND	SP		Loose gray poorly graded SAND (SP), mps 0.1 in., no structure, no odor, wet, trace pockets of organic soil, trace shells				20	75	5				
	3 4 5 5	S4 15	12.0 14.0	ND	SM		Loose gray silty SAND (SM), mps 0.1 in., no structure, no odor, wet				15	65	20				
15	1 1 1 1	S5 23	14.0 16.0	ND	OL/ OH		Very soft gray ORGANIC SOIL (OL/OH), mps 0.2 in., no structure, no odor, wet, trace pockets of fine sand, trace shells					10	90				
	2 3 2 3	S6 24	16.0 18.0	ND	SM		Loose gray silty SAND (SM), mps 0.2 in., no structure, no odor, wet, 20% - 30% pockets of lean clay, trace shells				15	65	20				
	1 1 1 2	S7 24	18.0 20.0	ND	CL		Very soft sandy lean CLAY (CL), mps 0.3 in., no structure, no odor, wet, 15% - 20% pockets of organics				5	25	70				
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
7/9/19	0710	16.0	34.0	61.0	9.5

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Splitspoon Sample
G - Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 95.0
Rock Cored (ft) 5.0
Samples 22S, 1C

Boring No. HA19-B3

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.

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA19-B3
File No. 132753-006
Sheet No. 2 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
							-FILL-										
						-7.1											
25	1 1 1 2	S8 8	24.0 26.0	ND	OL/ OH	24.0	Very soft gray ORGANIC SOIL (OL/OH), mps 0.1 in., no structure, organic odor, wet						100				
							-ORGANIC DEPOSITS-										
						-12.1											
30	4 14 27 38	S9 22	29.0 31.0	ND	CL	29.0	Hard gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet						100				
35	7 10 12 15	S10 24	34.0 36.0	ND	CL		Very stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 1.5 - 2.0 tsf						100				
							-MARINE DEPOSITS-										
40	5 6 8 9	S11 24	39.0 41.0	ND	CL		Stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 1.25 - 1.5 tsf						100				
45	5 6 6 9	S12 11	44.0 46.0	ND	CL		Stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet						100				
50	1 3 5 6	S13 23	49.0 51.0	ND	CL		Medium stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf						100	S	M	H	

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

Boring No. HA19-B3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
55	2 3 4 6	S14 23	54.0 56.0	ND	CL		Medium stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.0 - 0.25 tsf						100	S	M	H	
60	3 3 6 6	S15 23	59.0 61.0	ND	CL		Stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.25 - 0.75 tsf						100	S	M	H	
							-MARINE DEPOSITS-										
65	WOR 3" WOH 3" 4 5 6	S16 21	64.0 66.0	ND	CL		Stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.0 - 0.5 tsf						100	S	M	H	
70	3 3 6 6	S17 24	69.0 71.0	ND	CL		Medium stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.0 - 0.25 tsf						100	S	M	H	
75	3 5 8 7	S18 24	74.0 76.0	ND	CL		Medium stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.0 - 0.25 tsf						100	S	M	H	
80	4 6 7 7	S19 15	79.0 81.0	ND	CL		Medium stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP < 0.25 tsf						100	S	M	H	

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA19-B3
File No. 132753-006
Sheet No. 4 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
85	3 4 4 6	S20 23	84.0 86.0	ND	CL		Medium stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf						100	S	M	H	
							-MARINE DEPOSITS-										
90	WOR 4 12 11	S21 24	89.0 91.0	ND	CL		Stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf						100	S	M	H	
						-76.6 93.5	Note: Drill action indicates change in density at 93.5 ft.										
95	37 18 100/ 5"	S22 1	94.0 95.4	ND	CL		Hard gray sandy lean CLAY with gravel (CL), mps 0.9 in., no structure, no odor, wet, trace weathered argillite -GLACIOMARINE DEPOSITS- TOP OF BEDROCK 95.4 FT	5	10	5	5	20	55	S	M	L	
						-78.5 95.4	Note: Drill action and drill wash indicate bedrock. Note: Advanced roller bit to 99.0 ft. SEE CORE BORING REPORT FOR ROCK DETAILS										
100																	
105																	
110																	

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

Boring No. HA19-B3

HALEY ALDRICH

CORE BORING REPORT

Boring No. **HA19-B3**
File No. 132753-006
Sheet No. 5 of 5

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
100	3.5	C1	99.0 104.0	52 49	87 82			Hard to moderately hard, fresh, gray, aphanitic ARGILLITE. Bedding extremely thin, joints moderately dipping, close to wide, planar to undulating, smooth, fresh, tight.
	3							
	3							
	3.5							-BEDROCK-
	3						-87.1	
							104.0	BOTTOM OF EXPLORATION 104.0 FT
105								
110								
115								
120								
125								
130								

TEST BORING REPORT

Boring No. HA19-B4

Project	SOUTH BOSTON INNOVATION, 329 NORTHERN AVE., BOSTON, MA
Client	CARGO VENTURES
Contractor	GEOLOGIC-EARTH EXPLORATION, INC.

File No. 132753-006
Sheet No. 1 of 5
Start June 24, 2019
Finish July 15, 2019
Driller P. Fischer
H&A Rep. A. Fleming
Elevation 16.0 (est.)
Datum Boston City Base
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW/NW	S	NX	Rig Make & Model: B57 Mobile Drill Truck
Inside Diameter (in.)	4/3	1 3/8	3	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Drive to 34.0 ft, NW Spun to 87.0 ft
				Hoist/Hammer: Cat-Head Doughnut Hammer
				PID Make & Model: Ion Science Tiger

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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						15.5	-BITUMINOUS CONCRETE-										
					SP	0.5	Tan to light yellow brown poorly graded SAND (SP), mps 0.2 in., no structure, no odor, moist		5	5	70	20					
					SM	15.0 1.0	-FILL-	10	10	10	30	20	20				
							Black silty SAND with gravel (SM), mps 3.5 in., no structure, no odor, moist, trace concrete										
							Note: Location precleared with vac truck to 6.0 ft.										
5	24 13 13 14	S1 4	6.0 8.0	ND	SP		Medium dense gray to brown poorly graded SAND (SP), mps 0.2 in., no structure, no odor, wet				30	65	5				
	3 5 8 7	S2 12	8.0 10.0	ND	SP		Medium dense gray poorly graded SAND (SP), mps 0.1 in., no structure, no odor, wet				30	65	5				
10	WOR/ 4" -1 4 4 4	S3 8	10.0 12.0	ND	SP		Similar to above, except loose				30	65	5				
							-FILL-										
	4 1 4 3	S4 5	12.0 14.0	ND	SP		Loose gray poorly graded SAND (SP), mps 0.1 in., no structure, no odor, wet				25	70	5				
	1 1 1 1	S5 8	14.0 16.0	ND	OL/ OH		Very soft gray sandy ORGANIC SOIL (OL/OH), mps 0.1 in., no structure, no odor, wet					30	70				
15	2 1 2 1	S6 24	16.0 18.0	ND	OL/ OH		Soft gray ORGANIC SOIL (OL/OH), mps 0.1 in., no structure, no odor, wet, trace pockets of poorly graded sand, trace shells, trace pockets of lean clay					10	90				
						-2.0											
	WOR 1 3 4	S7 24	18.0 20.0	ND	OL/ OH	18.0	Soft gray ORGANIC SOIL with sand (OL/OH), mps 0.2 in., no structure, faint organic odor, wet, trace shells					20	80				
20							-ORGANIC DEPOSITS-										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
7/12/19	0705	16.0	34.0	71.0	9.41

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Splitspoon Sample
G - Geoprobe

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

Summary
Overburden (ft) 87.0
Rock Cored (ft) 5.0
Samples 20S, 1C

Boring No. HA19-B4

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 WITH PERM PID COLUMN HA-LIB09-BOS.GLB HA-TB+CORE+WELL-09 W FENCE.GDT G:\132753 - 2 HARBOR STREET\GINT\132753-006 TB_C_OW.GPJ Aug 2, 19

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA19-B4
File No. 132753-006
Sheet No. 2 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
25	4 2 2 2	S8 22	24.0 26.0	ND	OL/ OH		Soft gray ORGANIC SOIL with sand (OL/OH), mps 0.1 in., no structure, organic odor, wet					20	80				
							-ORGANIC DEPOSITS-										
30	2 3 3 3	S9 15	29.0 31.0	ND	OL/ OH		Medium stiff gray ORGANIC SOIL (OL/OH), mps < 0.1 in., no structure, organic odor, wet						100				
						-18.0											
35	7 9 7 9	S10 1	34.0 36.0	ND	CL	34.0	Very stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet						100	S	H	M	
40	13 17 21 23	S11 4	39.0 41.0	ND	CL		Hard gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet						100	S	H	M	
							-MARINE DEPOSITS-										
45	4 7 7 8	S12 24	44.0 46.0	ND	CL		Stiff gray lean CLAY (CL), mps < 0.1 in., no structure, no odor, wet PP 0.5 - 0.75 tsf						100	S	H	H	
50	5 6 8 8	S13 3	49.0 51.0	ND	CL		Stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet						100	S	M	H	

