Final Report

# Report on Groundwater Observation Wells

## Volume I

Submitted to

**City of Boston – Inspectional Services Department/Groundwater Trust**

Submitted by

**Stone & Webster Civil & Transportation Services, Inc.**

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VOLUME I

# REPORT ON

# GROUNDWATER OBSERVATION WELLS

# FOR THE

# INSPECTIONAL SERVICES DEPARTMENT

# OF THE

# CITY OF BOSTON

# AND

# THE GROUNDWATER TRUST


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# 1.0 EXECUTIVE SUMMARY

Stone and Webster Civil and Transportation Services Corporation is pleased to have had the opportunity to perform this interesting study for the Department of Inspectional Services and the Groundwater Trust.

The study area included the neighborhoods of Beacon Hill, Back Bay, Chinatown, Fenway and the South End.

This report documents the location of 757 groundwater observation wells, 657 of which were surveyed in the field and 308 which were field tested. There are 189 functioning wells located on well location maps, and 159 wells which are identified as non functioning or plugged. The non functioning or plugged wells may be located by field sketchs which are included with the field data sheets in Volume II. All of the wells can be located on maps provided in this report by a unique numbering system.

This report also includes recommendations for developing an observation well network. Specifically it is recommended that a well network of 869 wells be installed in the study area. This network would include the 189 working wells, resulting in the need for an additional 680 wells. This report also includes general recommendations for locations considered to be first priority for new well installation and includes a list of other actions considered necessary to effectively implement this program. It is also recommended that a trial cleaning be performed on the plugged and non functioning wells to determine the cost effectiveness of cleaning as opposed to installing new wells.

A sample specification for installing a well is included as Appendix B to this report.

# 2.0 INTRODUCTION

## 2.1 Purpose

Many areas within the City of Boston are built on filled land over what was once marshland and tidal estuaries. Typically the soil underlying the fill is soft organics and is unsuitable for the support of structures. Because of this many residential and commercial structures are built on pile foundations. Prior to the early 1900's untreated timber piles were in common use. These piles may behave satisfactorily for centuries, however, decay of untreated piles causes a dramatic loss of strength and subsequent damage to buildings. Decay of untreated timber piles may occur if they are exposed to air in a moist environment. This condition occurs when the groundwater falls below the top of the pile.

Throughout the past 100 years the City of Boston has periodically experienced the problem of a falling water table and deterioration of untreated timber piles. In the 1930's the Boston Public Library was underpinned at significant expense to prevent collapse of the building due to deterioration of untreated timber piles. Currently there are several known areas of deterioration of piling which have necessitated remedial actions. These include residential properties in the vicinity of Brimmer Street at the base of Beacon Hill, Hudson Street in

Chinatown, and Hemenway Street near Northeastern University. Undoubtedly other areas of deteriorating piling exist undetected at this time.

In 1986 Mayor Flynn appointed a committee known as the Groundwater Trust whose charge was to "develop solutions and recommendations as to how to raise the groundwater table in areas where it has fallen". The committee consists of representatives from the affected neighborhoods as well as one representative of the Boston City Council and several representatives of concerned city agencies. The membership of this committee is given in Appendix A. The initial action of the Ground Water Trust was to recommend that a consultant be hired to inventory all existing observation wells in the affected areas of the City and to recommend the location of new wells. Certain other assignments were also identified and these are itemized under Section 2.3. It is understood that this is the first step towards obtaining comprehensive groundwater data to identify areas of low groundwater and to develop remedial actions to prevent further deterioration of piling and collapse of structures. In June of 1989 Stone and Webster Civil and Transportation Corporation signed a contract with the Inspectional Services Department of the City of Boston to provide these services. This report describes the work accomplished by Stone & Webster under the contract.

The purpose of this study was to provide the basis for planning the future expansion of the groundwater monitoring system for the City of Boston. It's primary function was to locate, test and tabulate existing wells. Because the present study did not include significant interpretation of groundwater data, specific locations of new wells have not been determined. The first priority for the next phase of this project should be to engage a consultant with appropriate experience to provide a groundwater data base management system and to evaluate and interpret the existing data. As a result of their evaluation, new wells should be located and installed in a phased approach. The location of the first phase of new wells should be determined based on evaluation of existing data, which was beyond the scope of this study. Subsequent planning of additional well locations will be very much influenced by the data provided by new wells installed in earlier phases of the study.

## 2.2 Study Area

The area studied included the Back Bay, Beacon Hill, South End, Chinatown and Fenway neighborhoods and is shown on Figure 1. These areas were identified by the Ground Water Trust as requiring investigation. The actual bounds of this area were established by Stone and Webster in consultation with the Trust. As part of this study Stone and Webster was required to identify other areas of the City which may contain structures supported on timber piles and which may also require groundwater monitoring. This is addressed in Sections 5.0 and 6.0.

## 2.3 Scope

The following has been taken directly from Attachment A of the Contract titled Scope of Services:

1. Develop a list of existing observation wells, including those installed by the W.P.A. and other Public and Private organizations.

2. Locate in the field existing wells and then determine if those wells are operable. This would entail no digging, pavement removal or other subsurface exploration.

3. Perform field tests at each accessible well to verify the quality of each observation well found.

4. Prepare a written summary which would include a summary of those wells that are found to be operable.

5. Prepare a table summarizing information on the functioning observation wells, including locations, top elevations if known, well depth, depth to water level and elevation if known, date installed (if known) and other pertinent comments.

6. Prepare a table outlining locations of observation wells that were found and determined not to be operable, and the course of action necessary to make them usable.

7. Recommend locations for additional observation wells needed to monitor accurately the ground water in the affected areas.

8. Recommend a timetable for reading the wells.

9. Establish a framework for monitoring the data, including method of recording, presenting and evaluating all relevant data.

10. Establish technical specifications for new observation wells for use by the City in soliciting bids for well installation and in monitoring the work performed.

11. Train City of Boston employees in the accurate measuring, monitoring and recording of ground water levels.

12. The consultant shall attend meetings held in conjunction with the work described herein (up to four meetings).

13. Delineate any other service that the consultant believes would benefit the City in its analysis of the ground water problem.

14. Prepare base maps on mylar. Prepare three presentation boards and a summary report.

## 2.4 Acknowledgements

Stone & Webster gratefully acknowledges the special help it has received from all the members of the Groundwater Trust in completing this assignment. The efforts of Councilman David Scondras, Mr. Thomas McNicholas, Commissioner of the Inspectional Services Department, Mr. William Rizzo, Chairman of the Groundwater Trust, and Mr. William Corcoran, representative of the Boston Trust Department were particularly helpful. The interest and support of the Facilities and Planning Group of the Fenway Program is also recognized and appreciated.

Stone & Webster also acknowledges the support of Asaf Qazilbash & Associates in performing the field survey, as well as co-op college students Chris Burke and Roger Babb for their enthusiastic and perceptive contributions.

# 3.0 INVENTORY OF EXISTING WELLS

## 3.1 Methodology

The methodology and procedures used to record, find and test observation wells included the following steps:

* Review available records
* Solicit data from agencies, institutions and private firms.
* Plot and number each well
* Input well data into data base
* Field search to locate each well not currently being monitored by others.
* Field test each well for operability
* Input results of field search and test into data base

A discussion of these steps follows in the various subsections.

### 3.1.1 Collection of Observation Well Data

Sources of observation well data included a report by Lambrechts et al (6) to the Boston Redevelopment Authority entitled "Report on Groundwater in Back Bay Boston" (1985) and a report compiled by Cotton and Delaney, (4) entitled "Groundwater Levels on Boston Peninsula, Massachusetts-Hydraulic Atlas 513" (1975).

In addition, a letter requesting any available observation well information was sent to public agencies, institutions and private firms. A meeting was held with the Facilities and Planning Group - Fenway Program, Inc., and all of their

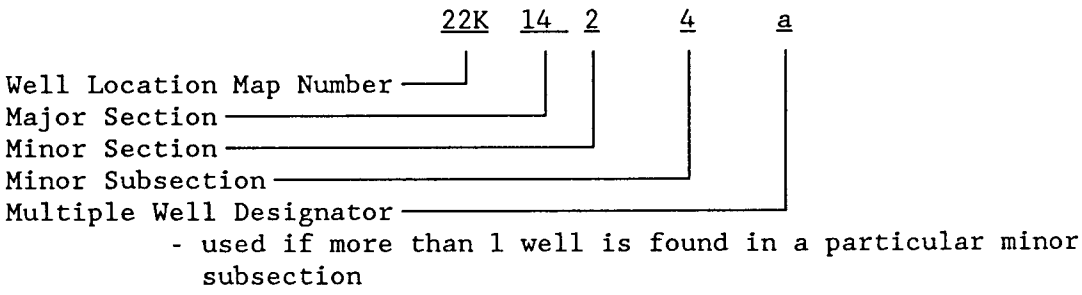
membership was solicited for information on observation wells. A list of those who have contributed is given on Table 1.

In addition, 14 unrecorded wells were found by Stone and Webster personnel while performing other field tasks.

### 3.1.2 Initial Data Input

The first step in the organization of the database was to plot the location of recorded observation wells on a set of Well Location Maps derived from Boston Water and Sewer (BW&S) maps. These maps were prepared by the BW&S from aerial photographs taken in 1982 and developed to a scale of 1"-100'. These maps include building footprints and street address numbers, as well as spot elevations. The building footprints and addresses were particularly useful in the location of the wells, while spot elevations were convenient for estimation of surface elevations for wells with none on record. In total, 757 observation well records are included in the database.

To facilitate development and use of the database, a unique number was assigned to each well. This number was obtained by overlaying a transparent numbering template over the area of the Well Location Map (see Figure 2). Assigned numbers took the form:




This numbering system was developed to give the observation wells surveyed a geographic identity. This identity was helpful in developing the observation well database, and will greatly facilitate its use. This number along with the well source and previous well number were entered into the database

### 3.1.3 Field Survey

The Field survey work entailed searching for documented wells as plotted on the Well Location Maps. Inspectors would look for "street boxes" in the general area of each plotted observation well. Street boxes are typically a circular steel casting approximately 9 inches in diameter and 3 feet in length with a locking cap placed flush with the ground surface. These boxes are used to protect the vertical access piping to underground utility connections such as gas valves or water services, or as in this case to protect the vertical standpipe of an

observation well.

