STAGE I
ARCHAEOLOGICAL SURVEY
(First Phase)

MAIN AND PLYMOUTH STREETS
Howard Alley to Pearl Street
and
FURMAN STREET
Atlantic Avenue to Joralemon Street

CONTRACT 1A
RED HOOK WATER POLLUTION CONTROL PROJECT
BROOKLYN, NEW YORK

for

Mason & Hanger-Silas Mason Co., Inc.

under their contract No. 213085

with

Department of Water Resources
City of New York

by

Ralph S. Solecki, Phd.
597 Piermont Road
Demarest, New Jersey 07627

267

February 3, 1977

597 Piermont Road
Demarest, New Jersey 07627
February 1, 1977

re: Archaeological Survey
Contract 1A
Red Hook WPCP

Mr. August Matzdorf, P.E.
Area Manager
Mason and Hanger-Silas Mason Co., Inc.
437 Madison Avenue
New York City, New York 10022

Dear Mr. Matzdorf,

I have received your letter of January 31, wherein you have requested that I divide my report on the Stage 1 Archaeological Survey of Contract 1A, Red Hook WPCP into two phases. I understand that the first phase is to concern only the tunnel sections (i.e., Furman Street between Atlantic Avenue and Jeralemon Street, and Main and Plymouth Streets).

I have readied the first phase of my report as you have instructed me, and am sending it to you herewith. It is my understanding that the second phase report will include this section, to which I shall add additional material such as illustrations and the results of the additional core boring studies planned for those respective areas, plus incidental other data resulting from further researches.

Very sincerely yours,

Ralph S. Solecki

Ralph S. Solecki, Ph.D.

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An Archaeological Assessment of the Proposed Sewer Tunnels at Furman Street, between Atlantic Avenue and Joralemon Street, and Main and Plymouth Streets, between Howard Alley and Pearl Street, in Brooklyn Heights, Brooklyn.

Dr. Ralph S. Solecki
February 1, 1977

The information concerning the tunnels to be mined for the Red Hook Intercepting Sewer, as part of Contract 1A of the Red Hook Water Pollution Control Project, PW-152, set forth herewith is derived from historical sources, records of the City of New York, geological core borings and on site visits.

The two areas (Main and Plymouth Streets, and Furman Street) were viewed by Dr. Ralph Solecki on separate occasions. He made a brief walk-over survey preliminary to photography, on January 3rd. He had viewed the Furman Street area from an automobile travelling on this street the same day. He visited the Furman Street area again on January 10th briefly in connection with the examination of the boring core samples which are stored in Brooklyn at the Coney Island Treatment Plant.

In a general summary of the findings the author of this report feels that since both sections of tunnel will be mined very deep below the ground water table, and in areas which were originally out beyond the original shorelines, there will be no adverse impact on the environment. So far as can be ascertained, there is no evidence that old docks or wharfs will be met in the tunnel construction. Additional core borings are proposed in

nearby open cut areas in order to get a more complete evaluation of the nature of the subsurface deposits in both areas. It may be possible to have some of the peat deposits dated at a future time by the 14C method.

This report is the first phase of and will be incorporated into a larger and more complete report on this project. The final report will study the areas of the branch intercepting sewers, to be constructed in open cut, in Atlantic Avenue, Joralemon Street and Fulton Street. The present report is in two parts, the first part dealing with the Main and Plymouth Streets area, and the second part dealing with the Furman Street area.

HISTORY:

The area just to the north of old Fulton Street (now called Cadman Plaza West) is shown on the old early colonial maps as part of the John Rapalye property fronting on the East River. It was occupied by a family of Indians called the Mareykawicks (Bolton, 1920, p.271), a branch of the Canarsie Indians, who controlled muct of western Long Island. The Mareykawick family was ruled over by a sachem called Maganwetinnenim in 1645. The Canarsies sold Mareykawick to the Dutch in 1670 (Bolton, ibid., p. 274). This shoreland (Fig. 1) was used by the Indians for fishing and oystering up to Blackwell's Island. Physical evidence of Indian occupation was found and noted by Gabriel Furman in 1826 (Gabriel Furman, 1865, p. 34) (Furman 1874, pp. 98-100) at Bridge Street between Front and York and between Jay and Bridge Streets (Fig. 2). At this place were found ashes, cinders, some burned stones and habitation evidence, including fragments of pottery vessels, some arrowheads, and clay tobacco pipes. This material was found in situ (down to a depth of 3 to 4 feet) on the top of a hill about 70 feet high which is shown in Lt. Ratzer's map of 1766 (Bolton, 1922, pp. 133,4).

The lands of John Rapalye, lying between the Fulton Ferry and Wallabought Bay was confiscated by the City Corporation, and was sold to the Sands Brothers in 1784 (Armbruster, 1919, p. 24). These brothers laid out the land in streets in 1788, and named the place "Olympia", with the belief that this was going to become the "coming city on account of its superior situation" (ibid.). A permit was given to William Furman and Theodosius Hunt (Furman and Furman, 1937, p. 7) to establish a ferry at

the foot of present Main Street, which met the Old Ferry Road at the point where the latter makes a sharp curve, so that the new ferry road formed almost a straight line. This landing place became known as the New Ferry. Since the landing point in Manhattan was at Catherine Street, it became later known as the Catherine Street Ferry. The road was originally known as the New Ferry Road, which later became changed to Main Street (not to be confused with Old Ferry Road or Fulton Street, which had been also called Main Road). The New Ferry, or Catherine Street Ferry was also called at one time "Teamboat Ferry" (Ambruster, 1919, p. 25). The Catherine Street Ferry or "Teamboat" Ferry was originally powered by human muscle until 1810 (as were all of the ferries at this time) for rowboats or pirougues. The horse boat (which gave the name to the New Ferry) was first introduced in 1814 on the Catherine Street Ferry (Booth, 1859 , p. 686). This ferry was powered by a team of eight horses, or 8 horsepower, in which the crossing of the river was made in between 12 to 20 minutes, a vast improvement over the former method. The iron age competitor, steam, came the same year in the form of the steamboat, the Nassau, at the neighboring older ferry at present Fulton Street (Booth, ibid.).