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

Boring No. HA19-B4

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA19-B4
File No. 132753-006
Sheet No. 3 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
55	4 4 6 6	S14 24	54.0 56.0	ND	CL		Stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.25 - 0.5 tsf						100	S	M	H	
60	3 5 6 7	S15 24	59.0 61.0	ND	CL		Stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.5 - 0.75 tsf						100	S	M	H	
							-MARINE DEPOSITS-										
65	3 5 7 7	S16 21	64.0 66.0	ND	CL		Stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.5 - 0.75 tsf						100	S	M	H	
70	5 7 8 8	S17 14	69.0 71.0	ND	CL		Stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.0 tsf						100	S	M	H	
75	3 4 3 6	S18 22	74.0 76.0	ND	CL		Medium stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.25 - 0.75 tsf Note: Drill action indicates change in material and density at 77.0 ft.						100	S	M	H	
						-61.0 77.0											
80	27 100/ 5"	S19 3	79.0 79.9	ND	SM		Very dense gray silty SAND with gravel (SM), mps 0.8 in., no structure, no odor, wet, trace lean clay, trace weathered argillite -GLACIAL TILL-	5	10	10	20	30	25				

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

Boring No. HA19-B4

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA19-B4
File No. 132753-006
Sheet No. 4 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
85	58 91 84 74	S20 9	84.0 86.0	ND	SM		Very dense gray silty SAND with gravel (SM), mps 0.7 in., no structure, no odor, wet	5	10	5	20	40	20				
							-GLACIAL TILL-										
						-71.0 87.0	-TOP OF BEDROCK 87.0 FT Note: Drill wash indicates top of bedrock. Advanced roller bit to 89.0 ft.										
90							SEE CORE BORING REPORT FOR ROCK DETAILS										

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

Boring No. HA19-B4

HALEY ALDRICH

CORE BORING REPORT

Boring No. **HA19-B4**
File No. 132753-006
Sheet No. 5 of 5

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
90	4	C1	89.0	46	77			Moderately hard, fresh, gray, aphanitic ARGILLITE. Bedding extremely thin, joints moderately dipping, wide to close, planar to undulating, smooth, fresh, tight
	3		94.0	35	58			
	3							
	3							-BEDROCK-
	3							
							-78.0	
95							94.0	BOTTOM OF EXPLORATION 94.0 FT
100								
105								
110								
115								
120								

TEST BORING REPORT

Boring No. HA19-B5

Project	SOUTH BOSTON INNOVATION, 329 NORTHERN AVE., BOSTON, MA
Client	CARGO VENTURES
Contractor	GEOLOGIC-EARTH EXPLORATION, INC.

File No. 132753-006
Sheet No. 1 of 2
Start June 24, 2019
Finish June 25, 2019
Driller D. Sheldon
H&A Rep. A. Fleming
Elevation 15.5 (est.)
Datum Boston City Base
Location See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HW	S	--	Rig Make & Model: B57 Mobile Drill Truck
Inside Diameter (in.)	4	1 3/8	--	Bit Type: Roller Bit
Hammer Weight (lb)	300	140	-	Drill Mud: None
Hammer Fall (in.)	24	30	-	Casing: HW Drive to 9 ft
				Hoist/Hammer: Cat-Head Doughnut Hammer
				PID Make & Model: Ion Science Tiger

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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					SP	15.2 / 0.3	-BITUMINOUS CONCRETE-				75	25					
					SM	14.7 / 0.8	Tan to light brown poorly graded SAND (SP), mps 0.1 in., no structure, no odor, moist	5	5	10	25	35	20				
							-FILL-										
							Black silty SAND (SM), mps 0.7 in., no structure, no odor, moist, trace brick, 5% - 10% concrete										
							Note: Location precleared with vac truck to 6.0 ft.										
							-FILL-										
5	22 8 9 12	S1 7	5.0 7.0	ND	SM		Medium dense black to dark gray silty SAND (SM), mps 0.2 in., no structure, no odor, moist				30	45	25				
	9 6 6 4	S2 11	7.0 9.0	ND	SM		Medium dense black to dark gray silty SAND (SM), mps 0.1 in., no structure, no odor, moist, trace pockets of lean clay, trace pockets of poorly graded sand				30	45	25				
						6.5											
10	2 2 2 2	S3 4	9.0 11.0	ND	OL/ OH	9.0	Soft gray ORGANIC SOIL (OL/OH), mps 0.1 in., no structure, no odor, wet, trace shells						100				
							-COHESIVE FILL-										
15	1 2 2 2	S4 22	14.0 16.0	ND	CL		Soft gray lean CLAY (CL), mps 0.2 in., no structure, no odor, wet, trace pockets of black poorly graded sand						100				
20	2 1 1 2	S5 6	19.0 21.0	ND	CL		Very soft gray to black lean CLAY (CL), mps 0.1 in., no structure, no odor, wet, trace pockets of poorly graded sand					5	95				

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 - Splitspoon Sample
G - Geoprobe

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft) 51.0
Rock Cored (ft) --
Samples 11S

Boring No. HA19-B5

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.

HALEY ALDRICH

TEST BORING REPORT

Boring No. HA19-B5
File No. 132753-006
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	USCS Symbol	Stratum Change Elev/Depth (ft)	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (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
							-COHESIVE FILL-										
						-8.5											
25	1 2 2 2	S6 13	24.0 26.0	ND	OL/ OH	24.0	Gray ORGANIC SOIL (OL/OH), mps 0.1 in., no structure, organic odor, wet, trace shells						100				
							-ORGANIC DEPOSITS-										
30	1 1 1 2	S7 24	29.0 31.0	ND	OL/ OH		Gray ORGANIC SOIL (OL/OH), mps 0.1 in., no structure, organic odor, wet, trace peat fibers and shells						100				
						-18.5											
35	8 10 16 17	S8 24	34.0 36.0	ND	CL	34.0	Very stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 3.0 - 4.5 tsf						100	S	H	M	
40	6 6 14 20	S9 22	39.0 41.0	ND	CL		Very stiff gray lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 2.0 - 2.5 tsf						100	S	H	M	
							-MARINE DEPOSITS-										
45	46 29 38 39	S10 4	44.0 46.0		CL		Hard gray to olive brown lean CLAY (CL), mps 0.1 in., no structure, no odor, dry PP 4.0 - 4.5 tsf						100	S	H	M	
50	3 4 5 7	S11 23	49.0 51.0		CL		Stiff gray to olive brown lean CLAY (CL), mps 0.1 in., no structure, no odor, wet PP 0.75 - 1.5 tsf -MARINE DEPOSITS-						100	S	M	H	
						-35.5											
						51.0	BOTTOM OF EXPLORATION 51.0 FT										

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

Boring No. HA19-B5

APPENDIX E

Rock Core Photographs

BORING ID	CORE ID	CORE RUN DEPTH (FT)	CORE RUN EL. (FT, BCB)	RECOVERY		RQD[NOTE 2]	
				IN.	%	IN.	%
HA19-B1	C1	114.0 TO 119.0	-97.8 TO -102.8	54	90	45	75
HA19-B2	C1	114.0 TO 117.0	-97.2 TO -100.2	36	100	22	61
HA19-B2	C2	117.0 TO 119.0	-100.2 TO -102.2	18	75	18	75
HA19-B3	C1	99.0 TO 104.0	-82.1 TO -87.1	52	87	49	82
HA19-B4	C1	89.0 TO 94.0	-73.0 TO -78.0	46	77	35	58

NOTES:

1. "X" INDICATES DRILL BREAK; "/" INDICATES JOINT.
2. "RQD" INDICATES ROCK QUALITY DESIGNATION (PERCENT OF ROCK PIECES RECOVERED EQUAL TO OR GREATER THAN 4 IN. IN LENGTH).