The locking cap of a street box is typically embossed with lettering to identify the vertical piping below it. Many of the street boxes covering wells were embossed with such designations as "Boston Building Department-Water Level," "Guild Instrumentation" and "Carr-Dee Drilling." Other street boxes were embossed with "water" or some other designation. Where a street box with a water designation was the only street box in the general area of a plotted well, inspectors had to conclude the street box might actually be the observation well being investigated. Obvious water service valves or water main junctions were not investigated. Where it was concluded that a street box was an observation well, a sketch of the street box location was prepared on a field data form unless the location as shown on the Well Location Map was considered sufficiently accurate. This sketch together with the Well Location Map were eventually used by a two man team to locate the street box and test the well.

In total, 657 observation well locations were field surveyed and 308 were identified as wells. No observation wells were found in 349 locations.

### 3.1.4 Test for Operability

All observation wells which were found were tested using a slug test to determine if they are functioning. The object of the slug test is to cause a lowering of the groundwater level inside the observation well and then to measure and record the time rate of recovery of the groundwater as it returns to the original level.

Prior to testing, well specific information was obtained. This information included the condition of the cover plate, the depth of the groundwater level, the total depth of the well, the inside diameter of the well and the condition of the top of the standpipe.

Lowering the groundwater level was accomplished by placing a bailer into the well and removing groundwater from the well. Typically the water level in the stand pipe was lowered a distance of several ft. The rate of groundwater recovery was measured using an electronic water level indicator and a stop watch.

Groundwater level readings were taken until the groundwater returned to the original level or for 30 minutes, whichever occurred first. In those cases where the groundwater level returned to the original level, the well was classified as functioning. In those cases where a groundwater level showed no discernable recovery in 30 minutes, the well was classified as non functioning. Where a groundwater level showed signs of recovering to its original level, but did not recover fully in 30 minutes, a groundwater level reading was taken at least 24 hours later. At this reading, if the groundwater level had recovered to the original level, the well was classified as functioning. If the groundwater level had not recovered to the original level it was classified as non functioning.

Observation wells currently being monitored by others were not tested and were assumed to be functioning.

### 3.1.5 Final Database Update

Results of the field survey and testing were input as a final update to the database. Field survey notes such as the general location of the well, if found, the condition of the cover plate and any other information relevant to locating the well for future readings are shown on the field forms which are included in Volume II.

## 3.2 Datum For Elevations

Elevations referenced are in the Boston City Base (BCB) datum which is 5.65 feet below the National Geodetic Vertical Datum (NGVD) at mean sea level. Mean tide levels in Boston Harbor are: high tide at elevation +10.54 BCB and low tide at elevation +1.06 BCB.

## 3.3 Summary of Results

A total of 657 wells were identified from the two major sources [references (4) and (7)] and 100 well locations were identified by other parties. Since the 100 wells are understood to be monitored currently, no effort was made to either locate or field test these wells. A total of 189 wells were judged to be functioning and their approximate location is shown on Figure 3. There were 139 wells which were found to be plugged or otherwise obstructed and could not be tested, and 20 wells which failed to pass the slug test. The detailed location of the functioning wells are shown on the Well Location Maps on Figures 9 through 26.

The results of the data collection, field surveying and testing are summarized as follows:

| | |
|---|---|
| Wells field surveyed | 657 |
| Operating wells by others (Not field surveyed) | 100 |
| Total Wells in Database | 757 |

Surveyed Wells

| | |
|---|---|
| Wells found | 308 |
| Wells not found | 349 |
| Total Surveyed Wells | 657 |

Tested Wells

| | |
|---|---|
| Wells tested operable | 89 |
| Wells did not respond | 20 |
| Wells damaged/plugged | 91 |
| Miscellaneous* | 108 |
| Total Tested Wells | 308 |

Total Operating Wells

| | |
|---|---|
| Wells tested operable | 89 |
| Operating wells by others (not field surveyed) | 100 |
| Total Operating Wells | 189 |

Detailed results of this survey are given on Tables 2 and 3.

* This category includes gate boxes which turned out to be water services, deep wells, small diameter wells that could not be slug tested, piezometers and wells that could not be opened.

## 4.0 REVIEW OF FACTORS AFFECTING GROUNDWATER LEVELS

Planning an observation well network requires a review of the surficial geology, groundwater fluctuations, sources of groundwater losses and obstructions to groundwater flow as well as an understanding of the areas where untreated timber piles are to be found. This information, together with knowledge of where functioning wells currently exist, as shown on Figure 3, is necessary in order to plan a well network. This section of the report is a review of earlier publications concerning groundwater conditions and related issues in the City of Boston. All sources of data are referenced.

### 4.1 Groundwater Conditions

#### 4.1.1 General

Any discussion of the groundwater history of the City of Boston must include the extensive land filling which occurred, as well as the surficial geology, the deleterious effects of the groundwater table drawdown and the several attempts to monitor the groundwater table over the years.

The following history is necessarily brief and does not include the complete historical record. Those interested in more details are invited to study the references at the conclusion of this report.

#### 4.1.2 Land Filling

The original shoreline for Boston in colonial times is shown on Figure 4. Only a narrow causeway of land running about where Washington Street is now connected the several hills of Boston to the mainland. Most of the Back Bay, Lower Beacon Hill, Chinatown, and portions of the Fenway and the South End were a tidal estuary until landfilling began about the turn of the nineteenth century.

The first major structure to be constructed in the Back Bay was the Mill Dam which was completed in about 1821. The dam carried a toll road and was built on what is now Beacon Street, extending from the Public Gardens to Brookline Street. The dam consisted of two parallel masonry block walls about 15 feet in height and 50 ft. apart, built on a grillage of timbers with the space between filled with mud and sand. The purpose of the dam was to use tidal water to power machinery in mills located along the cross dam on Gravelly Point.

In 1831 two rail lines, the Boston & Providence and the Boston and Worcester were chartered and construction of their embankments across the tidal estuaries was begun almost immediately. The Boston & Worcester crossed the tidal flats at the location of the present Boston & Albany tracks, while the Boston & Providence Line crossed in northwest-southeast orientation, terminating at Park Square. The two lines intersected at what is now Back Bay Station. Quoting from Aldrich (1) "The railroads influenced the growth of Back Bay in two important ways. First they greatly interfered with the flow of water, hence reducing the usefulness of the area as a power project, increasing its undesirable aspects and hastening the day of its filling. Second, they influenced materially the ultimate layout of streets in the Back Bay, which factor had a tremendous impact on its physical and sociological development."

Major filling of the tidelands began in the late 1850's. Fill for the decades long project came from Needham and consisted of clean sand and gravel. Filling was completed in the late 1800's and as sections were completed land was sold for residential and commercial development. In 1910 a tidal dam was built across the Charles River to control the height of the water in the river at about el +8, and in 1951 the Storrow Drive was built.

4.1.3 Surficial Geology

Typical soil profiles in the Back Bay are illustrated on Figure 5. Starting from the bedrock and extending upward the soil generally consists of a variable thickness of glacial till, stiff to medium gray clay, varying in thickness from 40 ft. to over 100 ft., a relatively thin and discontinuous deposit of sand, overlain by peat and organic silt, which in turn is overlain by the granular fill.

The following detailed description of the various soil types which constitute the surficial soils in the Back Bay area of Boston are taken from Aldrich (1).

The glacial till which overlies bedrock consists of a random mixture of rock fragments of all sizes, varying from cobbles and boulders down to sand, silt and clay sizes. The till is very compact and extremely competent. In the Back Bay the till is relatively thin and no more than 30 ft. in thickness.

The clay which in turn overlies the till is called the Boston Blue Clay. The actual color is blue-gray to drab olive green, and in the Back Bay it varies in thickness from 50 to 125 ft. Clay was encountered as deep as 180 ft. in borings at the corner of Beacon and Fairfield Streets. The clay commonly has a stiff yellow crust which was caused by drying out during periods when the sea level was greatly lowered. The stiff crust of the Blue Clay is typically the supporting stratum for many of the timber pile foundations.

Overlying the Boston Blue Clay in an irregular fashion is the sand and gravel outwash. This was deposited by swiftly moving streams of the glacial melt water about twelve to fourteen thousand years ago. The deposit of well stratified sand and fine gravel is generally medium compact, highly pervious and easily excavated. The outwash deposit begins to increase in thickness around Dartmouth and Exeter Streets, and at Massachusetts Avenue on the old colonial peninsula it has been termed appropriatly Gravelly Point. At the Christian Science Church the sand and gravel outwash is approximately 20 ft. thick, and east of Copley Square it occurs only irregularly.

The organic soils are found above the outwash or in some instances directly overlying the Boston Blue Clay. These soils vary in composition from organic silt to peat and in the Back Bay area they are continuous and range in thickness from 5 to 25 ft. The top surface of organic soils varies from below el. 0 to el. +9. [Kaye(6)]

Overlying the organics is the fill which for the most part is granular in nature, highly permeable, and of variable density.

4.1.4 Groundwater Monitoring Programs

There have been only two major groundwater monitoring programs in the past 60 years. The first effort occured between the years of 1936 and 1940 and was conducted by the Works Progress Administration (9). Approximately 1300 wells were installed by either the WPA or the Boston Sewer Department. The need for this monitoring effort probably grew out of concern about the untreated timber piles in the city as exemplified by the problems of the Boston Public Library (Section 5.1).

While the actual water level readings from the 1936 - 1940 survey are available at the Boston Public Library, the extreme highs and extreme lows have been included by Cotton and Delaney (4) in the second major monitoring program. This was sponsored by the US Geological Survey and was published in 1975. This project was based on data from about 400 wells remaining from the WPA survey. Two readings were taken, one in September of 1967 and the other in March of 1968. These were plotted as groundwater contours and compared with the extremes of the 1936 - 1940 survey.

In 1985, Lambrechts et al (6) reviewed and augmented the above mentioned data as it pertained to a more limited study area bounded by Albany Street on the South, Massachusetts Avenue on the West, the Charles River on the North and extending East to Charles Street. This report included considerable discussion about construction activity and some additional water level information together with a listing of all known observation wells in the area of concern. That report did not include any field surveys or testing, and it was the starting point for this report.