According to Stiles (1884, Vol.II, p. 105) in the 1820's there were a few small wooden dwellings on Main Street and with the exception of one domicile, no other houses of note on the west side of Main Street until the junction of Fulton and Main. On the east side of Main Street, there were similarly few buildings. Activity was marked in this period by frequent changes. The City Corporation began tearing down old structures between Pearl and Water Streets on the north side of Dover Street

(Furman, 1865, p. 185). All of the streets in the city until about 1840 were simply dirt paved. Land around the shore front was being filled in steadily. The area of Water Street between Main and Washington Streets was raised and "regulated" in 1824 (Stiles, 1884, Vol. II, p. 220). At the foot of the Catherine Street Ferry was established a small public market, called "Titus's" market, which was in reality a butcher stand, something like the one at the old Fulton Ferry. There was other evidence of a small shopping center, as would naturally arise at a communication center. There was a tavern and grocery at the northeast corner of Main and Water Streets called Van Winkles (Stiles, 1884, Vol. II, p. 94).

Lower Main Street lay between high and low water tide marks. The old water line went to the corner of the present Gold Street, and from there, along the line of present Marshall Street to the Wallabought Bay or the Navy Yard (Stiles, 1884, Vol. II, Footnote 1). The construction of gravel sidewalks with curbstones was ordered for the New Ferry (Catherine Street ferry) in 1813 (Stiles, 1884, Vol. II, p. 31). The records show a low water mark of the East River arching just north of Water Street in 1846 (Section 1, Block 25, Liber 154, p. 100, to grantee Andre B. Hoxtun, October 14, 1846). Similarly in another record, (Section 1, Block 26, Liber 118, page 52) the land was under water on March 28, 1844. Another record dated January 1, 1848,,the same water line is indicated just a little north and parallelling Water Street. Plymouth Street was under water in this record, but there is an indication of where the bulkhead line was planned north of Plymouth Street as of 1835. This bulkhead line was established under the direction of a General

Swift who recommended a line of bulkheads along the East River in 1836 (Stiles, 1884, Vol. II, p. 252). Mention is made of the avarice and cupidity of the citizens who were shore front owners and who hastened to extend their lots into the water, doing "some injury to the water line". (ibid.).

The first negative impact on the area was the construction of the Brooklyn Bridge in the third quarter of the 19th century. The bridge approach necessitated a lot of room for its long approach on the Brooklyn side, cutting a bifurcating swath through Old Brooklyn, eliminating blocks of old residences and tenements, shabby stores, saloons (which if they were in the same numbers as on lower Fulton Street, must have been numerous) and similar structures (McCollough, 1972, p. 418). Presently old "Olympia" presents a forlorn aspect of warehouses and dreary battered business structures. Its demise as a residential and business area can be directly contributed to the erosion of the neighborhood precipitated first by the Brooklyn Bridge, and later by the Manhattan Bridge, which flank this area on the south and north respectively. The latest and final sealing off of this "cul-de-sac" isolation was signaled by the construction of the maze of roadways and concrete servicing the Brooklyn-Queens Expressway twenty years ago. The bridge was opened in 1883, and in just two years, the bridge trains were handling upwards of twenty million passengers, and just five years later in 1888, ther were thirty million passengers a year (McCollough, 1972, 544). The ferries continued to run (the last of the Brooklyn Ferries, the Hamilton-Battery Ferry ran until 1942), but dwindled away into the twentieth century. As a consequence, both the Catherine Street and Fulton Ferries ceased to exist, and so died the neighborhood.

STREET PAVINGS:

The following information on street pavings of this area from the period of the 1900's is derived from the Department of Highways at 40 Worth Street, New York City, New York. Earlier data is being researched elsewhere.

Plymouth Street between Main and Bridge Streets was paved with granite blocks, grade 2, on 6 inches of concrete base to a width of 20 feet and finished on August 24, 1908 (Anonymous, 1960, p. 275). Main Street between Water and Prospect Streets was paved with granite blocks, Class B on 6 inches of concrete foundation, which was laid to a width of 24 feet with a job completion on October 13, 1932. There were tracks on this street which were to be removed by the railroad company (Anonymous, n.d., Card 3/5). A contract was completed on August 8, 1917 in which granite paving was put on a 6-inch concrete foundation between Plymouth and Front Streets on Main Street (Anonymous, n.d., Card 209/12). Main Street between Plymouth and Water Streets was laid with granite blocks, grade 1, on a 6-inch concrete foundation to a width of 60 feet with a job completion on July 23, 1917.

SEWER TUNNEL AND THE GEOLOGIC PROFILE:

The proposed sewer tunnel in Main and Plymouth Streets will lie in the area formerly part of the East River (see Fig. 1). According to the Perris map of 1855 the "Antique Water Line" (presumably the high water line) cut to the south of Water Street, or to the south of the proposed tunnel route. The early colonial records indicate that the low water mark cuts roughly between and parallel to Water and Plymouth Streets. This area is in the low lying land facing the East River between the Brooklyn Bridge on the west and the Manhattan Bridge on the east (which actually straddles the proposed tunnel route) to the north of the Brooklyn-Queens Expressway bridge approaches. The tunnel bore having a diameter of 108 inches, is proposed to extend from Howard Alley on Main Street northward to the junction of Main Street and Plymouth Street, and eastward on Plymouth Street to Pearl Street. Under the bulkhead plan of 1835, the lands were filled in and made available for use a few years later. According to the records about the end of the 18th century, the high tides of the East River sometimes came close to Front Street, or up to the low bluff formerly facing on the East River at that point.