HALEY ALDRICH

UNDERGROUND ENGINEERING & ENVIRONMENTAL SOLUTIONS

SOUTH BOSTON INNOVATION CAMPUS
2 HARBOR STREET / 329 NORTHERN AVENUE
BOSTON, MASSACHUSETTS

PHOTOGRAPH OF BEDROCK CORE

FILE NO. 132753-006 Sept. 2019

\\haleyaldrich.com\share\bos_common\132753 - 2 Harbor Street\006 - Design\Subsurface Data Report\Appendix F - Rock Core Photos\[2019-0904-HAI-SBIC-Rock Core Photos.xlsx]Photos

APPENDIX F

Test Pit Logs and Annotated Photographs

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA19-TP1

Project	SOUTH BOSTON INNOVATION CAMPUS
Location	CORNER 2 HARBOR ST/329 NORTHERN AVE, BOSTON, MA
Client	ICCNE LLC
Contractor	JAMES W. FLETT CO., INC.
Equipment Used	Caterpillar M320 Excavator
File No.	132753-006
H&A Rep	S. Shay
Date	22 Jul 2019
Weather	85 F, sunny

Ground El.: 16.9 ft
El. Datum: BCB
Location: See Plan
Groundwater depths/entry rates (in./min.): Dry

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0				-ASPHALT-										
		16.5 0.4	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 0.25 in., no structure, no odor, dry				65	35					
		16.1 0.8	SP	Dark brown poorly graded SAND with silt (SP), 5 - 8% oversized, mps 4 in., no structure, no odor, moist, trace brick	5	5	15	40	25	10				
1														
2		14.8 2.1	GP	Gray poorly graded GRAVEL with sand (GP), 10% oversized, mps 3 in., no structure, no odor, moist, highly compacted as dense grade material	20	40	20	10	10					
		13.9 3.0		-FILL-										
3			SP	Yellow brown poorly graded SAND (SP), mps 0.4 in., no structure, no odor, moist				65	35					
4				Note: Concrete protective slab over tunnel encountered at 4.4 ft.										
		12.5 4.4		BOTTOM OF EXPLORATION 4.4 FT										

Obstructions:

Remarks: Ground surface elevation by Feldman; pit backfilled in 6-in. lifts and compacted with a vibratory plate compactor.

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

Standing Water in Completed Pit

at depth Dry ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24		=
over 24		=

Test Pit Dimensions (ft)

Pit Length x Width (ft) 6 x 8 ft
Pit Depth (ft) 4.4

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

HA TESTPIT-09 HA-LIB09-BOS.GLB HA-TP07-1.GDT G:\132753 - 2 HARBOR STREET\GINT\132753-006 TP.GPJ Aug 15, 19

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA19-TP2

Project	SOUTH BOSTON INNOVATION CAMPUS
Location	CORNER 2 HARBOR ST/329 NORTHERN AVE, BOSTON, MA
Client	ICCNE LLC
Contractor	JAMES W. FLETT CO., INC.
Equipment Used	Caterpillar M320 Excavator

File No.	132753-006
H&A Rep	S. Shay
Date	24 Jul 2019
Weather	Mid-60s F, mostly cloudy

Ground El.: 16.2
El. Datum: BCB

Location: See Plan

Groundwater depths/entry rates (in./min.): Seepage very slowly at depth of 6.2 ft only at NW corner of pit

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0		15.9		-ASPHALT-										
		0.4	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 0.25 in., no structure, no odor, dry				65	35					
				-FILL-										
		15.0												
		1.2	SM	Dark brown to black silty SAND with gravel (SM), 15% oversized, mps 1.5 ft as rubble fill, no structure, no odor, moist, trace brick, fabric, cobbles, ash, and cinders, occasional pockets of disturbed peat	5	10	15	15	35	20				
2				Note: Exposed 4-in. ductile iron pipe on concrete at 2.7 in.										
4														
		11.2												
		5.0	CL	Gray lean CLAY (CL)										
6				Note: Possible concrete duct bank at 6.5 ft.										
								50	50					
8				-COHESIVE FILL-										
		7.7												
		8.5		BOTTOM OF EXPLORATION 8.5 FT Note: Test pit did not encounter remnant support of excavation associated with CA/T tunnel.										

Obstructions: Pipe at 2.7 ft and concrete duct bank a 6.5'

Remarks: Ground surface elevation by Feldman; pit backfilled in 6-in. lifts and compacted with a vibratory plate compactor.

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

Standing Water in Completed Pit

at depth Dry ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	3	= 4.5 as rubble
over 24	--	= --

Test Pit Dimensions (ft)

Pit Length x Width (ft) 10 x 6.5 ft
Pit Depth (ft) 8.5

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

HA TESTPIT-09 HA-LIB09-BOS.GLB HA-TP07-1.GDT G:\132753 - 2 HARBOR STREET\GINT\132753-006 TP.GPJ Aug 15, 19

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA19-TP3

Project	SOUTH BOSTON INNOVATION CAMPUS	**File No.**	132753-006
Location	CORNER 2 HARBOR ST/329 NORTHERN AVE, BOSTON, MA	**H&A Rep**	S. Shay
Client	ICCNE LLC	**Date**	23 Jul 2019
Contractor	JAMES W. FLETT CO., INC.	**Weather**	68 F, Rain
Equipment Used	Caterpillar M320 Excavator		

Ground El.: 16.3 ft
El. Datum: BCB
Location: See Plan
Groundwater depths/entry rates (in./min.): Dry

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0		15.9		-ASPHALT-										
		0.4	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 0.25 in., no structure, no odor, dry				65	35					
		15.2												
		1.1	SM	Dark brown silty SAND with gravel (SM), 5 to 8% oversized, mps 4 in., no structure, no odor, moist	5	10	15	15	35	20				
		14.7												
		1.6	GP	Gray poorly graded GRAVEL with sand (GP), 10% oversized, mps 3 in., no structure, no odor moist, highly compacted dense grade material	20	40	20	10	10					
2														
				-FILL-										
4														
6				Note: Few splintered pieces of wood at 6.2 ft.										
		9.1												
		7.2	SP	Yellow brown poorly graded SAND (SP), mps 0.4 in., no structure, no odor, moist				50	50					
		8.4		Note: Hand excavated 1.5' x 4' area in center of pit. Concrete protective slab over tunnel encountered at 7.9 ft.										
		7.9		BOTTOM OF EXPLORATION 7.9 FT										

Obstructions:

Remarks: Ground surface elevation by Feldman; pit backfilled in 6-in. lifts and compacted with a vibratory plate compactor.

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

Standing Water in Completed Pit

at depth Dry ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24		=
over 24		=

Test Pit Dimensions (ft)

Pit Length x Width (ft) 10 x 6
Pit Depth (ft) 7.9

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

HA TESTPIT-09 HA-LIB09-BOS.GLB HA-TP07-1.GDT G:\132753 - 2 HARBOR STREET\GINT\132753-006 TP.GPJ Aug 15, 19

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TEST PIT LOG

Test Pit No. HA19-TP4

Project	SOUTH BOSTON INNOVATION CAMPUS	**File No.**	132753-006
Location	CORNER 2 HARBOR ST/329 NORTHERN AVE, BOSTON, MA	**H&A Rep**	S. Shay
Client	ICCNE LLC	**Date**	22 Jul 2019
Contractor	JAMES W. FLETT CO., INC.	**Weather**	85 F, mostly sunny
Equipment Used	Caterpillar M320 Excavator		

Ground El.: 16.4 ft
El. Datum: BCB
Location: See Plan
Groundwater depths/entry rates (in./min.): Dry

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests: Dilatancy	Toughness	Plasticity	Strength
0				-ASPHALT-										
		16.0 0.4	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 0.25 in., no structure, no odor, dry				65	35					
1		15.3		-FILL-										
		1.1	SP	Dark brown poorly graded SAND with silt (SP), 5 to 8% oversized, mps 4 in., no structure, no odor, moist, trace brick	5	5	15	40	25	10				
				-FILL-										
		14.6 1.8	GP	Gray poorly graded GRAVEL with sand (GP), 10% oversized, mps 3 in., no structure, no odor, moist, highly compacted as dense grade material	20	40	20	10	10					
2														
3				-FILL-										
4		12.3 4.1	SP	Yellow brown poorly graded SAND (SP), mps 0.4 in., no structure, no odor, moist				50	50					
				-FILL-										
		11.6 4.8		Note: Concrete protective slab over tunnel at 4.8 ft.										
				BOTTOM OF EXPLORATION 4.8 FT										

Obstructions:

Remarks: Ground surface elevation by Feldman; pit backfilled in 6-in. lifts and compacted with a vibratory plate compactor.