4.1.5 Groundwater Table

The groundwater table may be defined as the elevation to which water will rise in a standpipe which is open ended and is embedded in an aquifer. An aquifer

is a relatively permeable soil, such as sand or gravel, through which water may travel relatively easily. Conversely an aquitard is a soil of low permeability such as a clay or a silt which is resistant to the flow of water. Generally the water table is expressed as an elevation and if sufficient data is known isochrones or contours of equal elevation may be constructed. There are both confined and unconfined aquifers. A confined aquifer is an aquifer which is confined between two aquitards. Usually the water table in a confined aquifer will rise above the top of the aquifer. An unconfined aquifer, or water table aquifer, is an aquifer in which the water table forms the upper boundary.

In Boston there are at least three water tables. The first water table is in the fill and the fill can be called an unconfined aquifer. The second water table is in the sand outwash which is overlain by the organic silt and or peat and is considered a confined aquifer. While this aquifer may be connected to the fill locally by excavations made for the infrastructure which have been backfilled with granular soils, it typically is considered to be isolated from the groundwater table in the fill. The third aquifer in the Boston profile is in the granular portions of the glacial till. This is frequently found just overlying bedrock. Other localized aquifers may exist in sand lenses which may occur within the Blue Clay.

While these various aquifers are important for some engineering considerations, the only one of importance with respect to timber piling, which has been identified to date, is the unconfined aquifer in the fill. The following discussion pertains to that aquifer.

The normal groundwater level prior to filling is assumed to have been at least equal to the mean tide level, or el. 5.7. About 1878, after substantial filling of the Back Bay was completed, according to Snow (7), the goundwater table was about el. 7.7. In 1910 the Charles River Dam was completed and the river was maintained at about el. 8. While it may have been assumed that the dam would have a positive effect on goundwater tables throughout the Back Bay area, the effects were really quite limited to the immediate proximity of the river itself. This limitation on the Charles as a significant source of groundwater recharge is probably due to the Mill Dam which underlies Beacon Street, as well as the Boston Marginal Conduit which parallels the river about where Storrow Drive is today.

In 1894, Mr. Frederick P. Stearns, reporting to the Joint Board on the Improvement of the Charles River, stated that "The lower level of the groundwater at a considerable distance from the river ... indicates clearly that the height of the groundwater is governed for the most part by leakage into sewers and not by the height of the water in the Charles River." (7) In a general sense this continues to be true to this day.

In the three definitive reports on groundwater conditions in the Back Bay Area (4) (7) (10), the groundwater table varies from a high of about el. 10 to a low of el. +2 to 0, omitting local extremes. Review of the reports indicates certain areas which were low in the 1936-1940 survey, in the 1967-1968 survey, and in the report by Lambrechts et al (6) for the period between 1968 and 1985. A composite of these areas are shown on figure 7. These areas include lower Beacon Hill, an area between Boylston Street and Columbus Avenue, an area on either side

of the Southwest Corridor Project, an area just east of the Muddy River in the Fenway and an area centered on Tremont Street between Concord Street and the Massachusetts Turnpike Extention.

4.1.6 Sources of Groundwater Drawdown and Recharge

Lambrechts et al (6) have a detailed discussion of the various sources of groundwater losses. The following review has been taken in part from that report.

Sewers

All studies to date of the cause of groundwater drawdown attribute a significant influence to the local sewer system. A discussion of the influence of the sewer system on the groundwater table by Snow (7) in 1936 follows:

"With the filling of the basin came the construction of drains and sewers emptying into either the South Bay or the Charles River. Plans in 1863 show that by that time an extensive system had been constructed, but definite records as to location have been since either lost or destroyed. This, together with the fact that they have settled several feet in places, makes the present location of these drains entirely a matter of conjecture, except where they have been uncovered by recent construction. These sewers and drains were the beginning of the present maze of underground channels of which little or nothing is known, but which form channels by or along which the groundwater can escape to sewers in which the gradient is at a sufficiently low elevation to help drain the area." In the opinion of Mr. Snow, the city was underlain by a maze of subterranean channels leading groundwater off to the Harbor.

All of the early sewers were constructed on top of an 8 to 12 inch underdrain which was designed to collect and control groundwater during construction. These remain in place to this day and are capable of transporting significant quantities of groundwater.

The West Side Interceptor was a part of the Boston Main Drainage System that was constructed from 1877 to 1884. It is an egg shaped sewer, 57 in. wide and 66 in. high, constructed with a double or triple row of mortared bricks. It was constructed down Charles Street to Beacon, down Beacon to Hereford, down Hereford and Dalton to Falmouth, then west to Gainsborough Street. The invert grade varies from approximately el. 0 at Beacon and Arlington to el. - 5.5 at Huntington and Gainsborough, and was designed to intercept combined sewers which formerly discharged into the Charles River at Beaver, Berkeley, Dartmouth, Fairfield and Hereford Streets. Excess storm flow and sewage could still overfow into the Charles at numerous overflow outlets.

The Boston Marginal Conduit was constructed in 1910 as part of the project which constructed the new dam and lock on the Charles River. The Marginal Conduit was intended to collect flow from Stony Brook and mixed sewage and storm water overflows from the West Side Interceptor which used to discharge to the river. It was constructed in a reinforced concrete horse shoe shaped section 76 in. wide and 92 in. high, supported on wood piles, and located immediately north of Back Street, and today it is below Storrow Drive. It was built between two rows of

wood sheeting which was driven into the organic silt and left in place. A portion of the Marginal Conduit was relocated inland when the Storrow Drive Underpass was built in 1951. The relocated section is an 8 ft. diameter reinforced concrete pipe with an invert el. of -1.5 which extends from Dartmouth to Mr. Vernon Street. Beneath the sewer line is the underdrain line which ties into the old underdrain line under Storrow Drive.

Both the West Side Interceptor and the Boston Marginal Conduit impeded the flow of groundwater into the Back Bay from the Charles River. They also have the ability to transport water rapidly along their length via their underdrain system.

The St. James Avenue sewer has been the source of groundwater table drawdown since it was investigated as a result of concern for the foundations of the Trinity Church during the 30's. The installation of a dam in the sewer caused nearby groundwater to return to acceptable levels, but the dam requires periodic maintenance and when it does not function the local groundwater falls.

Subways, Railroads and Depressed Arteries

The Boylston and Huntington Avenue Subways were constructed in 1914 and 1940 respectively. During Construction the groundwater table was undoubtedly drawn down to new lows [the maximum depth of excavation of both projects is about el. -19] for the period of the construction. Since then the subways undoubtedly act as an impediment to ground water flow and also as a drain depending upon how much water leaks into the subways.

The Southwest Corridor Project which has been under construction during the 1980's has two tracks for the relocated Orange Line Subway and three tracks for commuter rail and AMTRAK service. The corridor is located on the former Penn Central alignment from Forest Hills to the South Cove area, and also coincides with the two original railroad embankments which crossed the Back Bay. For over 2100 feet it is constructed with two reinforced concrete slurry walls penetrating 8 to 15 ft. into the underlying clay. Efforts were made to permit lateral groundwater flow by the use of a groundwater equalization underdrain system but it was reported in 1985 (6) that the groundwater on both sides of the Southwest Corridor East of the Back Bay Railroad Station are several feet below el +5.

The Massachusetts Turnpike Extension was built between 1963 and 1966 and is just north of the Conrail railroad alignment. The highway is depressed about 15 to 20 ft. below adjacent city streets, ascending from about el. 6 at Tremont to about el. 11 at Massachusetts Avenue. The project was designed to prevent groundwater flow into an underdrain system by use of two rows of sheeting which penetrate into clay in the vicinity of the Prudential Center. It is not clear how effectively the sheet piling prevents the loss of groundwater into the underdrain system. Again, the structure is another impediment to the flow of groundwater.

The Storrow Drive underpass was built in the early '50's and is approximately 1300 ft long with 300 ft approach ramps at either end. The road surface is about 15 to 17 feet below the ground surface. The underpass never proved to be very water tight, and it was believed in 1985 (7) to be pumping 20,000 gpd from

each of several wet wells. This structure is consequently a barrier to the recharge of the Back Bay groundwater system as well as a groundwater sink.

Sources of Groundwater Recharge

A discussion of the various sources of groundwater recharge follows:

1. Surface infiltration - Over 80% of the area in question is paved. Consequently only a small amount of recharge can be expected from surface infiltration.

2. Recharge from the local rivers - The largest local body of water is the Charles River. The West Side Interceptor, the Boston Marginal Conduit and the Mill Dam effectively isolate the Boston Peninsula from significant recharge from the Charles River. The Muddy River is a groundwater source in the Fenway.

3. Recharge from leaking water mains - This has proved in the past to be a significant source of localized recharge. Currently the BW&S is aggressively finding and repairing leaking pipes to minimize losses.

4. Permanent recharge systems - Two known systems are installed at Copley Square and Trinity Church. These systems are very local and do not effect groundwater conditions beyond their immediate vicinity.

4.2 Summary

In order to propose additional well locations it is important to understand certain factors which affect the groundwater history of the Boston Peninsula. Review of these factors indicates that numerous reasons exist for a lowered groundwater table, including the following:

* Paving has reduced recharge to a minimum

* Leaking sewers

* Subways, depressed expressways and railroads act as an impediment to groundwater flow and in some instances as a groundwater sink

* Leaking pressurized distribution lines which acted as a source of groundwater recharge have been repaired.

Review of the data also indicates certain areas which were low in the 1936-1940 survey and in the 1967-1968 survey as shown on figure 7. These areas include lower Beacon Hill, an area between Boylston Street and Columbus Avenue, an area on either side of the Southwest Corridor Project, an area just east of the Muddy River in the Fenway and an area centered on Tremont Street between Concord Street and the Massachusetts Turnpike Extention.