The proposed tunnel which will be about 1,150 feet long in the section to be excavated, will have an invert about 19-20 feet below ground water table. The approximate top of the sewer tunnel will be about ten feet above the invert, or about 9-10 feet below the ground water table. This will be about 15 to 20 feet below the ground. The sewer is planned to be included within the present street limits.

In the line of the presently proposed tunnel there were ten subsurface borings, which Dr. Solecki examined in company with geologists Irving Ostrofsky and Peter Kuuk of the New York City Department of Public Works at their storage area at a sewage treatment plant on Coney Island. These are borings numbered 36 and 35, located on Main Street between Front Street and Water Street; borings 34 and 33 located between Water Street and Plymouth Street on Main Street; borings 31 and 30 located on Plymouth Street between Main Street and Washington Street; borings 26 and N-1 located on Plymouth Street between Washington and Adams Streets; and borings 16 and N-12 between Adams and Pearl Streets on Plymouth Street.

According to the geological profile along the route of the proposed sewer tunnel, there is a downward slope of the soil deposits toward the East River from the southerly end of Main Street from Howard Alley (boring No. 36) to Plymouth Street (boring No. 31). This would indicate a natural dip in the stratigraphy toward the river.

The borings on this street line indicate that there are at least four major soil deposits in the history of this shore area, respectively identified in this report as a to d, from top to bottom (see Fig. 2). The descriptions are as follows:

Layer a - A widespread blanket of recent fill, including sand, gravel, silt, clay, cinders, brick, concrete, boulders, timber, etc. It has an average thickness of about 11 feet, ranging from 7 feet to 16 feet thick. It lies at about an elevation of about 11 feet above the ground water table in the southern or landward side to 9 feet below ground water level.

Layer b - This is a deposit of organic silt penetrated by

fill. This appears to have been the original land surface dating from the original settler times. This soil horizon includes three lenses of related soils. It is nominally a very soft to soft, gray organic silt, with a trace to some clay, a trace to little sand, and a trace of gravel and a trace of cinders. It has an average thickness of 6 feet ranging from two feet thick to 14 feet thick. This soil horizon overlies a layer of "till" from the landward side, presumably of glacial age (Wisconsin). It has a slope angle of about 2.5% toward the river. Most of layer b lies well below the ground water table, beginning above ground water table (or about plus 5 feet) at a point just a little north of Howard Alley on Main Street, and slopes downward to the north toward the East River. This layer intrudes into the next layer below it, layer c, which slopes similarly downward to the East River. It is made up of a number of isolated lenses and pockets of soil, giving the layer an undulating characheristic. This layer lies well below the ground water table.

Layer c - This is a river sloping thickness of glacial till, including compact to very compact composition of fine to coarse brown sand, a trace to some silt, and a trace to little gravel. Possible boulders are included in the deposit. This layer has a thickness of about five feet, to an uncertain depth not plumbed by the present borings in this section. It lies well below the ground water table. This layer has several intrusive soil pockets and lenses.

Layer d - This is the bottommost soil horizon in this section, which is composed of sand ranging from compact to very compact, with medium to fine gray brown to brown sand with a

trace to little silt present. The deposit in this portion of the section is nearly horizontal in bedding. There is a trace of shells and some mica in the deposit. It lies about 25 feet below the ground water table and its total depth has not been plumbed by the present borings.

The profile section from Main to Pearl Streets on Plymouth indicates a shallow downward slope from the east to the west, or from Pearl Street to Main Street, which in fact appears to conform with the old shore line at this point. The thickness and depths of the deposits appear to be about the same as the dimensions for the deposits between Howard Alley and Plymouth Street on Main Street.

RESUME:

The proposed tunnel section described above will penetrate only a very small part of the fill zone, or layer a in this report. It will cut through soil horizon b, presumably the original ground surface, all below the original sea level of the East River. Thus it does not appear that the cutting of this tunnel will have any adverse effect on the historic or prehistoric heritage in the areas examined.

Although there are traces of timbers in some of the borings, these probably did not originate from the old piers and docks, which were presumably set out in deeper water, with the attendant bulkheading.

The street subsurface was certainly gouged out a number of times in order to accomodate water, sewage, gas and electric lines. However these cuts are well above the line of the proposed sewer tunnel.

FURMAN STREET

HISTORY:

Furman Street, named after the Furman family who lived at the corner of what is now Furman Street and Fulton Avenue in the early 1800's, did not exist originally because high tide almost lapped the foot of the sandy heights (Fig. 3). The road ran along the beach, much of it between high and low water (Langstaff, 1933, pp. 8, 12). The heights above this shore way, or the "Heights", was originally covered with, according to Stiles (1884, Vol. II, p. 35) a beautiful growth of cedar and locust trees. It was called "Iphetonga" or the "high sandy bank" by the Canarsee Indians. Reportedly a large number of stone arrowheads and other aboriginal implements were found in every stage of manufacture in this area after the washing of the river banks by storms and heavy rains and constant erosion. This bluff and elevation was named "Clover Hill" by the early colonial inhabitants. (Stiles, op. cit.).

In the early colonial days, the only means of access to the ferry from along the beach southwards was via Elizabeth Street (said to be named after one of the wives of the early residents of the area) (Stiles, 1884, Vol. II, p. 118). From the ferry to Pierrepont's distillery at the foot of Joralemon Street, the stretch was an open sandy beach, along which the tide flowed and ebbed, and at times it was impassable (Stiles, ibid, p. 131). Furman Street was laid out in 1804 (Anonymous, Block Records; Section 1, Block 200, Liber 8, p. 151), but since its situation was not usable, it had to be bulkheaded and filled in. Wharves, warehouses and even residences resulted as if by

magic after this was done, since the street was in a favorable location with respect to the location between the two ferries, the northern at the old Ferry (Fulton Street) and the southerly at Joralemon's Landing and later Atlantic Street. But it was nearly 50 years before the deep cove in front of the Joralemon property was filled in and Furman Street was extended to join the foot of Atlantic Street (Langstaff, 1933, pp. 8, 12, 16) (Fig. 4). The street was straightened out in 1842.