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

Standing Water in Completed Pit

at depth Dry ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24		=
over 24		=

Test Pit Dimensions (ft)

Pit Length x Width (ft) 6.2 x 10 ft
Pit Depth (ft) 4.8

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

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TEST PIT LOG

Test Pit No. HA19-TP5

Project	SOUTH BOSTON INNOVATION CAMPUS
Location	CORNER 2 HARBOR ST/329 NORTHERN AVE, BOSTON, MA
Client	ICCNE LLC
Contractor	JAMES W. FLETT CO., INC.
Equipment Used	Caterpillar M320 Excavator
File No.	132753-006
H&A Rep	S. Shay
Date	25 Jul 2019
Weather	80s F, parly cloudy

Ground El.: 16.6 ft
El. Datum: BCB
Location: See Plan
Groundwater depths/entry rates (in./min.): Dry

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0				-ASPHALT-										
		16.2 / 0.4	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 2.5 in., no structure, no odor, dry				65	35					
1		15.4 / 1.2		-FILL-										
			SP	Dark brown poorly graded SAND with silt (SP), 5 to 8% oversized, mps 4 in., no structure, no odor, moist, trace brick, trace fabric	5	5	15	40	25	10				
2				-FILL-										
		14.2 / 2.4	GP	Gray poorly graded GRAVEL (GP) with sand, 10% oversized, mps 3 in., no structure, no odor, moist, highly compacted as dense grade material	20	40	20	10	10					
3				-FILL-										
		12.7 / 3.9	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 2.5 in., no structure, no odor, dry				65	35					
4		12.0 / 4.6		Note: Concrete protective slab over tunnel encountered at 4.6 ft.										
				BOTTOM OF EXPLORATION 4.6 FT										

Obstructions:

Remarks: Ground surface elevation by Feldman; pit backfilled in 6-in. lifts and compacted with a vibratory plate compactor.

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

Standing Water in Completed Pit

at depth Dry ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24		=
over 24		=

Test Pit Dimensions (ft)

Pit Length x Width (ft) 9.5 x 9.5 ft
Pit Depth (ft) 4.6

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

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA19-TP6

Project	SOUTH BOSTON INNOVATION CAMPUS	**File No.**	132753-006
Location	CORNER 2 HARBOR ST/329 NORTHERN AVE, BOSTON, MA	**H&A Rep**	S. Shay
Client	ICCNE LLC	**Date**	24 Jul 2019
Contractor	JAMES W. FLETT CO., INC.	**Weather**	Low 70s F, partly cloudy
Equipment Used	Caterpillar M320 Excavator		

Ground El.: 15.9 ft
El. Datum: BCB
Location: See Plan
Groundwater depths/entry rates (in./min.): Dry

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests: Dilatancy	Toughness	Plasticity	Strength
0		15.6		-ASPHALT-										
		0.4	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 2 in., no structure, no odor, dry				65	35					
				-FILL-										
1		14.7												
		1.2	SP	Dark brown to black silty SAND (SP), 12 to 15% oversized, mps 9 in., no structure, no odor, moist, trace brick, trace fabric	5	5	10	35	30	15				
				-FILL-										
		14.0												
2		1.9	GP	Gray poorly graded GRAVEL with sand (GP), 10% oversized, mps 3 in., no structure, no odor, moist, highly compacted dense grade material.										
				Note: 24 in. x 12 in. concrete duct bank located at northeast end of pit encountered at 2.5 ft.	20	40	20	10	10					
3				-FILL-										
4		11.6		Note: 1.5-in. pipe perpendicular to concrete conduit at 4.3 ft.										
		4.3	SP	Tan poorly graded SAND (SP), single-grain structure, no odor, dry. Sand collapsing. Limited area to dig due to concrete duct bank.				15	85					
5														
6		9.9												
		6.0		BOTTOM OF EXPLORATION 6.0 FT										
				Note: Unable to advance test pit deeper due to duct bank. Test pit did not encounter remnant support of excavation associated with CA/T tunnel.										

Obstructions: Concrete duct bank at 2.5 ft.

Remarks: Ground surface elevation by Feldman; pit backfilled in 6-in. lifts and compacted with a vibratory plate compactor.

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

Standing Water in Completed Pit

at depth Dry ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24		=
over 24		=

Test Pit Dimensions (ft)

Pit Length x Width (ft) 6.2 x 10 ft
Pit Depth (ft) 6.0

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

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HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA19-TP7

Project	SOUTH BOSTON INNOVATION CAMPUS
Location	CORNER 2 HARBOR ST/329 NORTHERN AVE, BOSTON, MA
Client	ICCNE LLC
Contractor	JAMES W. FLETT CO., INC.
Equipment Used	Caterpillar M320 Excavator

File No.	132753-006
H&A Rep	S. Shay
Date	24 Jul 2019
Weather	Upper 60s F, mostly cloudy

Ground El.: 16.2 ft
El. Datum: BCB
Location: See Plan
Groundwater depths/entry rates (in./min.): Dry

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0		15.9		-ASPHALT-										
		0.4	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 0.25 in., no structure, no odor, dry				65	35					
				-FILL-										
1		14.9												
		1.3	SP	Dark brown poorly graded SAND with silt (SP), 5 to 8% oversized, mps 4 in., no structure, no odor, moist, trace brick, trace fabric	5	5	15	40	25	10				
				-FILL-										
		14.3												
2		1.9	GP	Gray poorly graded GRAVEL with sand (GP), mps 3 in., no structure, no odor, moist, highly compacted dense grade material, trace concrete										
3				-FILL-										
		12.9												
		3.3		Note: Concrete rubble with trace rebar encountered at 3.3 ft.										
4														
				-FILL-										
5		10.7												
		5.5		BOTTOM OF EXPLORATION 5.5 FT										
				Note: Due to obstructions, unable to advance deeper to determine depth to top of tunnel.										

Obstructions:

Remarks: Ground surface elevation by Feldman; pit backfilled in 6-in. lifts and compacted with a vibratory plate compactor.

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

Standing Water in Completed Pit

at depth Dry ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24		=
over 24		=

Test Pit Dimensions (ft)

Pit Length x Width (ft) 6.2 x 10 ft
Pit Depth (ft) 5.5

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

HA TESTPIT-09 HA-LIB09-BOS.GLB HA-TP07-1.GDT G:\132753 - 2 HARBOR STREET\GINT\132753-006 TP.GPJ Aug 15, 19

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA19-TP8

Project	SOUTH BOSTON INNOVATION CAMPUS
Location	CORNER 2 HARBOR ST/329 NORTHERN AVE, BOSTON, MA
Client	ICCNE LLC
Contractor	JAMES W. FLETT CO., INC.
Equipment Used	Caterpillar M320 Excavator
File No.	132753-006
H&A Rep	S. Shay
Date	25 Jul 2019
Weather	Low 70s F, partly cloudy

Ground El.: 16.6 ft
El. Datum: BCB
Location: See Plan
Groundwater depths/entry rates (in./min.): Dry

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0		16.2		-ASPHALT-										
		0.4	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 2 in., no structure, no odor, dry				65	35					
1				-FILL-										
		15.3												
		1.3	SP	Dark brown poorly graded SAND with silt (SP), 10 to 12% oversized, mps 8 in., no structure, no odor, moist, trace brick, trace fabric	5	5	15	40	25	10				
2				-FILL-										
		14.5												
		2.1	GP	Gray poorly graded GRAVEL with sand (GP), 10% oversized, mps 3 in., no structure, no odor, moist, highly compacted dense grade material	20	40	20	10	10					
3				-FILL-										
4														
		11.7												
		4.9	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 1.8 in., no structure, no odor, moist										
5														
				-FILL-				60	40					
6				Note: Concrete protective slab over tunnel encountered at 6.0 to 6.5 ft.										
		10.1												
		6.5		BOTTOM OF EXPLORATION 6.5 FT										
				Note: Top of tunnel appears to slope downard toward northern end of pit.										

Obstructions:

Remarks: Ground surface elevation by Feldman; pit backfilled in 6-in. lifts and compacted with a vibratory plate compactor.

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

Standing Water in Completed Pit

at depth Dry ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24		=
over 24		=

Test Pit Dimensions (ft)

Pit Length x Width (ft) 9.5 x 9.5 ft
Pit Depth (ft) 6.5

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

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA19-TP9

Project	SOUTH BOSTON INNOVATION CAMPUS
Location	CORNER 2 HARBOR ST/329 NORTHERN AVE, BOSTON, MA
Client	ICCNE LLC
Contractor	JAMES W. FLETT CO., INC.
Equipment Used	Caterpillar M320 Excavator
File No.	132753-006
H&A Rep	S. Shay
Date	25 Jul 2019
Weather	70s F, parly cloudy

Ground El.: 15.9 ft
El. Datum: BCB
Location: See Plan
Groundwater depths/entry rates (in./min.): Dry

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Color GROUP NAME & SYMBOL, % oversized, maximum particle size, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests: Dilatancy	Toughness	Plasticity	Strength
0		15.5		-ASPHALT-										
		0.4	SP	Yellow brown poorly graded SAND (SP), no oversized, mps 2 in., no oversized, no structure, no odor, dry				65	35					
1		14.7												
		1.2	SP	Dark brown poorly graded SAND with silt (SP), 8 to 10% oversized, mps 9 in., no structure, no odor, moist, trace brick, trace wood, trace sheet metal	5	5	15	40	25	10				
		14.0												
2		1.9	GP	Gray poorly graded GRAVEL with sand (GP), 10% oversized, mps 3 in., no structure, no odor, moist, highly compacted dense grade material Note: Pocket of broken concrete rubble with re-bar observed in east sidewall at depth of 2 to 3.5 ft										
3														
4				Note: Exposed 24-in. diameter concrete drain pipe. Top/crown at 3.8 ft.	20	40	20	10	10					
5				Note: 4-in. medium fine sand layer on concrete.										
6				Note: Hand excavated a 1 x 5 ft section of pit. Concrete protective slab over tunnel at 6.5 to 6.9 ft.										
		9.0												
		6.9		BOTTOM OF EXPLORATION 6.9 FT Note: Top of tunnel appears to slope downward toward eastern end of tunnel.										