## 5.0 TIMBER PILE FOUNDATIONS

Certain areas of the Boston Peninsula include structures supported on untreated timber piles which were built prior to the early 20th century. Those areas which were included in this study are Back Bay, Beacon Hill, South End, Chinatown, and the Fenway. Other areas of the City which have timber pile foundations include South Boston and parts of the North End. A report by Thompson and Lichtner (8) was prepared for the BRA for the rehabilitation of the South End in 1963. In this study the foundations of 15 structures were investigated. The intent was to determine both the type of foundation as well as the condition. Eight of the structures were on original land within the old shore line and seven were on filled land either west (6 structures) or east (1 structure) of the old peninsula. Interestingly, of the 8 structures within the old shoreline, all were founded on shallow foundations and 4 of the seven on fill were also on shallow foundations. One of the 4 which were shallow was supposed to be on piles but the piles were not found. While this is certainly not definitive, it does raise some question as to the number of pile supported structures that actually were built in the South End.

By 1890 building department regulations (7) required all untreated timber piles to be cut off below el. + 5 and no basements to be constructed below el. +12. It has been commonly accepted that if the groundwater is maintained at or above el. +5, no pile deterioration will occur. In actuality a number of piles were cutoff above el. +5, as noted by remedial work in the Brimmer Street area where piling was found cut off at el. +7.

### 5.1 Deleterious Effects of Groundwater Table Drawdown in Boston

There are several deleterious effects of groundwater table drawdown as follows:

Subsidence - This is settlement of the ground surface due to an increase in the effective stress on soft and compressible deposits. Subsidence will cause all structures such as pipelines and conduits which are not supported on piles to settle. Subsidence may cause negative skin friction on pile foundations.

Negative Skin Friction - This is downdrag on piles due to settlement of the soil surrounding the pile. This downdrag increases the load on the pile which in turn increases the settlement of the pile and could result in pile failure.

Deterioration of untreated timber piles - Untreated timber piles deteriorate when exposed to moist air. The following discussion is taken from Chellis (3). "All decay in wood piles is caused by the growth of fungus, a form of plant life which, by deriving its food from the wood, break down the cellular structure. Fungi must have moisture, air, favorable temperature and food in order to exist. By depriving the fungi of any of these elements, decay can be prevented. For example, if wood can be kept dry, or if it can be kept continuously submerged at a low temperature, or rendered unsuitable for food by poisoning, it will not decay." The time rate of deterioration is variable depending upon the type of soil in which it is embedded and the type of wood. For instance, a pile which is embedded in an organic clay silt might have a much longer life after groundwater table drawdown than a pile embedded in a sandy fill. The fine grained soil will retain the water longer, which will act as a

preservative. On average, a spruce pile above the groundwater table will lose about 50% of its cross sectional area in 3 to 7 years.

Damage to Boston Structures

No major failures in the city are known to have been related to subsidence. This does not mean that numerous broken or leaking pipes and dipping roadways and sidewalks could not be attributed to this cause. It is just that no serious effort has been made to document the cause and effect. The effect of negative skin friction is also difficult to isolate from that of the damage caused by deteriorating piling.

Effort has been made from time to time to document damage due to deteriorating pile foundations. The first significant failure was the Boston Public Library which was discussed by Snow (7). "About seven years ago (1929) the Boston Public Library, built in the heart of the land developed in one of the old basins, showed several alarming cracks. After investigation by the City Building Department and their consulting engineers, it was found necessary to cut off decayed pile heads and replace them with concrete. The tops of some of the piles were completely gone and others were very badly decayed so that for about 40 percent of the area of the building underpinning was necessary." The cost of these repairs was approximately $250,000 (1929 dollars).

The report by Lambrecht et al (6) for the BRA indicated that there were records of 32 buildings which had decayed wood piling in the lower Beacon Hill area between 1927 and the early 1980's. Seventeen buildings required underpinning in the 1980's in the vicinity of Brimmer Street in Lower Beacon Hill.

In Chinatown, four Hudson Street buildings have recently collapsed and several others are severely damaged, all reportedly due to deterioration of the foundation piling. An Inspectional Services Department survey of 160 buildings on three Chinatown Streets have shown signs of damage which may be caused by deteriorating foundations.

Northeastern University has reported underpinning two residential buildings on Hemenway Street within the past several years at their Huntington Avenue Campus.

Undoubtedly other unreported cases exist.

# 6.0 RECOMMENDATIONS

## 6.1 GENERAL

The purpose of this study was to provide the basis for planning the future expansion of the groundwater monitoring system for the City of Boston. It's primary function was to locate, test and tabulate existing wells. Because the present study did not include significant interpretation of groundwater data, specific locations of new wells have not been determined. However certain general recomendations have been made regarding an observation well network. The first priority for the next phase of this project should be to engage a consultant with appropriate experience to provide a groundwater data base management system and to evaluate and interpret the existing data. As a result of their evaluation, new wells should be located and installed in a phased approach. The location of the first phase of new wells should be determined based on evaluation of existing data, which was beyond the scope of this study. Subsequent planning of additional well locations will be very much influenced by the data provided by new wells installed in earlier phases of the study.

## 6.2 OBSERVATION WELL NETWORK

This section includes general recommendations resulting from this study for a groundwater observation well network. These recommendations are based upon the results of the field survey and records of others which indicate a total of 189 wells are functioning in the study area in locations as identified on Figure 3. In order to plan the well network an average density of 2.5 acres per well is recommended. This is similar to the WPA study and is considered appropriate for this project. This is an average density and should vary as groundwater data in specific areas becomes available.

1. Total Number of Wells

   The total study area is approximately 2100 acres. A total of 189 wells have been identified as working in an area roughly equal to 400 acres. Assuming a density of 2.5 acres per well, the balance of the area (2100-400) will require 680 wells. This would provide a network of 869 working wells.

2. Modifications to an Average Well Density

   Areas of steep gradients would require more wells per acre than areas of very flat gradient. Areas with few structures (such as the parking lots at Northeastern University) would require fewer wells per acre than typical residential areas. Areas close to the Charles which have not historically been below el. +5 (such as the area North of Commonwealth Avenue between Charlesgate and Arlington Streets as shown on Figure 8) could have a lower density than the average, assuming groundwater levels are found to be above el. + 5.

3. Priority of Well Installation

First priority should be defining the groundwater table in areas with timber pile foundations and suspected low groundwater levels. Areas of high priority are shown on figure 8. Chinatown was not given high priority because it is believed that construction of the Central Artery will result in construction of a number of observation wells in that area of the city. The area north of Commonwealth Avenue is recommended as a priority area because it has a high percentage of timber pile supported residential structures and very few observation wells, not because it has been identified as an area of low groundwater. As stated in item 3 above, the density of wells in this area may be less than the average recommended density.

While the South End and parts of the North End have been identified as having untreated timber pile foundations, it does not appear justified at this time to recommend the installation of wells in these areas. It is believed that a number of new wells will be installed in conjunction with the construction of the Central Artery.

4. Plugged Wells

159 wells were found to be plugged or did not function. This represents a substantial increase in the current operating well network if they can be made operable at a reasonable cost. It is recommended that a well drilling contractor be hired for a trial to establish the cost and effectiveness of well cleaning. The fundamental approach to be used will involve jetting a smaller (nominal 1 in OD) pipe down the standpipe, which is typically a steel 2. in. OD pipe. Water or air may be used, and the jet should be directed directly down until the screen is reached, and then directed to the openings. It will not be clear until this trial is run for several days whether cleaning will be cheaper than installing a new well. It is important that a qualified person witness the cleaning and document the results. The final approved well will pass a slug test as described in Section 3.1.4.

## 6.3 OTHER ACTIONS

Certain other actions are recommended to maximize the value and minimize the cost of an observation well network . The following recommendations should be considered as an integral part of a well network.

1. Obtain the services of a competent consulting engineer. Services to be provided should include:

   * Develop software for the database to produce time plots and groundwater contours.

   * Read all existing wells and input to data base and produce first cut at groundwater contour data. (alternatively the city will read the wells and input the data to the data base). It is recommended that initially all wells be read four times (winter, spring, summer

and fall) and twice yearly (fall and spring) thereafter.

* Review building permit records to determine location of timber pile foundations. (review of Thompson and Lichtner Report (9) indicates an effort should be made to confirm the presence of timber piling.)

* Survey elevations of all wells for which no data is available.

* Review new groundwater data and location of timber pile foundations to confirm first priority locations of groundwater wells as identified in this report.

* Develop trial program to clean plugged wells. Based on this program certain wells may become operative. This program should be controlled to ensure that the result is less expensive than installing new wells. Both location of the well and cost of cleaning must be considered.

* Install new wells. New wells should include a boring log and an installation record.

* Update groundwater map as new data is available.

* Revise priority locations on the basis of new data.

* Study and recommend remedial measures to raise the groundwater table in affected areas. This study to be provided to an interagency task force (Item 4 below)

2. Create new regulations requiring installation of permanent observation wells as part of any new construction.

3. Interagency coordination to require the MWRA and BW&S and other pertinant state and municipal agencies to install permanent observation wells as part of any new construction.

4. Interagency task force to review the cause of lowered groundwater and determine and implement remediation measures.

## LIST OF REFERENCES


1. Aldrich, H. P., 1970, Back Bay Boston, Part I, Journal of the Boston Society of Civil Engineers, Volume 57, Number 1.

2. Aldrich, H. P., Lambrechts, J. R., 1986, Back Bay Boston, Part II, Groundwater Levels, Civil Engineering Practice, Journal of the Boston Society of Civil Engineers, Volume 1, Number 2.

3. Chellis, 1961 Pile Foundations, McGraw & Hill Book Company

4. Cotton, J. E., and Delaney, D. F., 1975, Groundwater Levels on the Boston Peninsula, Massachusetts, Hydrologic Investigations Atlas HA-513, U.S. Geological Survey, Reston VA, 4 sheets.

5. Kaye, C. A. 1961, Pleistocene Stratigraphy of Boston, Massachusetts, Professional Paper 424-B, U.S. Geological Survey, pp B-732 to B-76,.

6. Lambrechts, J. R., Gevalt, D. H., Aldrich, H., 1985, Report on Groundwater in Back Bay Boston, Boston, Massachusetts, for the Boston Redevelopment Authority.