An engraving by R. Kupfer, New York, in 1867, shows the Brooklyn shore including Fulton and Furman Streets. It shows much activity and the built up nature of Furman Street, which by then had been bulkheaded and filled in. One additional street westward of Furman Street is shown toward the East River with ships docked along the shore up and down the street. An earlier view by Hugh Reinagle, dated 1827-1834, shows sailing ships and docks along Furman Street, and the windmill and distillery of Pierrepont at the foot of Joralemon Street. There was a large flat extending up to his distillery at low water at the foot of Joralemon's lane (Stiles, op.cit. p. 160). In 1820 an editorial in the Star said that the street between the Old Ferry (Furman Street) and New South Ferry required raising and should be widened and regulated. It would appear surprising that the newspaper at this early date would have to comment about the neglect of the streets and the danger of fires because of the proximity of highly flammable wooden structures (Stiles, op.cit. pp. 197-8), but it should be remembered that the city by this time was already well through its second century.

Today the Heights still presents one of the most impressive views of the East River, the harbor and downtown New York, with

the Brooklyn Bridge looking up to the north. The Brooklyn-Queens Expressway flanking the river between the Heights and Furman Street certainly has not added to any of the old tranquility of the scene. It enters the area from the south just at Joralemon Street (Fig. 4).

STREET PAVINGS:

The following information on street pavings of this area from the period of the 1900's is derived from the records at 40 Worth Street, New York City. Earlier data is being researched elsewhere.

The card index file (93/9) in the Department of Highways records shows that Furman Street from Atlantic Avenue to Fulton Street had its granite cobble-stone pavement replaced, with the job completed August 6, 1906. Old granite blocks were used, which were placed on a 6-inch foundation of concrete. Again, Furman Street between Fulton and State had its granite pavement replaced on 6 inches of concrete foundation; the job was completed August 13, 1923. The railroad on this street was declared abandoned by the "B C B B Co." on November 8, 1922, which was approved by the Transit Commission on February 20, 1923. The original contract had been modified in that new granite paving blocks were called for. The granite pavement appears to have been continued southward on Furman Street between State and Atlantic Avenue and granite blocks of grade 1 were set on 6 inches of old concrete foundation and 5-1/2 inches of new concrete foundation, with the completion of the job on December 14, 1923. The width of the roadway was set at 32 feet (List of Paved Streets, 1960, p. 158). This pavement job did not last too long because the cobblestones were evidently removed and sheet asphalt was laid down between Fulton and Joralemon Streets on 6 inches of old concrete foundation. The job was done under the old Works Progress Administration (WPA), with

the date of completion on July 19, 1937. The width of the roadway was made to 34 feet wide (Anonymous, 1960, p. 158).

The cross streets of Atlantic Avenue and Joralemon Street of course did not escape surfacing. Atlantic Avenue between the East River and Clinton Street (outside the rails) was paved with granite blocks of grade No. 1 on six inches of old concrete foundation. The width of the roadway, in contrast to the much narrower Furman Street, presumably because of the ferry service at Atlantic Avenue, measured between 60 to 63 feet wide. The job was completed on September 24, 1928 (Anonymous, 1960, p. 11). Neighboring Joralemon Street was paved between the river and Hicks Street with granite blocks of class A on a six inch concrete foundation laid in 1908. The width of the roadway was set at 30 feet. The job was completed on December 2, 1937 (Anonymous, 1960, p. 215).

SEWER TUNNEL AND THE GEOLOGIC PROFILE:

According to our best information from early map surveys (Perris, 1955), the proposed 108 inch sewer tunnel between Atlantic Avenue and Joralemon Street in Furman Street will go through land fill which was placed there about the 1840's when Furman Street was extended southward in order to join Atlantic Avenue in a straight line with Furman Street farther north (Fig. 4). The original shoreline made an eastward or landward curve from the East River just about Joralemon Street where there had been originally a distillery, windmill and a landing in the late colonial days. The shoreline curved to a point between Columbia Place and Willow Place, then curved back to the river to a point just a few yards west of the junction of Atlantic Avenue and Columbia Street. The embayment so formed was a deep water cove, highly regarded as an anchorage in Colonial days.

This section of the proposed tunnel will be 800 feet long and 108 inches in diameter, to run between Atlantic Avenue on the south and Joralemon Street on the north (Fig. 4). The base or invert of the tunnel bore will be about 13 feet below the ground water table, and the top of the tunnel will be about 10 feet above the invert, or about three feet below the ground water table. The top of the tunnel will be between 14 to 18 feet below the present ground surface level. The tunnel section will lie west of the "antique water line" (Perris, 1855) or in the old cove area.

An examination of the geologic profile shows that there are five major soil horizons which will be encountered by the tunnel construction. These soil horizons, identified in the

accompanying geological section are lettered a to e, as determined by core borings along the street. These core borings are identified as Nos. 92, 89, 88, S-9, 87, 86, 85, S-10 and S-13. They were examined by Dr. R. Solecki in company with Mr. Irving Ostrofsky and Peter Kuuk, geologists with the Department of Public Works, New York City at storage points in a Coney Island sewage treatment pland and in the basement of the Manhattan Municipal Courthouse.

The general impression of the section is that below a blanket of fill thickness (Layer a), there is a thickness of soil material (Layers b, c, d) measuring about 15 feet and attenuated at the northern end (toward Joralemon Street), overlying a widespread soil deposit. The latter must be of Pleistocene Age, and related to the last Wisconsin glaciation in this region (presumably part of the ground moraine). There is a definite slope of the middle deposits (Layers b, c, d) from north to south in this section.