Obstructions:

Remarks: Ground surface elevation by Feldman; pit backfilled in 6-in. lifts and compacted with a vibratory plate compactor.

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

Standing Water in Completed Pit

at depth Dry ft
measured after 0.5 hours elapsed

Boulders

Diameter (in.) Number Approx. Vol. (cu.ft)
12 to 24 =
over 24 =

Test Pit Dimensions (ft)

Pit Length x Width (ft) 6.3 x 10 ft
Pit Depth (ft) 6.9

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

Photo 1: View looking west at HA19-TP1

Photo 2: Dense graded fill encountered at depth of approx. 2 ft below existing site grades at HA19-TP1

Photo 3: Hand excavated to top of tunnel protective slab at depth of 4.4 ft below existing site grades at HA19-TP1

Photo 4: Backfilled/compacted test pit at HA19-TP1

Photo 5: Saw cutting asphalt at HA19-TP2

Photo 6: Clay (hydraulic fill) material encountered at depth of approx. 5 ft below existing site grades at HA19-TP2

Photo 7: Backfilling/compacting within HA19-TP2

Photo 8: Asphalt patch at HA19-TP2 and HA19-TP3

Photo 9: View looking west at HA19-TP3 excavation

Photo 10: Installing trench box for temporary excavation support at HA19-TP3

Photo 11: Hand excavated at HA19-TP3 to top of tunnel protective slab at depth of 7.9 ft below existing site grades

Photo 12: Backfilling/compacting within completed HA19-TP3 test pit

Photo 13: View looking south at HA19-TP4

Photo 14: Looking into HA19-TP4 excavation; hand excavated to top of tunnel protective slab at depth of 4.8 ft below existing site grades

Photo 15: Backfilling/compacting within completed HA19-TP4 test pit

Photo 16: Completed/backfilled test pit at HA19-TP4

Photo 17: View looking south towards HA19-TP5

Photo 18: Hand excavation to expose top of tunnel at HA19-TP5

Photo 19: Top of tunnel protective slab encountered depth of 4.6 ft below existing site grades at HA19-TP5

Photo 20: View of excavated material generated from HA19-TP5 excavation

Photo 21: Looking west at the location of HA19-TP6 and HA19-TP7

Photo 22: View looking into HA19-TP6; concrete duct bank exposed at northeast end of test pit

Photo 23: Completed/backfilled test pit at HA19-TP6

Photo 24: View looking south at location of HA19-TP7

Photo 25: Dense graded material and concrete rubble/debris encountered at depth of approx. 1.9 ft below existing grades at HA19-TP7

Photo 26: View looking into HA19-TP7 excavation

Photo 27: View of excavated material generated from HA19-TP7 excavation

Photo 28: View looking east at HA19-TP8 excavation

Photo 28: Excavating at HA19-TP8, located near the center of the I-90 CA/T tunnel alignment

Photo 30: Trench box installed for temporary excavation support at HA19-TP8

Photo 31: Hand excavated to top of tunnel protective slab at depth of 6.0 to 6.5 ft below existing site grades at HA19-TP8

Photo 32: View looking east at HA19-TP9 excavation

Photo 33: Typical cross-section of fill material placed over CA/T tunnel alignment at HA19-TP9

Photos 34 and 35: Hand excavated to top of tunnel protective slab at depth of 6.5 to 6.9 ft below existing site grades at HA19-TP9

APPENDIX G

Stormwater Management Systems

HALEY & ALDRICH, INC.
465 Medford St.
Suite 2200
Boston, MA 02129
617.886.7400

15 April 2021
File No. 0200427-000

BCP-CG Harbor Property LLC
c/o Beacon Capital Partners
200 State Street, 5th Floor
Boston, Massachusetts 02109

Attention: Mr. Eric Ewer
Senior Vice President

Subject: Stormwater Storage and Infiltration Systems
2 Harbor Street/ 329 Northern Avenue
Boston, Massachusetts

Ladies and Gentlemen:

This letter summarizes analyses conducted by Haley & Aldrich to evaluate the effectiveness (i.e., mounding potential) for the subject project's stormwater storage and infiltration systems as it relates to complying with the Boston Water and Sewer Commission (BWSC) requirement to retain and infiltrate the 1.25-inch design storm volume for the impervious portion of the property (and the Leadership in Energy and Environmental Design (LEED) goal to retain and infiltrate the 1.15-inch design storm volume for the total footprint area of the property) to the subsurface within 72-hours in advance of overflow discharge to the local storm drain system servicing the project site.

Systems Description

Based on information provided to us by the project's Civil Engineer (Nitsch Engineering), the analyses described herein are based on a total stormwater runoff volume of 18,800 cubic feet (cf)/ 140,000 gallons that can be infiltrated from two separate systems identified as System 1 and System 2 (further subdivided as 2A and 2B) and as shown on the attached Drawing C-300 titled Site Utility Plan, prepared by Nitsch Engineering and dated 16 April 2021.

We understand that the System 1 design volume (14,500 cf/ 108,000 gallons) will be held within a tank positioned inside the building's one-level below grade parking structure, from which it will be pumped to an approximately 358 ft-long drainage gallery as generally shown in plan view on the attached Drawing C-300 and with cross-sectional details as shown on the attached Drawing C-500 titled Details I, prepared by Nitsch Engineering and dated 16 April 2021.

We also understand that the System 2 design volume (4,300 cf/ 32,000 gallons) will be collected from a network of area drains positioned throughout the project's planned greenscape/ hardscape improvements located to the north of the new building. Surface runoff from the area drains will be piped to two separate (2A and 2B) but connected storage/infiltration systems comprised of open-bottomed storm water storage chambers encapsulated by drainage stone as generally shown in plan

view on Drawing C-300; cross-sectional details of the drainage gallery are provided on the attached Drawing C-501 titled Details II, prepared by Nitsch Engineering and dated 16 April 2021.

Systems 1 and 2 (2A and 2B) are designed to facilitate infiltration of water into the miscellaneous fill soils anticipated to underlie the project site to a depth of about 20 ft below planned final site grades.

System Performance - Mounding Potential

Groundwater mounding occurs beneath stormwater management structures designed to infiltrate stormwater runoff. Concentrating recharge in a limited area can cause groundwater mounding that can affect/alter existing groundwater conditions resulting in unintended impacts to surface and subsurface structures and conditions. Following is a summary of results obtained from calculating groundwater mounding potential for Systems 1 and 2 (2A and 2B) using a widely known and accepted (although simplified) analytical method based on work by Hantush (1967).

The estimated mounding potential after 72-hours of infiltration directly below System 1 is 3.1 ft above static groundwater level, or El. 11.1 Boston City Base (BCB) assuming a season high groundwater elevation of El. 8 BCB. Estimated mounding potential for System 2A is 2.0 ft, or El. 10.0 BCB and for System 2B is 1.6 ft, or El. 9.6 BCB.

For all three cases, the mound height is for a short period of time and dissipates within a relatively small radial or lateral distance from the footprint of each infiltration system. A detailed summary of the analytical solution results is included in the attached Appendix A.

Closing

We trust that the above information meets your needs. If you have questions or wish to discuss the recommendations provided, do not hesitate to contact us.

Sincerely yours,
HALEY & ALDRICH, INC.