7. Snow, B. F., 1936, Tracing Loss of Groundwater, Engineering News Record, July 2, 1936.

8. The Thompson and Lichtner Company, Inc, December, 1963 Investigation of Subsoil and Foundation Conditions, for the Boston Redevelopment Authority.

9. Works Progress Administration Program, 1941, Final Report of the Groundwater Level Survey of Certain Areas of the City of Boston, Project Number W.P. 5325, and Supplemental Official Project Number W.P. 18868.

TABLE 1

FIRMS PROVIDING INFORMATION FOR THE DATA BASE

| Company | Contact |
|---|---|
| Boston Public Library | Mr. John J. Doherty |
| Boston Redevelopment Authority Engineering | Mr. William Barbato |
| Boston University | Mr. James Keating |
| First Church of Christ | Mr. Gary McKean |
| Ziner and Rosetti<br>- Gardner Museum | Mr. Erwin Ziner |
| Gilbert Small Co.<br>- Church of the Advent<br>- Lenox Hotel | Mr. William Rogers |
| J.M.B. Properties<br>- Copley Place | Mr. Frank Shea |
| MASCO | Mr. Brian Luke |
| Massachusetts Bay Transportation Authority: Southwest Corridor Project | Mr. William Quinlain |
| Massachusetts Turnpike Authority | Mr. John Grimm |
| Museum of Fine Arts | Mr. Warren Young |
| Northeastern Univ. | Mr. Cliff Fralen |
| R.M. Bradley<br>- Prudential Center | Ms. Pam Galeota |
| Trinity Church | Mr. Richard Merrill |
| Wentworth Institute of Technology | Mr. Kevin Fuchs |

TABLE 2

FUNCTIONING OBSERVATION WELL SUMMARY



| S&W NO. | PREVIOUS NO. | (*) DATA SOURCE | NEIGHBORHOOD | LOCATION | TEST DATE | GROUNDWATER DEPTH (FT) | GROUNDWATER ELEVATION (FT) | GROUND SURFACE ELEVATION (FT) | WELL DEPTH (FT) |
|---|---|---|---|---|---|---|---|---|---|
| 1910611 | | 3 | BACK BAY | WILLIAMS ST. & SHAWMUT AV | 08/15/89 | 11.80 | 0.00 | 0.00 | 14.90 |
| 20H1216 | | 3 | SOUTH END | HUNTINGTON & VANCOUVER | 08/14/89 | 8.80 | 0.00 | 0.00 | 13.80 |
| 20H1424 | | 3 | SOUTH END | RUGGLES ST & PARKER ST | 08/14/89 | 7.30 | 0.00 | 0.00 | 11.80 |
| 20H1528 | B89-10W | 16 | FENWAY | ON SHATTUCK ST | 05/12/89 | 20.50 | 17.70 | 38.20 | 25.00 |
| 20H1529 | B89-20W | 16 | FENWAY | ON SHATTUCK ST | 05/12/89 | 16.60 | 22.20 | 38.80 | 35.00 |
| 2010142 | 88-16 | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 9.20 | 7.90 | 17.10 | 0.00 |
| 2010168 | 88-17 | 12 | SOUTH END | NORTHEASTERN UNIV. | 10/23/89 | 11.90 | 6.80 | 18.70 | 0.00 |
| 2010213 | | 3 | SOUTH END | GREENLEAF & FORSYTH ST | 08/15/89 | 9.30 | 0.00 | 0.00 | 19.60 |
| 2010284 | 88-19 | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 11.20 | 7.40 | 18.60 | 0.00 |
| 2010396 | 88-24 | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 10.10 | 5.20 | 15.30 | 0.00 |
| 2010868 | 88-20 | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 9.20 | 7.20 | 16.40 | 0.00 |
| 21H2176 | B-3 | 11 | FENWAY | MUSEUM OF FINE ARTS | | | | | |
| 21H2182 | B-4 | 11 | FENWAY | MUSEUM OF FINE ARTS | | | | | |
| 21H2586A | A | 10 | FENWAY | 280 FENWAY | 10/28/86 | 12.75 | 4.63 | 17.38 | 0.00 |
| 21H2586B | B | 10 | FENWAY | 280 FENWAY | 10/28/86 | 11.75 | 6.71 | 18.46 | 0.00 |
| 21H2589A | C | 10 | FENWAY | 280 FENWAY | 10/28/86 | 13.88 | 5.10 | 18.98 | 0.00 |
| 21H2589B | D | 10 | FENWAY | 280 FENWAY | 10/28/86 | 14.00 | 4.81 | 18.81 | 0.00 |
| 21H2595 | E | 10 | FENWAY | 280 FENWAY | 10/28/86 | 13.75 | 5.48 | 19.23 | 0.00 |
| 21H2597A | F | 10 | FENWAY | 280 FENWAY | 10/28/86 | 3.25 | 4.85 | 8.10 | 0.00 |
| 21H2597B | G | 10 | FENWAY | 280 FENWAY | 10/28/86 | 3.42 | 5.80 | 9.22 | 0.00 |
| 21H2728 | B-1 | 11 | FENWAY | MUSEUM OF FINE ARTS | | | | | |
| 21H2729 | B-2 | 11 | FENWAY | MUSEUM OF FINE ARTS | | | | | |
| 2110248 | 88-1 | 12 | FENWAY | OFF HEMENWAY STREET | 10/23/89 | 7.60 | 4.60 | 12.20 | 0.00 |
| 2110249 | 88-2 | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 12.50 | 4.70 | 17.20 | 0.00 |
| 2110432 | T1 | 12 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 5.40 | 4.98 | 10.38 | 0.00 |
| 2110436 | OW5 | 12 | BACK BAY | CHRISTIAN SCIENCE CENTER | | | | | |
| 2110629 | III-W-35 | 1 | BACK BAY | 138 ST BOTOLPH ST | 08/11/89 | 9.30 | 0.00 | 0.00 | 18.80 |
| 2110837 | 88-5 | 12 | FENWAY | 84 FENWAY WAY | 10/23/89 | 10.60 | 5.80 | 16.40 | 0.00 |
| 2110838 | 88-5A | 12 | FENWAY | ON FENWAY WAY | 10/23/89 | 11.70 | 5.00 | 16.70 | 0.00 |
| 2110885 | 88-7 | 12 | FENWAY | 110 FENWAY | 10/23/89 | 13.00 | 4.60 | 17.60 | 0.00 |
| 2110896 | 88-6 | 12 | FENWAY | 163 HEMENWAY STREET | 10/23/89 | 12.50 | 5.20 | 17.70 | 0.00 |
| 2110912 | 88-3 | 12 | FENWAY | 129 HEMENWAY STREET | 10/23/89 | 12.90 | 4.70 | 17.60 | 0.00 |
| 2110941 | 88-4 | 12 | FENWAY | OFF HEMENWAY STREET | 10/23/89 | 13.30 | 4.10 | 17.40 | 0.00 |
| 2110942 | 88-4A | 12 | FENWAY | 143 HEMENWAY STREET | 10/23/89 | 12.70 | 4.60 | 17.30 | 0.00 |

* DATA SOURCE: 1 - H&A GROUNDWATER BACK BAY; 2 - CHRISTIAN SCIENCE CENTER; 3 - USGS HYDROLOGIC ATLAS-513; 4 - MASS TURNPIKE AUTHORITY; 5 - IDENTIFIED BY STONE & WEBSTER; 6 - QAZILBASH; 7 - GEO. ENG. INC.; 8 - URBAN ENGINEERING; 9 - BRA; 10 - ZINER & ROSSETTI INC; 11 - MUSEAUM OF FINE ARTS; 12 - NORTHEASTERN UNIVERSITY; 13 - R.M. BRADLEY; 14 - GILBERT SMALL & CO.; 15 - BOSTON WATER & SEWER; 16 - BRIGHAM & WOMAN'S HOSPITAL

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|---|---|---|---|---|---|---|---|---|---|
| 2110985 | 88-9 | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 10.30 | 7.60 | 17.90 | 0.00 |
| 2111252 | I106 | 12 | BACK BAY | ON MASSACHUSETTS AVE | | | | | |
| 2111256 | I104A | 12 | BACK BAY | 353 MASSACHUSETTS AVE | | | | | |
| 2111563 | 88-8 | 12 | FENWAY | ON FORSYTH STREET | 10/23/89 | 12.70 | 4.50 | 17.20 | 0.00 |
| 2111584 | 88-10 | 12 | FENWAY | ON HEMENWAY STREET | 10/23/89 | 11.90 | 5.80 | 17.70 | 0.00 |
| 2111587 | 88-10A | 12 | FENWAY | ON HEMENWAY STREET | 10/23/89 | 9.30 | 8.30 | 17.60 | 0.00 |
| 2111598 | 88-12 | 12 | FENWAY | ON FORSYTH STREET | 10/23/89 | 12.60 | 4.90 | 17.50 | 0.00 |
| 2111643 | 88-11 | 12 | FENWAY | ON ST. STEPHEN STREET | 10/23/89 | 12.50 | 4.80 | 17.30 | 0.00 |
| 2111646 | 88-11A | 12 | FENWAY | ON ST. STEPHEN STREET | 10/23/89 | 12.80 | 4.70 | 17.50 | 0.00 |
| 2111666 | 88-13 | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 10.00 | 7.30 | 17.30 | 0.00 |
| 2111747 | 88-13A | 12 | FENWAY | HUNTINGTON & OPERA PL. | 10/23/89 | 13.00 | 4.30 | 17.30 | 0.00 |
| 2111863 | 88-23 | 12 | BACK BAY | ON GAINSBOROUGH STREET | 10/23/89 | 9.60 | 6.60 | 16.20 | 0.00 |
| 2111875 | 88-22 | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 0.00 | 17.70 | 17.70 | 0.00 |
| 2111878 | 88-22A | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 13.60 | 4.10 | 17.70 | 0.00 |
| 2111979 | T1840 | 12 | BACK BAY | ON GAINSBOROUGH STREET | | | | | |
| 2112243 | 88-15 | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 13.30 | 4.60 | 17.90 | 0.00 |
| 2112275 | 88-14 | 12 | BACK BAY | NORTHEASTERN UNIV. | 10/23/89 | 9.70 | 8.00 | 17.70 | 0.00 |
| 2112439 | 88-21 | 12 | FENWAY | NORTHEASTERN UNIV. | 10/23/89 | 7.60 | 5.70 | 13.30 | 0.00 |
| 2112472 | 88-27 | 12 | FENWAY | NORTHEASTERN UNIV. | | | | | |
| 2112473 | 89-29 | 12 | FENWAY | NORTHEASTERN UNIV. | | | | | |
| 2112592 | 88-25 | 12 | BACK BAY | WILLIAM E. CARTER | 10/23/89 | 9.40 | 6.30 | 15.70 | 0.00 |
| 21J0298 | V-34 | 1 | BACK BAY | 176 WEST BROOKLINE ST. | 08/10/89 | 11.60 | 6.10 | 17.70 | 14.70 |
| 22H0146 | | 5 | BACK BAY | COMM. AVE & CUMMINGTON ST | 08/10/89 | 16.40 | 0.00 | 0.00 | 19.00 |
| 22H0841 | B-3 | 6 | BACK BAY | 509 PARK DRIVE | 08/09/89 | 12.00 | 0.00 | 0.00 | 17.60 |
| 22H1096 | BB-1 | 6 | FENWAY | RR TRACKS & BROKLINE AVE. | 08/10/89 | 9.80 | 3.70 | 13.50 | 15.00 |
| 22H1098 | BB-3 | 6 | FENWAY | RR TRACK & BROOKLINE AVE | 08/10/89 | 8.00 | 0.00 | 5.00 | 14.50 |
| 22H1527 | | 3 | BACK BAY | 879 BEACON ST. | 08/10/89 | 12.00 | 0.00 | 0.00 | 13.00 |
| 2210546 | II-W-44 | 1 | BACK BAY | 290 NEWBURY ST | 08/08/89 | 11.10 | 0.00 | 7.20 | 12.90 |
| 2210566 | II-W-B-2 | 1 | BACK BAY | ALLEY 442 274 NEWBURY ST | 08/08/89 | 7.80 | 7.10 | 14.90 | 18.80 |
| 2210754 | NE7 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2210756 | NE11 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2210766 | FE19 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2210767 | FE12 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2210768 | FE16 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |

* DATA SOURCE: 1 - H&A GROUNDWATER BACK BAY; 2 - CHRISTIAN SCIENCE CENTER; 3 - USGS HYDROLOGIC ATLAS-513; 4 - MASS TURNPIKE AUTHORITY; 5 - IDENTIFIED BY STONE & WEBSTER; 6 - QAZILBASH; 7 - GEO. ENG. INC.; 8 - URBAN ENGINEERING; 9 - BRA; 10 - ZINER & ROSSETTI INC; 11 - MUSEAUM OF FINE ARTS; 12 - NORTHEASTERN UNIVERSITY; 13 - R.M. BRADLEY; 14 - GILBERT SMALL & CO.; 15 - BOSTON WATER & SEWER; 16 - BRIGHAM & WOMAN'S HOSPITAL

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|---|---|---|---|---|---|---|---|---|---|
| 2210793 | FE20 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2210794 | FE13 | 13 | BACK BAY | PRUDENTAL CENTER | | | | | |
| 2210796 | FE17 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211227 | NC2 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211238 | NE1 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211239 | NE3 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211278 | III-W-10 | 1 | BACK BAY | DALTON & SCOTIA ST | 08/08/89 | 18.70 | 0.00 | 0.00 | 24.80 |
| 2211326 | NE5 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211364 | SE2 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211383 | SC2 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211398 | SE11 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211421 | NE10 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211423 | FE14 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211443 | SE5 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211444 | SE4 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211456 | SE6 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211663 | | 3 | FENWAY | ON HAVILAND ST. | 08/08/89 | 11.90 | 0.00 | 0.00 | 28.90 |
| 2211878 | III-W-13 | 1 | BACK BAY | 4-6 CLEARWAY ST. | 08/08/89 | 13.00 | 4.30 | 17.30 | 17.50 |
| 2211923 | N2 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2211953 | N1 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2212033 | SC5 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2212068 | SC4 | 13 | BACK BAY | PRUDENTIAL CENTER | | | | | |
| 2212077 | PT3 | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 1.45 | 5.81 | 7.26 | 0.00 |
| 2212513 | MASSAVE#3 | 1 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 9.05 | 8.59 | 17.64 | 0.00 |
| 2212561 | CSPS#10 | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 2.70 | 5.75 | 8.45 | 0.00 |
| 2212599 | ST.PAUL#5 | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 10.10 | 7.77 | 17.87 | 0.00 |
| 2212615A | CLWAY#2 | 2 | BACK BAY | 48 CLEARWAY ST | 08/14/89 | 12.05 | 5.76 | 17.81 | 0.00 |
| 2212648 | TP#3 | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 4.45 | 5.29 | 9.74 | 0.00 |
| 2212657 | TP#1(9) | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 3.10 | 5.36 | 8.46 | 0.00 |
| 2212659A | CH#8 | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 5.30 | 4.92 | 10.22 | 0.00 |
| 2212659B | CH#8A | 1 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 4.45 | 5.74 | 10.19 | 0.00 |
| 2212669 | PT5 | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 0.80 | 6.51 | 7.31 | 0.00 |
| 2212677A | TP#4 | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 5.10 | 5.59 | 10.69 | 0.00 |
| 2212677B | PT1 | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 1.30 | 6.08 | 7.38 | 0.00 |

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TABLE 2
FUNCTIONING OBSERVATION WELL SUMMARY

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|---|---|---|---|---|---|---|---|---|---|
| 2212678 | TP#2 | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 5.00 | 5.65 | 10.65 | 0.00 |
| 2212724 | PT6 | 2 | BACK BAY | CHRISTIAN SCIENCE CENTER | 08/14/89 | 2.05 | 5.14 | 7.19 | 0.00 |
| 2212834A | III-W-B-4 | 2 | BACK BAY | FOLLEN & ST BOTOLPH ST | 07/06/89 | 17.00 | 0.20 | 17.20 | 17.00 |
| 22J0294A | III-E-H-1 | 1 | BACK BAY | DARTMOUTH & STUART ST. | 11/21/89 | 16.50 | 0.80 | 17.30 | 24.30 |
| 22J0365 | III-E-28 | 1 | BACK BAY | STUART & CLARENDON ST. | 07/13/89 | 13.10 | 3.50 | 16.60 | 15.50 |
| 22J0433 | III-E-B-12 | 1 | BACK BAY | 350 STUART ST | 07/12/89 | 15.80 | 4.00 | 19.80 | 18.80 |
| 22J0582 | | 5 | SOUTH END | 36 ISABELLA ST. | 11/21/89 | 15.50 | 0.00 | 0.00 | 19.00 |
| 22J0596 | III-E-36 | 1 | BACK BAY | 21 CORTES ST | 07/12/89 | 15.70 | 3.70 | 19.40 | 18.60 |
| 22J0674 | III-E-A-5 | 1 | BACK BAY | 19 CORTES ST. | 11/21/89 | 15.00 | 3.00 | 18.00 | 17.40 |
| 22J0928 | OW | 8 | BACK BAY | COPLEY PLACE | | | | | |
| 22J1195 | | 5 | SOUTH END | 2 CAZENOVE ST. | 08/04/89 | 13.40 | 0.00 | 0.00 | 14.30 |
| 22J1272 | V-16 | 1 | SOUTH END | 3 ST CHARLES ST | 07/13/89 | 13.60 | 0.00 | 0.00 | 21.00 |
| 22J1278 | | 5 | SOUTH END | CHANDLER & ST CHARLES ST | 07/13/89 | 13.00 | 0.00 | 0.00 | 19.80 |
| 22J1286 | | 5 | SOUTH END | 76 BERKELEY ST | 08/03/89 | 14.70 | 0.00 | 0.00 | 21.40 |
| 22J1349 | IV-3 | 1 | SOUTH END | CHANDLER ST | 07/12/89 | 16.90 | 1.00 | 17.90 | 20.90 |
| 22J1691 | V-11 | 1 | BACK BAY | 8 YARMOUTH ST | 07/13/89 | 11.70 | 6.40 | 18.10 | 19.60 |
| 22J1763 | V-14 | 1 | SOUTH END | ACROSS 132 CHANDLER ST | 07/13/89 | 11.30 | 0.00 | 0.00 | 15.00 |
| 22J1996 | V-43 | 1 | BACK BAY | 13 WARREN ST | 07/12/89 | 13.00 | 4.20 | 17.20 | 15.20 |
| 22J2047 | IV-5 | 1 | BACK BAY | 41 BERKELEY ST | 08/02/89 | 12.80 | 0.00 | 0.00 | 14.70 |
| 22K0888 | OW-9 | 4 | SOUTH END | HEARLD ST & SHAWMUT AVE | 08/07/89 | 13.00 | 0.00 | 0.00 | 14.70 |
| 22K1615 | OW11 | 4 | SOUTH END | ON WASHINGTON ST. | 08/07/89 | 19.70 | 0.00 | 0.00 | 11.30 |
| 22K1689 | OW14 | 4 | SOUTH END | HARRISON & W.M. MULLINS W | 08/07/89 | 7.40 | 0.00 | 0.00 | 17.40 |
| 23H2691 | | 3 | BACK BAY | 86 BAYSTATE RD. | 08/07/89 | 10.80 | 0.00 | 0.00 | 17.10 |
| 2312044 | II-W-22 | 1 | BACK BAY | MARLBOROUGH ST | 08/04/89 | 11.00 | 6.10 | 17.10 | 13.10 |
| 2312189 | II-W-37 | 1 | BACK BAY | 496 COMM AVE | 08/04/89 | 9.80 | 0.00 | 0.00 | 14.90 |
| 2312743 | II-W-36 | 1 | BACK BAY | 246 COMM AVE | 08/04/89 | 10.00 | 0.00 | 0.00 | 15.80 |
| 2312849 | II-W-46 | 1 | BACK BAY | 201 NEWBURY ST | 08/04/89 | 11.10 | 6.80 | 17.90 | 23.40 |
| 2312887 | II-W-51 | 1 | BACK BAY | 220 NEWBURY ST ALLEY 441 | 08/04/89 | 6.00 | 7.70 | 13.70 | 14.80 |
| 23J0172 | II-W-8A | 1 | BACK BAY | DARTMOUTH ST | 07/07/89 | 8.10 | 4.80 | 12.90 | 13.00 |
| 23J0254 | II-E-3 | 1 | BACK BAY | CLARENDON ST | 07/07/89 | 8.00 | 7.00 | 15.00 | 14.30 |
| 23J1171 | II-E-18 | 1 | BACK BAY | 50 COMM AVE | 07/14/89 | 10.00 | 0.00 | 0.00 | 16.00 |
| 23J1633 | II-E-17 | 1 | BACK BAY | COMM AVE & CLARENDON ST | 07/14/89 | 9.30 | 0.00 | 0.00 | 19.00 |
| 23J1674 | II-E-23 | 1 | BACK BAY | 277 DARTMOUTH ST | 06/05/89 | 10.00 | 6.20 | 16.20 | 14.80 |
| 23J1771 | II-E-24 | 1 | BACK BAY | 108 NEWBURY ST | 08/04/89 | 10.40 | 7.10 | 17.50 | 17.00 |