The descriptions of the soil horizons are as follows:

Layer a - This is the widespread fill, containing sand, gravel, silt, clay cinders, brick, timber, plaster, concrete etc. In the section of concern, it has a maximum thickness of 26 feet (toward the Atlantic Avenue or southern end), a minimum thickness of 13 feet (toward Joralemon Street or northern end) with an average of 15 feet thickness. It follows the original upward slope towards Joralemon Street following the presumed original beach line. Better than half of this fill zone lies above the ground water table.

Layer b - This is a lens of sand with organic silt penetrated by fill, containing loose fine to coarse gray sand,

some organic silt, trace to little gravel, trace of bricks, trace of cinders, trace of shells etc. It was probably part of the original cove bottom and beach (at the northern end) which stood there in colonial times until Furman Street was extended southward to join Atlantic Avenue. The maximum thickness of this lens is 9 feet, with an average thickness of about 5 feet. It disappears at Atlantic Avenue. As noted above, in the section under investigation, this soil horizon slopes down to the south toward Atlantic Avenue from Joralemon Street. At the latter end, Layer b rises above ground water level, otherwise it is all under this elevation.

Layer c - This is a lens of peat which has been intruded in the middle by Layer b. It has a maximum thickness of 10 feet with an average thickness of 5 feet. It diminishes to 0 feet thickness toward Joralemon Street, and increases in dimensions south toward Atlantic Avenue. It is composed of peat with little to some organic silt.

Layer d - This is a lens of silty sand composed of compact to very compact fine to coarse gray brown sand, little to some silt, and a trace to little gravel. It is attenuated in the northern section just short of Joralemon Street. It has a maximum thickness of 10 feet with an average of 6 feet in thickness.

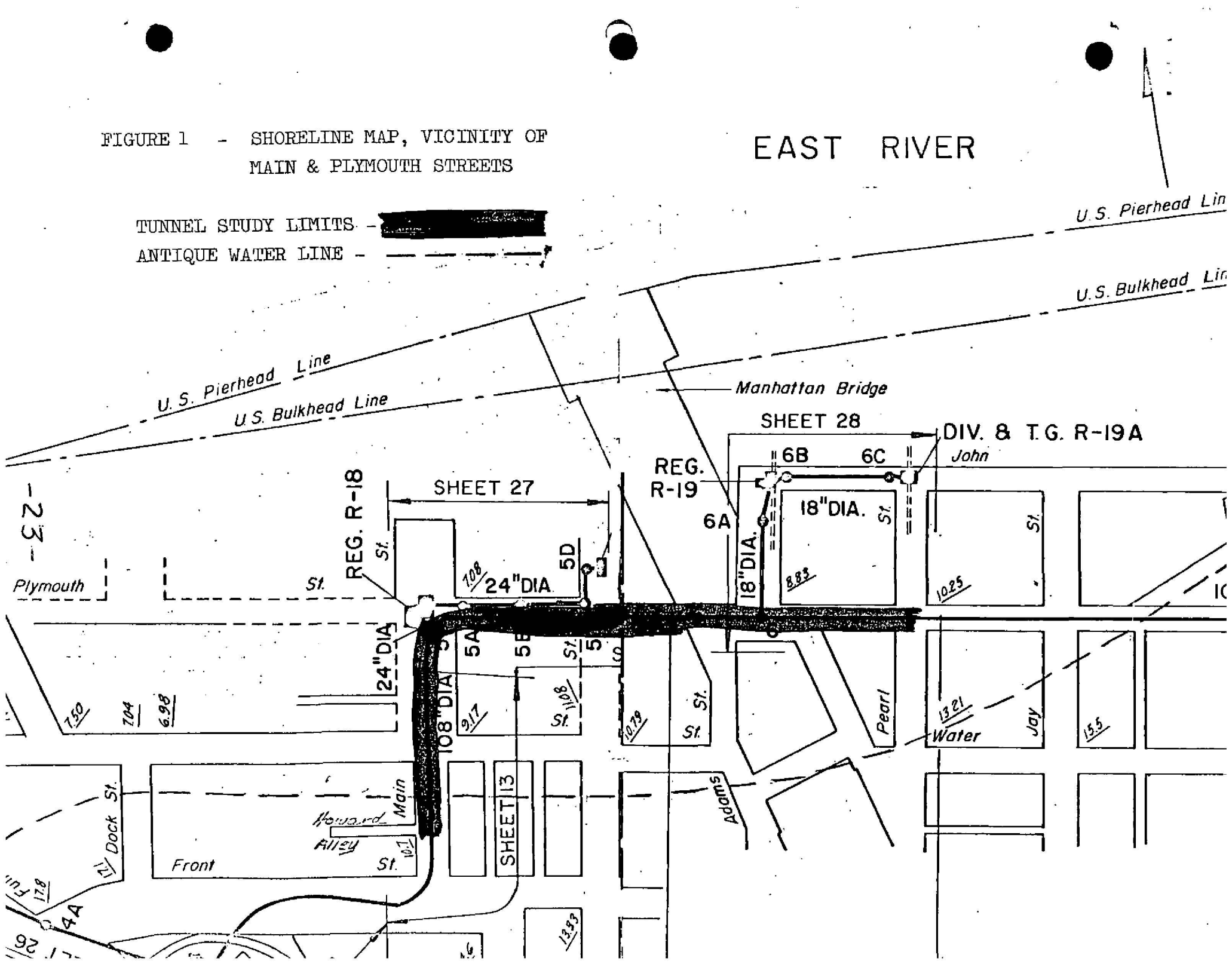
Layer e - This is a soil horizon of layered silt, containing stiff layered brown silt, little to some fine and little to some clay. It intrudes into the "till" horizon which is widespread at this lower depth. Layer e occurs between 26 feet and 14 feet below the ground water table. There is a marked or abrupt downward slope of this deposit from the area of Joralemon Street southward toward Atlantic Avenue.

RESUME:

So far as can be ascertained from the borings and section, the proposed tunnel between Atlantic Avenue and Joralemon Street will encounter no prehistoric or historic materials. There are traces of timbers in the Layer a which may have originated from fill. There do not appear to be any indications of pilings in Layer b, the original soil. The surface had been certainly cut into a number of times in order to accomodate utilities, etc. but this would have been well above the proposed sewer tunnel.