Michael Atwood, P.E.
Principal

Attachments

- Drawing C-300 titled Site Utility Plan, prepared by Nitsch Engineering, dated 16 April 2021
- Drawing C-500 titled Details I, prepared by Nitsch Engineering, dated 18 February 2021
- Drawing C-501 titled Details II, prepared by Nitsch Engineering, dated 18 February 2021
- Appendix A - Calculations

C: Nitsch Engineering; Attn: Brittney Veeck, Chris Hodney

2 HARBOR

329 NORTHERN AVE
BOSTON, MA 02210

OWNER
BCP-CG HARBOR PROPERTY LLC
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3	2/18/2021	100% SCHEMATIC DESIGN
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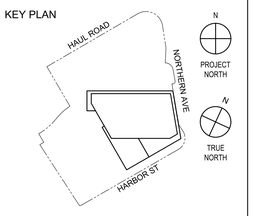
KEY PLAN



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SCALE:	1" = 20'
PROJECT NO:	1550
SEAL & SIGNATURE	

SCALE: 1" = 20'
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BWSC SITE PLAN #21

BWSC USE ONLY

DRAWING TITLE:

SITE UTILITY PLAN

DRAWING NO:

C-300

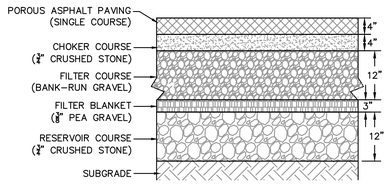
SITE ADDRESS:
2 HARBOR STREET
BOSTON, MA 02210

BWSC ACCOUNT/METER NUMBER:
XXXXXXXX/XXXXXXX

WARD / PARCEL NUMBER:
06/02674115

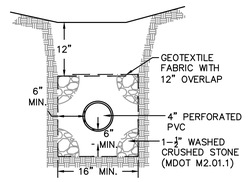
SITE USE:
COMMERCIAL (C)

OWNER CONTACT INFORMATION:
ERIC EWER
BEACON CAPITAL PARTNERS
200 STATE ST
BOSTON, MA 02109



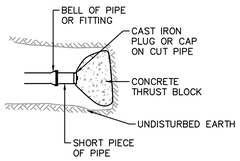
TYPICAL POROUS ASPHALT SECTION DETAIL

NOT TO SCALE



UNDERDRAIN DETAIL

NOT TO SCALE



PLUG OR CAP DETAIL

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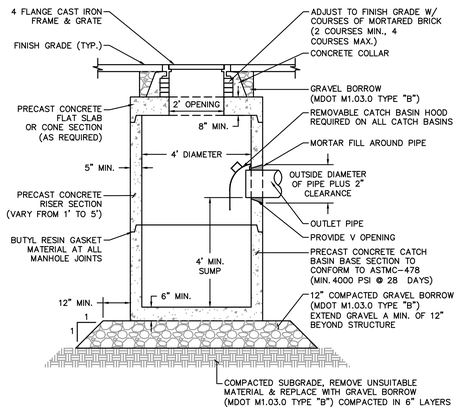
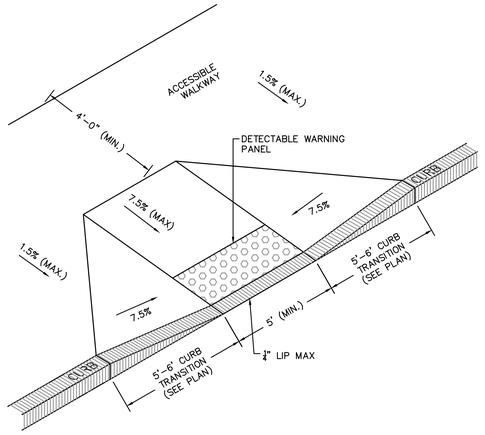


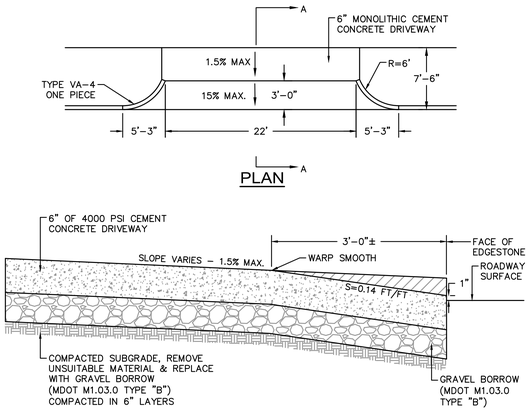
TYPICAL CATCH BASIN DETAIL

NOT TO SCALE



ACCESSIBLE RAMPS WITH GREATER THAN 12'-6" SIDEWALK DETAIL

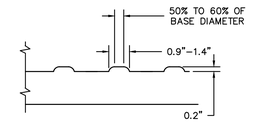
NOT TO SCALE



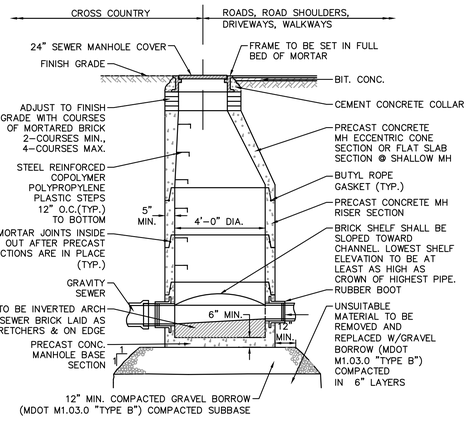
SECTION A-A CONCRETE DRIVEWAY

TYPICAL DRIVEWAY-BOSTON STANDARD DETAIL

NOT TO SCALE

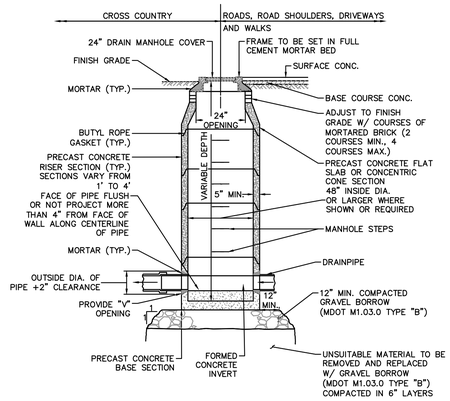


SECTION A-A



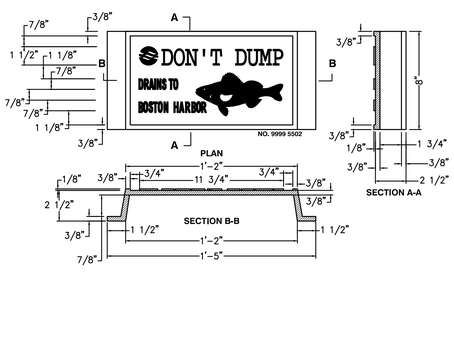
TYPICAL SEWER MANHOLE DETAIL

NOT TO SCALE



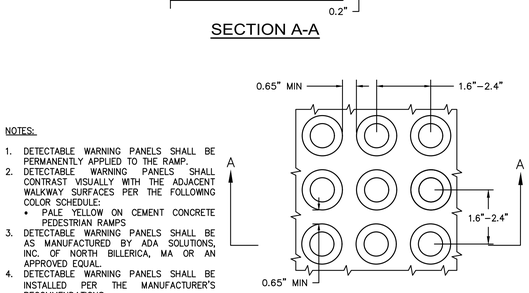
TYPICAL DRAIN MANHOLE DETAIL

NOT TO SCALE



BWSC "DON'T DUMP" PLAQUE DETAIL

NOT TO SCALE



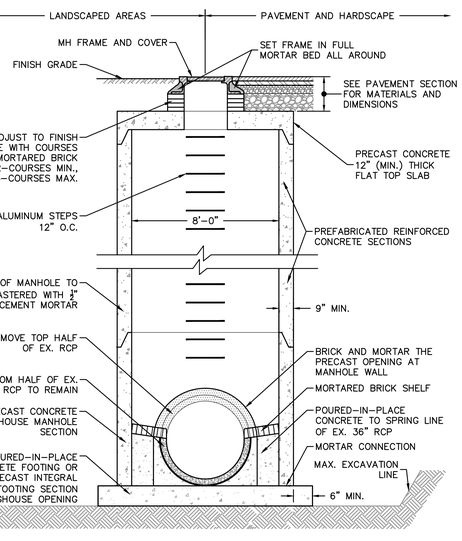
DETECTABLE WARNING PANEL

NOTES:

1. DETECTABLE WARNING PANELS SHALL BE PERMANENTLY APPLIED TO THE RAMP.
2. DETECTABLE WARNING PANELS SHALL CONTRAST VISUALLY WITH THE ADJACENT WALKWAY SURFACES PER THE FOLLOWING COLOR SCHEDULE:
   - PALE YELLOW ON CEMENT CONCRETE PEDESTRIAN RAMPS
3. DETECTABLE WARNING PANELS SHALL BE AS MANUFACTURED BY ADA SOLUTIONS, INC. OF NORTH BILLERICA, MA OR AN APPROVED EQUAL.
4. DETECTABLE WARNING PANELS SHALL BE INSTALLED PER THE MANUFACTURER'S RECOMMENDATIONS.

DETECTABLE WARNING PANEL FOR PEDESTRIAN RAMPS DETAIL

NOT TO SCALE

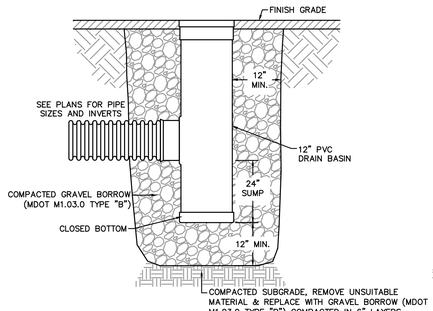


NOTES:

1. PREFABRICATED REINFORCED CONCRETE MANHOLE SECTIONS SHALL BE USED AND SHALL BE DESIGNED TO WITHSTAND AASHTO HS-20-44 LOADING.
2. SHOP DRAWINGS WILL BE REQUIRED TO BE SUBMITTED FOR APPROVAL. THE SHOP DRAWINGS SHALL BE STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN MASSACHUSETTS.