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|---|---|---|---|---|---|---|---|---|---|
| 23J1787 | II-E-29 | 1 | BACK BAY | CLARENDON ST | 06/05/89 | 10.00 | 0.00 | 0.00 | 17.00 |
| 23J1796 | | 5 | BACK BAY | ACROSS 494 BOYLSTON ST. | 08/15/89 | 10.00 | 0.00 | 0.00 | 19.60 |
| 23J1819 | II-E-A-2 | 1 | BACK BAY | NEWBURY & BERKELEY ST | 06/05/89 | 10.00 | 7.60 | 17.60 | 17.10 |
| 23J1838 | II-E-A-1 | 1 | BACK BAY | ALLEY 438 | 06/05/89 | 7.80 | 0.00 | 0.00 | 19.60 |
| 23J1946 | III-E-3 | 1 | BACK BAY | NEAR 376 BOYLSTON ST | 08/15/89 | 12.90 | 5.90 | 18.80 | 19.70 |
| 23J1947 | | 5 | BACK BAY | 396 BOYLSTON ST. | 08/15/89 | 12.00 | 0.00 | 0.00 | 19.00 |
| 23J1965 | III-E-B-6 | 1 | BACK BAY | ARLINGTON ST | 07/13/89 | 9.60 | 7.50 | 17.10 | 19.70 |
| 23J1999 | | 5 | BACK BAY | ST. JAMES & ARLINGTON ST | 08/18/89 | 12.00 | 0.00 | 0.00 | 19.50 |
| 23J2037 | III-E-C-14 | 1 | BACK BAY | HADASSAH WAY | 07/13/89 | 9.30 | 5.00 | 14.30 | 15.50 |
| 23J2343A | II-E-28 | 1 | BACK BAY | BOYLSTON & DARTMOUTH ST | 06/05/89 | 11.00 | 0.00 | 0.00 | 13.00 |
| 23J2343B | II-E-A-3 | 1 | BACK BAY | BOYLSTON & DARTMOUTH ST | 06/05/89 | 11.00 | 6.10 | 17.10 | 18.10 |
| 23J2419 | III-E-I-1 | 1 | BACK BAY | BOYLSTON ST | 07/14/89 | 10.00 | 8.08 | 18.08 | 13.80 |
| 23J2421 | II-E-A-4 | 1 | BACK BAY | CLARENDON & BOYLSTON ST | 06/05/89 | 10.00 | 7.50 | 17.50 | 22.50 |
| 23J2443 | III-E-I-8 | 1 | BACK BAY | ACROSS 545 BOYLSTON ST | 07/14/89 | 10.10 | 0.00 | 0.00 | 17.80 |
| 23J2455 | III-E-B-5 | 1 | BACK BAY | CLARENDON ST | 07/14/89 | 0.00 | 17.40 | 17.40 | 16.00 |
| 23J2471 | | 5 | BACK BAY | IN FRONT OF TRINITY CHUR. | 08/15/89 | 10.10 | 7.37 | 17.47 | 16.80 |
| 23J2472 | III-E-I-4 | 1 | BACK BAY | ST JAMES AVE | 07/14/89 | 11.00 | 7.14 | 18.14 | 18.30 |
| 23J2481A | III-E-I-2 | 1 | BACK BAY | ST JAMES AVE | 07/14/89 | 10.00 | 7.73 | 17.73 | 18.90 |
| 23J2492 | III-E-11 | 1 | BACK BAY | ST JAMES AVE | 07/14/89 | 12.80 | 0.00 | 0.00 | 18.50 |
| 23J2529 | III-E-B-4 | 1 | BACK BAY | ST JAMES AVE & BERKLEY | 07/14/89 | 14.00 | 4.60 | 18.60 | 19.30 |
| 23J2561A | III-E-14 | 1 | BACK BAY | BERKELEY ST | 07/14/89 | 13.70 | 0.00 | 0.00 | 14.30 |
| 23J2616 | | 1 | BACK BAY | ACROSS 35 ST. JAMES AVE. | 08/15/89 | 12.70 | 0.00 | 0.00 | 19.90 |
| 23J2621 | | 1 | BACK BAY | 31 ST. JAMES AVE | 08/15/89 | 13.10 | 0.00 | 0.00 | 17.90 |
| 23J2745 | | 5 | BACK BAY | STUART & ARLINGTON ST. | 08/15/89 | 12.10 | 0.00 | 0.00 | 19.90 |
| 23K1478 | | 5 | CHINATOWN | SUMMER ST & ATLANTIC AVE | 11/21/89 | 13.80 | 0.00 | 0.00 | 18.20 |
| 23K2044 | | 3 | CHINATOWN | ACROSS 107 SOUTH ST. | 07/24/89 | 7.90 | 0.00 | 0.00 | 20.00 |
| 23K2082 | | 3 | CHINATOWN | EAST ST & ATLANTIC AVE | 08/21/89 | 8.90 | 0.00 | 0.00 | 0.00 |
| 23K2085 | | 5 | CHINATOWN | 711 ATLANTIC AVE | 11/21/89 | 9.60 | 0.00 | 0.00 | 26.10 |
| 23K2721 | | 5 | CHINATOWN | 729 ATLANTIC AVE | 11/30/89 | 11.50 | 0.00 | 0.00 | 29.90 |
| 23K2772 | | 5 | CHINATOWN | ON ATLANTIC AVE | 11/30/89 | 9.00 | 0.00 | 0.00 | 30.00 |
| 23K2775B | | 5 | CHINATOWN | ON KNEELAND ST. | 11/30/89 | 9.80 | 0.00 | 0.00 | 14.10 |
| 24J0516 | | 5 | LOWER BEACON HILL | 22 EMBANKMENT ROAD | 08/15/89 | 9.70 | 0.00 | 0.00 | 17.30 |
| 24J1126 | OW-D | 15 | LOWER BEACON HILL | ALONG CHARLES RIVER | | | | | |
| 24J1214 | I-B-2 | 1 | LOWER BEACON HILL | PINCKNEY ST | 06/02/89 | 10.50 | 3.70 | 14.20 | 19.00 |

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|---|---|---|---|---|---|---|---|---|---|
| 24J1237 | I-B-1 | 1 | LOWER BEACON HILL | ACROSS 127 PINCKNEY ST | 07/24/89 | 13.40 | 4.60 | 18.00 | 16.30 |
| 24J1238 | | 5 | LOWER BEACON HILL | PINCKNEY ST | 08/15/89 | 12.90 | 0.00 | 0.00 | 20.00 |
| 24J1278 | | 5 | LOWER BEACON HILL | 30 BRIMMER ST | 08/15/89 | 11.40 | 0.00 | 0.00 | 14.20 |
| 24J1279 | PIPE 2 | 14 | LOWER BEACON HILL | CHURCH OF THE ADVENT | | | | | |
| 24J1284 | I-A-3 | | LOWER BEACON HILL | CHURCH OF THE ADVENT | 06/02/89 | 10.10 | 9.90 | 20.00 | 16.10 |
| 24J1287 | PIPE 1 | 14 | LOWER BEACON HILL | CHURCH OF THE ADVENT | | | | | |
| 24J1813 | OW-B | 15 | LOWER BEACON HILL | ALONG CHARLES RIVER | | | | | |
| 24J1825 | OW-C | 15 | LOWER BEACON HILL | ALONG CHARLES RIVER | | | | | |
| 24J1838 | I-B-3 | 1 | LOWER BEACON HILL | MT VERNON ST | 06/02/89 | 10.50 | 3.80 | 14.30 | 19.00 |
| 24J1912 | I-A-4 | 1 | LOWER BEACON HILL | MT VERNON & BRIMMER ST | 07/11/89 | 11.10 | 8.90 | 20.00 | 18.50 |
| 24J1913 | PIPE 3 | 14 | LOWER BEACON HILL | CHURCH OF THE ADVENT | 07/02/89 | 0.00 | 0.00 | 0.00 | 0.00 |
| 24J1921 | PIPE 4 | 14 | LOWER BEACON HILL | CHURCH OF THE ADVENT | 07/02/89 | 0.00 | 0.00 | 0.00 | 0.00 |
| 24J1923 | OW-10 | 15 | LOWER BEACON HILL | CHARLES & MT. VERNON ST | | | | | |
| 24J1979 | | 5 | LOWER BEACON HILL | 69 BRIMMER ST | 08/15/89 | 8.60 | 0.00 | 0.00 | 18.00 |
| 24J2088 | I-1 | 1 | LOWER BEACON HILL | 7 CHARLES ST | 07/24/89 | 10.50 | 6.41 | 16.91 | 11.70 |
| 24J2513 | OW-A | 15 | LOWER BEACON HILL | ALONG CHARLES RIVER | | | | | |
| 24J2529 | I-B-4 | 1 | LOWER BEACON HILL | BEAVER PLACE | 06/02/89 | 13.10 | 2.00 | 15.10 | 14.30 |
| 24J2651 | OW-5 | 15 | LOWER BEACON HILL | BRIMMER & BEACON ST | | | | | |
| 24J2721 | OW-6 | 15 | LOWER BEACON HILL | 4 CHARLES ST | | | | | |