LIST OF FIGURES

FIGURE 1 - SHORELINE MAP, VICINITY OF MAIN & PLYMOUTH STREETS



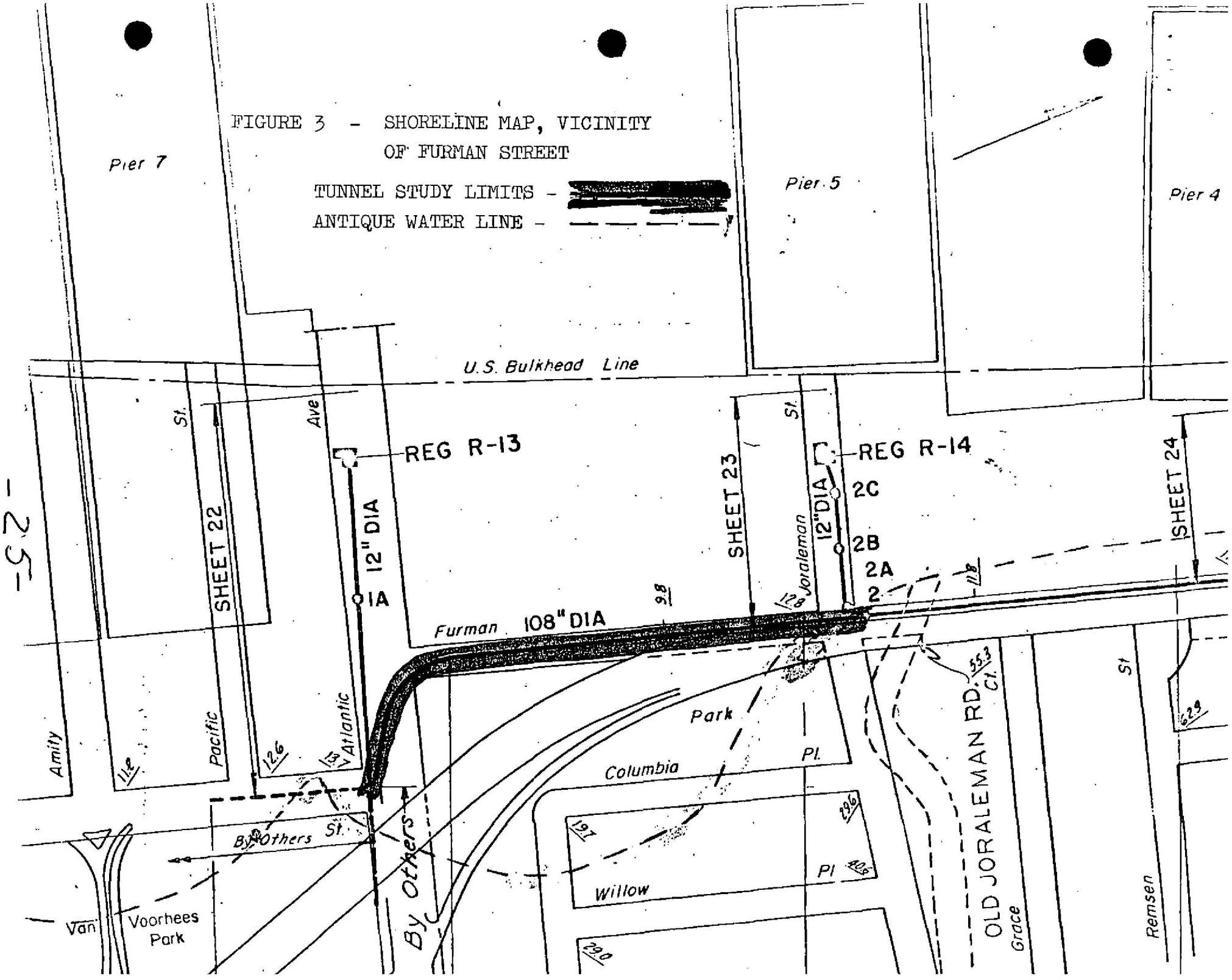
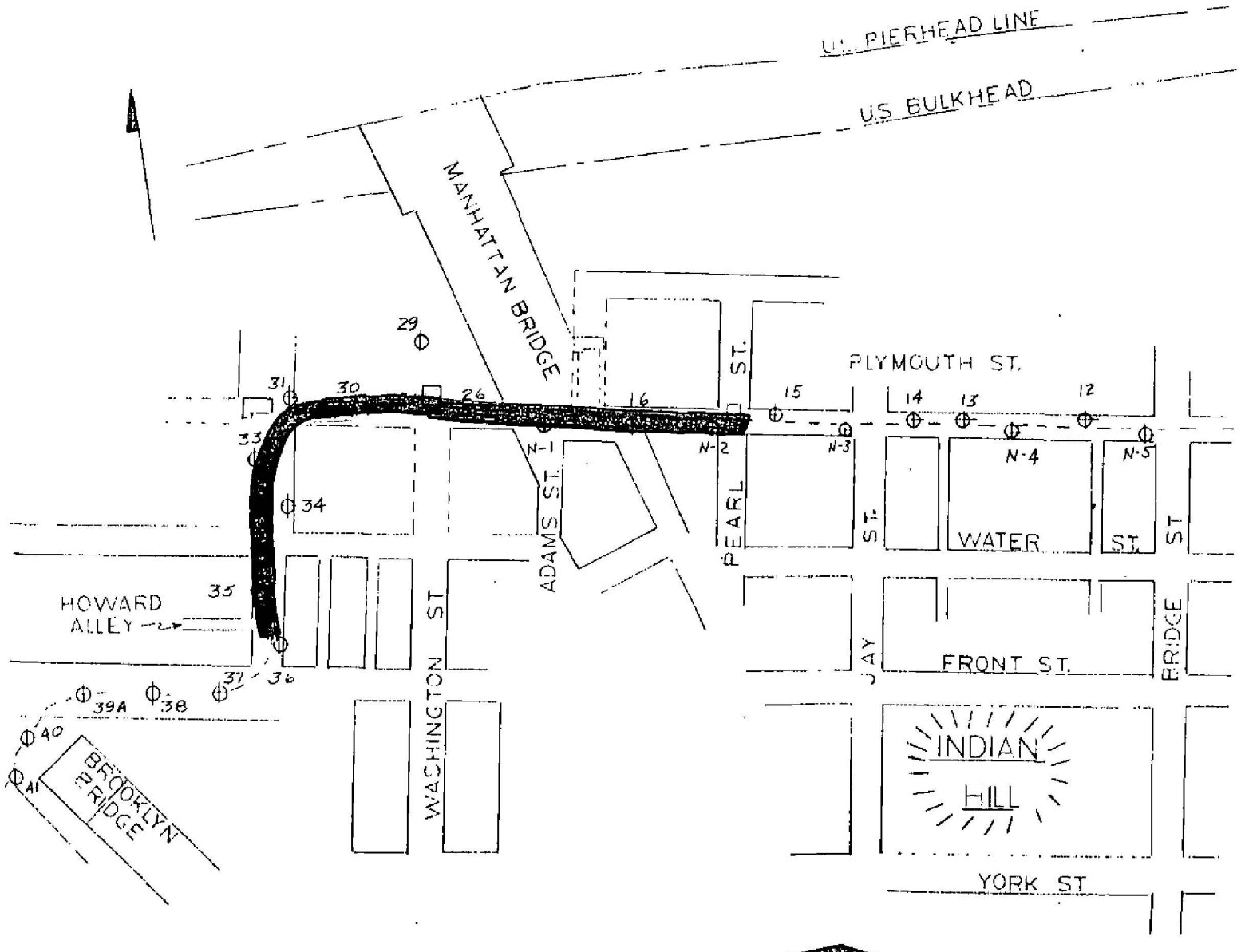
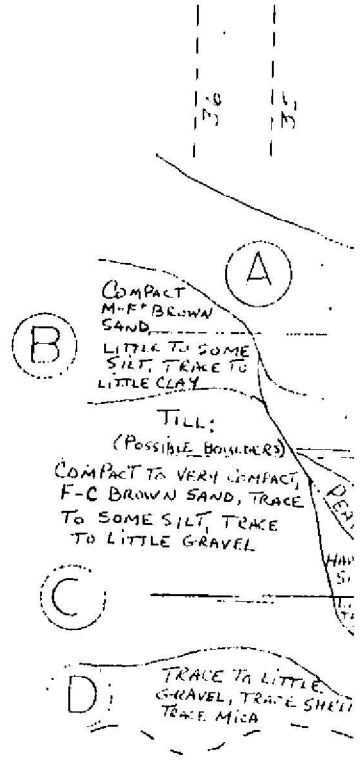