8' DOGHOUSE MANHOLE DETAIL

NOT TO SCALE



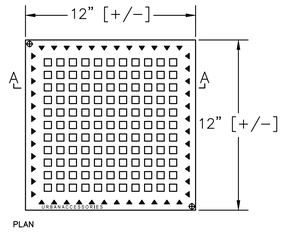
SECTION VIEW

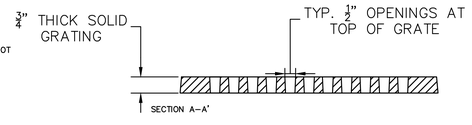
NOTES:

1. FRAME AND GRATE SHALL BE DUCTILE IRON CONFORMING TO ASTM A536 GRADE 70-50-05.
2. 12" AREA DRAINS SHALL BE NYLOPLAST MODEL 2812 AS MANUFACTURED BY ADVANCED DRAINAGE SYSTEMS, INC., OR APPROVED EQUAL.
3. AREA DRAINS SHALL BE CUSTOM MANUFACTURED ACCORDING TO THE PLANS AND DETAIL.
4. CASTINGS SHALL BE FURNISHED WITH A BLACK PAINT.
5. SEE PLANS FOR LAYOUT AND ELEVATIONS OF DRAIN PIPES TO AREA DRAINS.

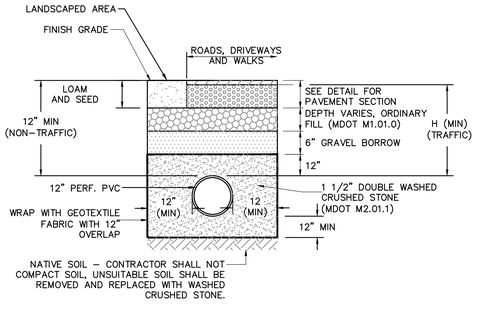
12" AREA DRAIN DETAIL

NOT TO SCALE





PEDESTRIAN GRATE (ADA COMPLIANT)



SUBSURFACE SYSTEM 1 INFILTRATION SYSTEM DETAIL

NOT TO SCALE

2 HARBOR

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BCP-CG HARBOR PROPERTY LLC
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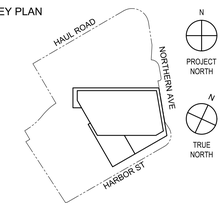
KEY PLAN



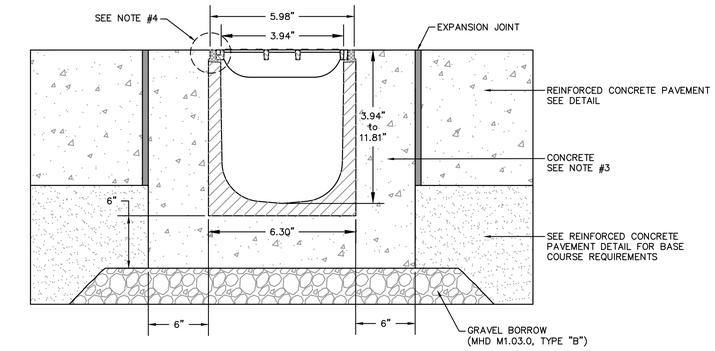
PROJECT DATUM:	PROJ. 0'-0" = +16'-6" BCB
SCALE:	AS NOTED
PROJECT NO:	1550
SEAL & SIGNATURE	

DRAWING TITLE:

DETAILS I

DRAWING NO:

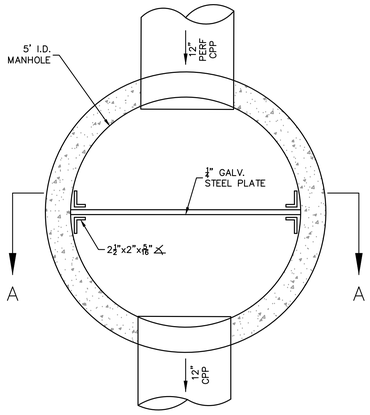
C-500



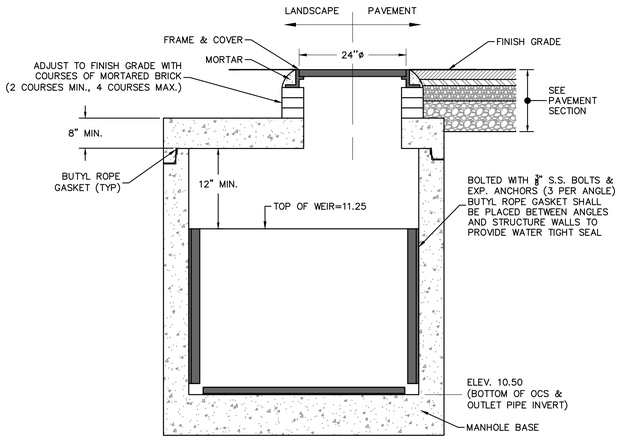
NOTES:
1. TRENCH DRAIN SHALL BE A POLYMER CONCRETE CHANNEL SYSTEM WITH A DUCTILE IRON RAIL AND GRATE.
2. TRENCH DRAIN SYSTEM AND GRATES SHALL BE H-20 LOADING.
3. CONCRETE CRADLE FOR TRENCH DRAIN SHALL BE MINIMUM 4,000 PSI. CONCRETE SHALL BE VIBRATED TO ELIMINATE AIR POCKETS.
4. THE FINISHED LEVEL OF THE SURROUNDING CONCRETE SHALL BE SET ½" ABOVE THE TOP OF THE CHANNEL EDGE.
5. TRENCH DRAIN GRATE SHALL BE ADA COMPLIANT.
6. TRENCH DRAIN SYSTEM SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
7. ALL TRENCH DRAINS SHALL BE PROVIDED WITH AN INLINE CATCH BASIN AT THE LOW POINT OF THE SYSTEM. WIDTH OF INLINE CATCH BASIN TO MATCH WIDTH OF TRENCH DRAIN.

4" TRENCH DRAIN IN CONCRETE PAVEMENT DETAIL

NOT TO SCALE



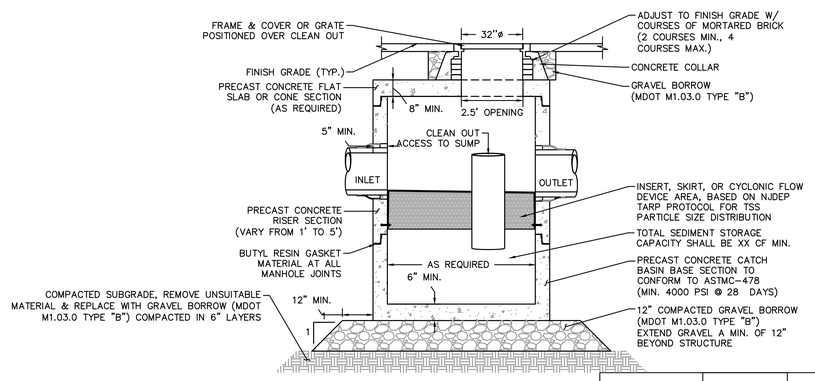
PLAN



SECTION A-A

OUTLET CONTROL STRUCTURE (OCS700)

NOT TO SCALE



NOTE :

1. THE USE OF FLEXIBLE CONNECTIONS IS RECOMMENDED AT THE INLET AND OUTLET WHERE APPLICABLE.
2. THE COVER SHOULD BE POSITIONED OVER THE OUTLET DROP PIPE AND THE OIL CLEANOUT PIPE.
3. STRUCTURE DESIGNED FOR H20 LOADING

STRUCTURE NAME	MINIMUM WQF	PEAK FLOW RATE*	MINIMUM SEDIMENT STORAGE CAPACITY
WQS500	0.70 CFS	X.XX CFS	12 CF
WQS501	1.91 CFS	X.XX CFS	33 CF

* PEAK FLOW RATE BASED ON RATIONAL ANALYSIS FOR A 25-YEAR STORM EVENT. STRUCTURE SHALL BE ABLE TO PASS PEAK FLOW RATE WITHOUT CAUSING A BACKWATER CONDITION.

WATER QUALITY STRUCTURE DETAIL

NOT TO SCALE

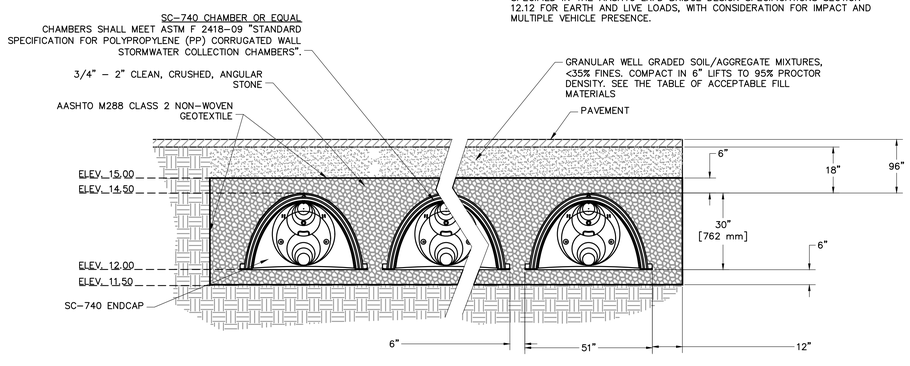
PLAN

SECTION A-A

OUTLET CONTROL STRUCTURE (OCS701)

NOT TO SCALE

THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCE.



SUBSURFACE SYSTEM 2A AND 2B INFILTRATION SYSTEM DETAIL

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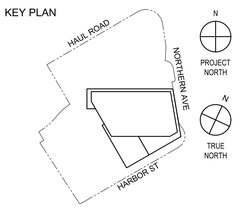


PROJECT DATUM:	PROJ. 0'-0" = +16'-6" BCB
SCALE:	AS NOTED
PROJECT NO:	1550
SEAL & SIGNATURE	

DRAWING TITLE:

DETAILS II

DRAWING NO:

C-501

Appendix A

Calculations

HALEY ALDRICH	CALCULATIONS	0200427-000
		1 of 4
Client:	BCP-CG Harbor Property LLC	15-Apr-21
Project:	2 Harbor Street/ 329 Northern Avenue	SHL
Subject:	Stormwater Storage and Infiltration Systems	MDK

PROBLEM STATEMENT & OBJECTIVE

To evaluate the following related to the proposed stormwater infiltration at the Subject property:

a) Evaluate the mounding potential for the subject project's stormwater storage and infiltration systems as it relates to complying with the requirement to retain and infiltrate the design storm volume within 72-hours.
b) Three total systems are evaluated in this analysis: System 1 (14,500 CF), System 2A (2,500 CF), and System 2B (1,800 CF) for a total volume of 18,800 CF.

REFERENCES

1. Massachusetts Stormwater Guidance.
2. Discroll (1986), Groundwater and Wells.
3. Hantush, M.S., 1967, Growth and decay of groundwater mounds in response to uniform percolation: Water Resources Research, v. 3, p. 227–234.

ASSUMPTIONS

1. Ground surface elevation is El. 16.0 BCB (Boston City Base)
2. Seasonal high groundwater elevation is El. 8.0 BCB
3. Fill thickness is 20 feet below ground surface. The fill is predominately SAND.
4. The Rawl's Rate for SAND (8.3 inches/hour) is used in the mounding analysis with a 1/2 factor of safety applied for an estimated hydraulic conducitivity of 4.1 inches/hour or 8.2 feet/day

SYSTEM 1:

1. The proposed infiltration volume for System 1 is 14,500 CF over a period of 72-hours.
2. For this analysis, System 1 is assumed to consist of a 358' x 10' linear drainage gallery.
3. Estimated maximum groundwater mounding for System 1 after 72-hours is 3.1 feet above static water level, or El. 11.1 BCB
4. The Hantush (1967) solution result for System 1 is located on **Page 2**.

SYSTEM 2A:

1. The proposed infiltration volume for System 2A is 2,500 CF over a period of 72-hours.
2. For this analysis, System 2A is assumed to consist of a 54' x 26' open-bottomed infiltration system.
3. Estimated maximum groundwater mounding for System 2A after 72-hours is 2.0 feet above static water level, or El. 10.0 BCB
4. The Hantush (1967) solution result for System 2A is located on **Page 3**.

SYSTEM 2B:

1. The proposed infiltration volume for System 2B is 1,800 CF over a period of 72-hours.
2. For this analysis, System 2A is assumed to consist of a 40' x 26' open-bottomed infiltration system.
3. Estimated maximum groundwater mounding for System 2B after 72-hours is 1.6 feet above static water level, or El. 9.6 BCB
4. The Hantush (1967) solution result for System 2A is located on **Page 4**.

SYSTEM 1 HANTUSH (1967) SOLUTION RESULTS

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0)), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

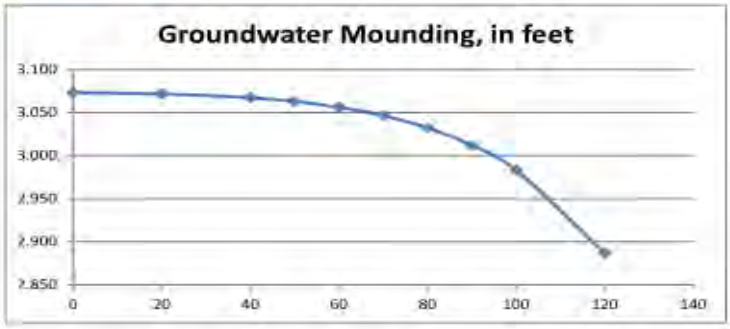
Input Values

1.3500	R	**Recharge (infiltration) rate (feet/day)**
0.150	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
8.25	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
179.000	x	**1/2 length of basin (x direction, in feet)**
5.000	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
12.000	hi(0)	**initial thickness of saturated zone (feet)**

15.073	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
3.073	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
3.073	0
3.073	20
3.069	40
3.063	50
3.056	60
3.046	70
3.032	80
3.013	90
2.988	100
2.958	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

SYSTEM 2A HANTUSH (1967) SOLUTION RESULTS

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
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use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.5950	R	Recharge (infiltration) rate (feet/day)
0.150	Sy	Specific yield, Sy (dimensionless, between 0 and 1)
8.25	K	Horizontal hydraulic conductivity, Kh (feet/day)*
27.000	x	1/2 length of basin (x direction, in feet)
13.000	y	1/2 width of basin (y direction, in feet)
3.000	t	duration of infiltration period (days)
12.000	hi(0)	initial thickness of saturated zone (feet)

Conversion Table	
inch/hour	feet/day
0.67	1.33
2.00	4.00

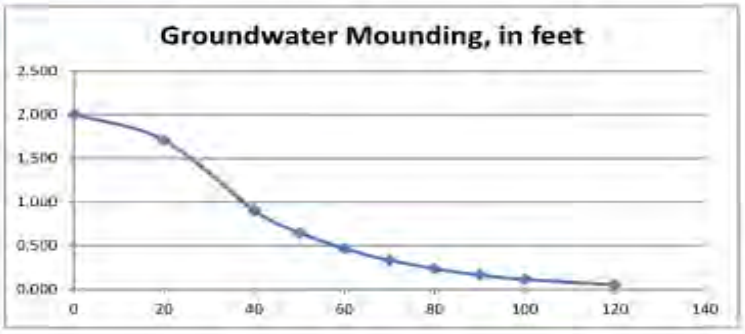
hours	days
36	1.50

*In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

14.089	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
2.089	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.089	0
1.710	20
0.905	40
0.563	50
0.359	60
0.235	70
0.158	80
0.107	90
0.076	100
0.055	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

SYSTEM 2B HANTUSH (1967) SOLUTION RESULTS

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
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use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

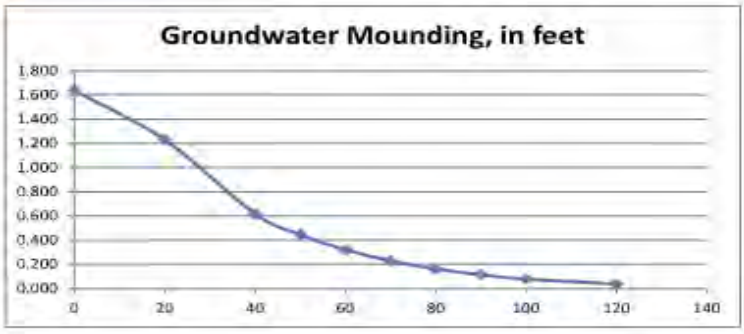
Input Values

0.5800	*R*	**Recharge (infiltration) rate (feet/day)**
0.150	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
8.25	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
20.000	x	**1/2 length of basin (x direction, in feet)**
13.000	y	**1/2 width of basin (y direction, in feet)**
3.000	t	**duration of infiltration period (days)**
12.000	hi(0)	**initial thickness of saturated zone (feet)**

13.639	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.639	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
1.639	0
1.241	20
0.618	40
0.349	50
0.191	60
0.109	70
0.063	80
0.037	90
0.022	100
0.013	120

Re-Calculate Now



Disclaimer

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