FIGURE 3 - SHORELINE MAP, VICINITY OF FURMAN STREET

TUNNEL STUDY LIMITS -

ANTIQUE WATER LINE -





FROM SOUTH TO
MAIN ST. BETW
HOWARD ALLEY
PLYMOUTH ST

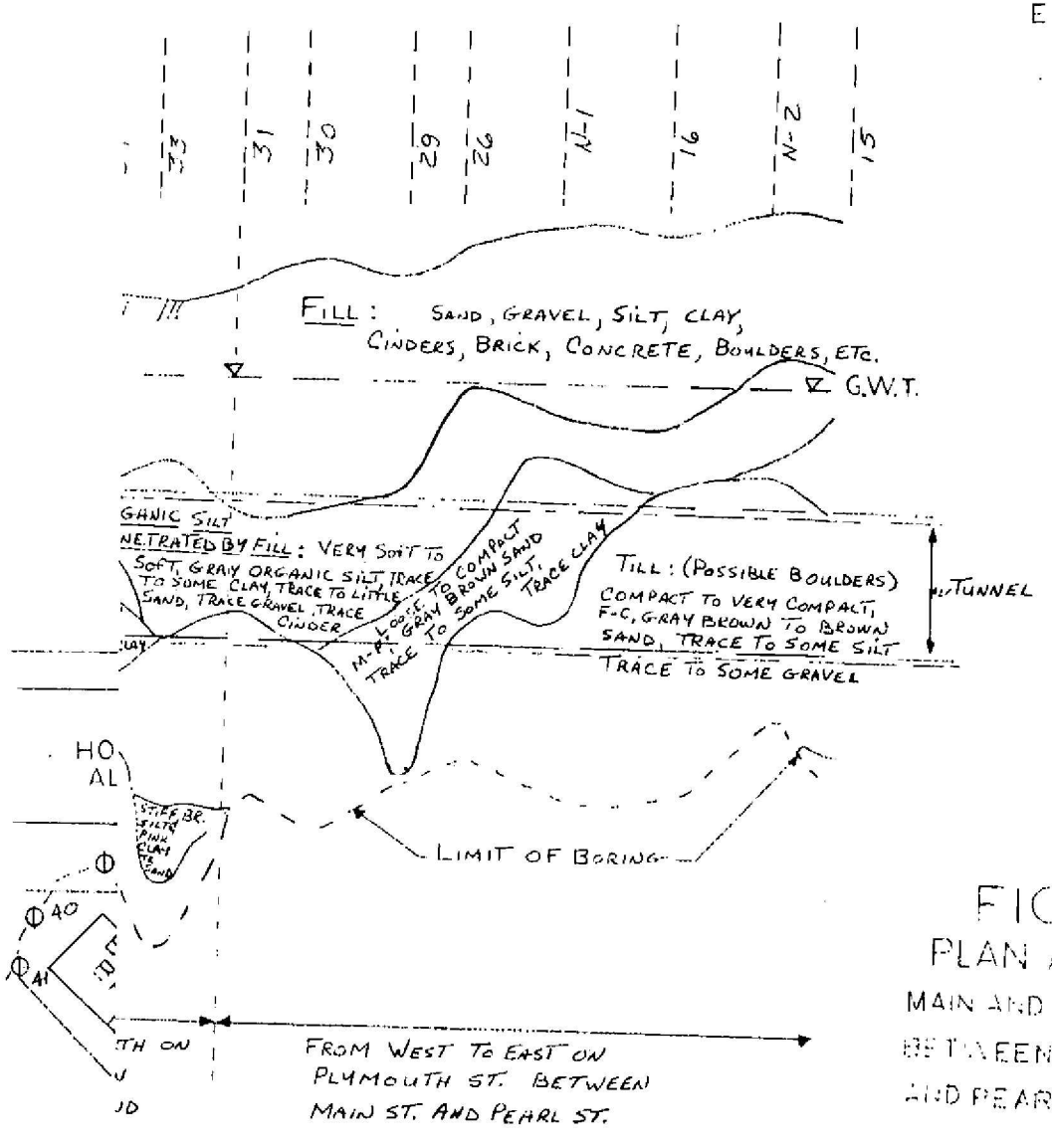
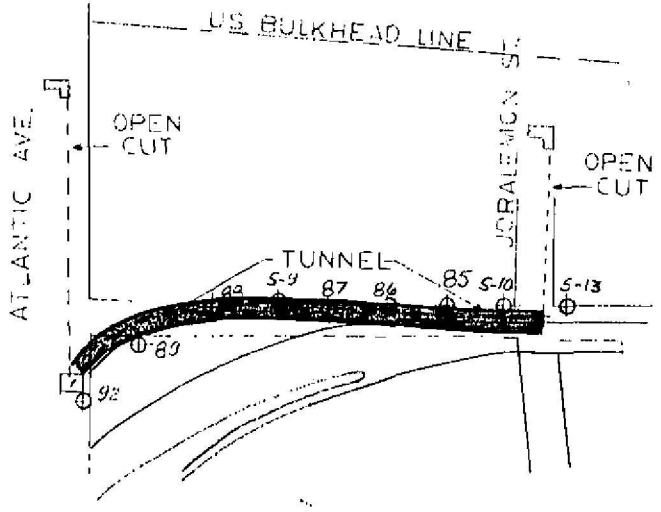


FIGURE 7

PLAN AND SECTION

MAIN AND PLYMOUTH STREETS BETWEEN HOWARD ALLEY AND PEARL ST.



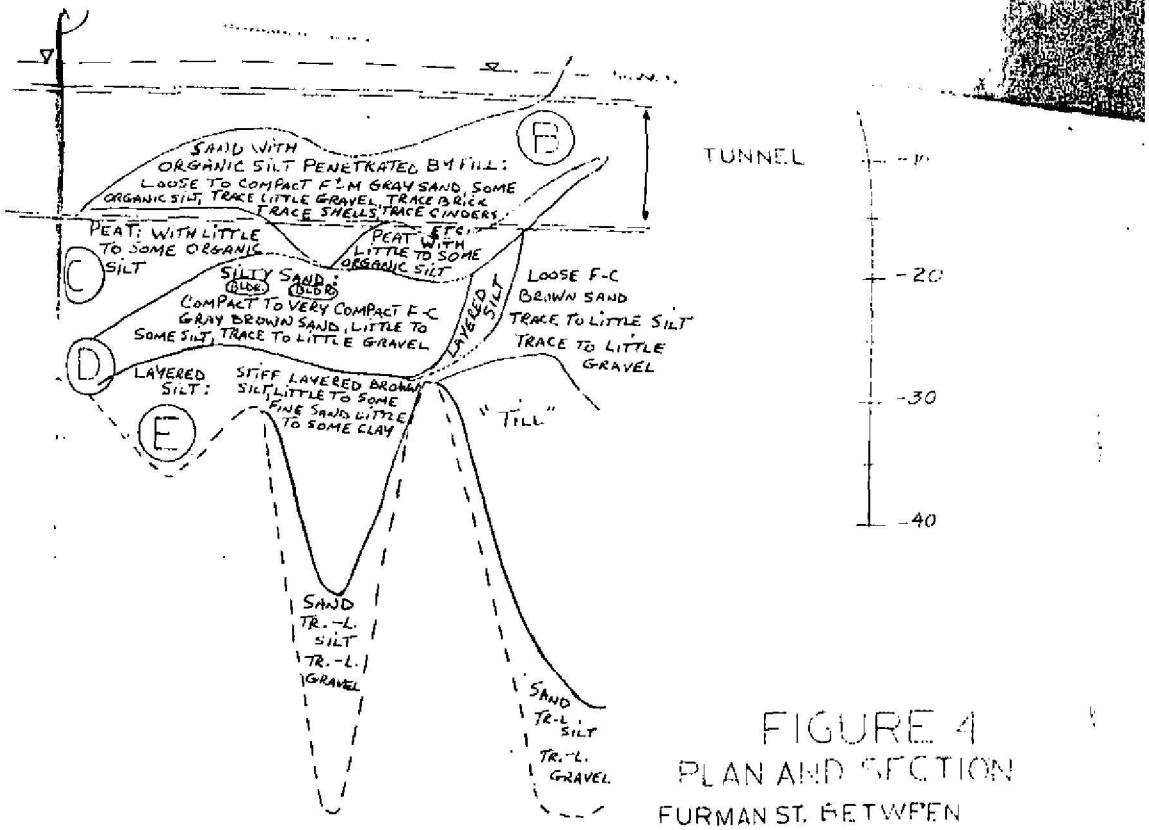


FIGURE 4
PLAN AND SECTION
FURMAN ST. BETWEEN
ATLANTIC AVE. AND JORALEMON ST.

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