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|---|---|---|---|---|---|---|---|
| 19I0688 | | 3 | BACK BAY | | NO | 07/25/89 | |
| 19I1343 | | 3 | BACK BAY | | NO | 07/25/89 | |
| 19J0291 | | 3 | BACK BAY | | NO | 08/01/89 | |
| 20G0583 | | 7 | SOUTH END | | NO | 08/18/89 | |
| 20G0591 | | 7 | SOUTH END | | NO | 08/18/89 | |
| 20G0596 | | | SOUTH END | | NO | 08/18/89 | |
| 20G0626 | | 7 | SOUTH END | | NO | 08/18/89 | |
| 20G1986 | | 7 | SOUTH END | | NO | 12/27/89 | |
| 20G2064 | | | SOUTH END | 58 FENWOOD ST | YES | 11/21/89 | WATER SERVICE |
| 20G2068 | | | SOUTH END | 56 FENWOOD ST | YES | 11/21/89 | WATER SERVICE |
| 20G2079 | | 7 | SOUTH END | | NO | 08/18/89 | |
| 20G2098 | | | SOUTH END | 20 KEMPTON ST | YES | 12/26/89 | WATER SERVICE |
| 20G2619 | | 7 | SOUTH END | | NO | 12/26/89 | |
| 20G2647 | | 7 | SOUTH END | | NO | 08/18/89 | |
| 20G2686 | | | SOUTH END | 56 WHITNEY ST | YES | 12/27/89 | CANNOT OPEN |
| 20G2687 | | 7 | SOUTH END | | NO | 08/18/89 | |
| 20G2727 | | 7 | SOUTH END | 9 KEMPTON ST | YES | 12/27/89 | CANNOT OPEN |
| 20H0527 | | 3 | SOUTH END | | NO | 07/31/89 | |
| 20H0565 | | | SOUTH END | | NO | 07/31/89 | |
| 20H0853 | | 7 | SOUTH END | | NO | 08/18/89 | |
| 20H0855 | | 7 | SOUTH END | | NO | 08/18/89 | |
| 20H0858 | | 7 | SOUTH END | | NO | 08/18/89 | |
| 20I0111 | | | SOUTH END | | NO | 07/25/89 | |
| 20I0132 | | 3 | SOUTH END | | NO | 07/25/89 | |
| 20I0151 | | 3 | SOUTH END | ON FIELD ST. | YES | 07/25/89 | PLUGGED |
| 20I2058 | | 3 | SOUTH END | | NO | 07/25/89 | |
| 20I2133 | | 3 | SOUTH END | 31 LENOX ST. | YES | 07/25/89 | PLUGGED APPROXIMATELY 5 F DOWN WELL |
| 20I2336 | | 3 | SOUTH END | | NO | 07/25/89 | |
| 20I2732 | | 3 | SOUTH END | | NO | 07/25/89 | |
| 20J0154 | V-61 | 1 | BACK BAY | 563 MASS AVE | YES | 08/14/89 | PLUGGED |
| 20J0223 | V-57 | 1 | BACK BAY | WORCESTER ST | YES | 08/14/89 | PLUGGED |
| 20J0243 | V-56 | 1 | BACK BAY | | NO | 07/11/89 | |
| 20J0328 | V-60 | 1 | BACK BAY | | NO | 07/11/89 | |
| 20J0898 | | 3 | SOUTH END | 1819 WASHINGTON ST. | YES | 08/14/89 | PLUGGED |
| 20J1692 | | 3 | SOUTH END | | NO | 08/01/89 | |
| 20J1755 | | 3 | SOUTH END | ON HARRISON AVE. | YES | 08/14/89 | PLUGGED |
| 20J2355 | | 5 | SOUTH END | MASS AVE & HARR.AVE | YES | 08/14/89 | PLUGGED |
| 20J2433 | | 3 | SOUTH END | | NO | 08/14/89 | |
| 21G2683 | | 3 | FENWAY | | NO | 07/31/89 | |
| 21G2786 | | 7 | FENWAY | | NO | 08/18/89 | |
| 21G2798 | | 7 | FENWAY | BROOKLINE AVE. | YES | 12/27/89 | WATER SERVICE |
| 21H0379 | | 3 | FENWAY | | NO | 07/31/89 | |
| 21H0586 | | 3 | FENWAY | 112 JERSEY ST. | YES | 08/10/89 | PLUGGED APPROXIMATELY 5 F DOWN |
| 21H0998 | | 3 | FENWAY | ON THE FENWAY (RIVERWAY) | YES | 07/31/89 | CANNOT OPEN |
| 21H1058 | | 3 | FENWAY | ON QUEENSBERRY ST. | YES | 08/10/89 | PLUGGED |
| 21H2213 | | 7 | FENWAY | | NO | 08/18/89 | |
| 21H2239 | | 7 | FENWAY | | NO | 08/18/89 | |

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|---|---|---|---|---|---|---|---|
| 21H2253 | | 7 | FENWAY | PARKING LOT @ BETH ISRAEL | YES | 08/18/89 | CANNOT OPEN |
| 21H2433 | | 3 | FENWAY | | NO | 08/18/89 | |
| 21H2582 | | 3 | FENWAY | | YES | 08/10/89 | WATER SERVICE |
| 2110463 | III-W-D-1 | 1 | BACK BAY | FALMOUTH ST | YES | 08/11/89 | WATER SERVICE |
| 2110572 | III-W-D-2 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2110589 | III-W-31 | 1 | BACK BAY | | NO | 07/07/89 | ALLEY HAS BITUMINOUS CONCRETE OVERLAY |
| 2110644 | III-W-32 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2110673A | III-W-B-7 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2110673B | III-W-B-7A | 1 | BACK BAY | | NO | 07/07/89 | NEW SIDEWALKS IN AREA |
| 2110697 | III-W-39 | 1 | BACK BAY | | NO | 07/07/89 | PARK AREA BUILT AT THE END OF THE STREET |
| 2110698 | V-A-1 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2110721 | III-W-41 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2110727 | III-W-B-5 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2110744 | III-W-40 | 1 | BACK BAY | 30 CUMBERLAND ST | YES | 08/11/89 | CANNOT OPEN |
| 2110748 | V-3 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2110762 | V-7 | 1 | BACK BAY | 213 WEST NEWTON ST | YES | 08/11/89 | WATER SERVICE |
| 2110767A | V-A-8 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2110767B | V-A-8A | 1 | BACK BAY | | NO | 07/07/89 | |
| 2110816 | | 3 | SOUTH END | | NO | 07/25/89 | |
| 2111245 | | 3 | SOUTH END | | NO | 07/25/89 | |
| 2111256A | III-W-B-8 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2111256B | III-W-B-8A | 1 | BACK BAY | | NO | 07/07/89 | |
| 2111277 | | 3 | SOUTH END | 238 ST. BOLOTPH ST. | YES | 08/11/89 | PLUGGED |
| 2111292 | III-W-B-9 | 1 | BACK BAY | 363 MASS AVE | YES | 08/11/89 | WATER SERVICE |
| 2111331 | V-A-11 | 1 | BACK BAY | | NO | 07/07/89 | NEW SIDEWALKS IN THE AREA |
| 2111331A | III-W-B-10 | 1 | BACK BAY | | NO | 07/13/89 | |
| 2111331B | III-W-B-10A | 1 | BACK BAY | | NO | 07/07/89 | |
| 2111332 | V-2 | 1 | BACK BAY | | NO | 07/07/89 | NEW SIDEWALKS IN THE AREA |
| 2111355 | V-1 | 1 | BACK BAY | | NO | 08/11/89 | |
| 2111438 | V-20 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2111442A | V-A-9 | 1 | BACK BAY | 16 CLAREMONT PARK | YES | 08/11/89 | CANNOT OPEN |
| 2111442B | V-A-9A | 1 | BACK BAY | 16 CLAREMONT PARK | YES | 08/11/89 | PLUGGED |
| 2111454 | V-6 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2111477 | V-5 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2111497 | V-19 | 1 | BACK BAY | NEAR 156 WORCESTER ST | YES | 08/11/89 | WATER SERVICE |
| 2111538 | | 3 | FENWAY | FORSYTH & HEMENWAY ST | YES | 08/11/89 | CANNOT TEST STAND PIPE TO SMALL |
| 2111547 | | 3 | FENWAY | | NO | 07/25/89 | |
| 2111596 | | 3 | FENWAY | ON FORSYTH ST | YES | 08/11/89 | PLUGGED |
| 2111635 | | 3 | FENWAY | ST. STEPHEN & SPEAR ST | YES | 08/11/89 | PLUGGED |
| 2111856 | | 3 | FENWAY | 288 ST. BOTOLPH ST. | YES | 08/11/89 | FAILED TEST |
| 2112024A | V-A-10 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2112024B | V-A-10A | 1 | BACK BAY | | NO | 07/07/89 | |
| 2112064 | | 3 | SOUTH END | | NO | 08/11/89 | |
| 2112119 | V-18 | 1 | BACK BAY | | NO | 08/21/89 | |
| 2112144 | V-17 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2112837 | T-2 | 9 | BACK BAY | | NO | 08/21/89 | |

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NON FUNCTIONING OBSERVATION WELL SUMMARY

| S&W NO. | PREVIOUS NO. | (*) DATA SOURCE | NEIGHBORHOOD | LOCATION | FOUND (YES/NO) | TEST DATE | COMMENTS |
|---|---|---|---|---|---|---|---|
| 21I2865 | V-28 | 1 | BACK BAY | MASS AVE & TREMONT ST | YES | 08/11/89 | PLUGGED |
| 21J0158 | V-21 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALKS IN THE AREA |
| 21J0174 | V-8 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALKS IN THE AREA |
| 21J0229 | V-23 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALKS IN THE AREA |
| 21J0243 | V-22 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J0315 | V-24 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALK IN THE AREA |
| 21J0339 | V-36 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALK IN THE AREA |
| 21J0357 | V-35 | 1 | SOUTH END | MONTGOMERY ST $ W.CANTON | YES | 08/11/89 | PLUGGED |
| 21J0431 | V-51 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J0474 | V-50 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J0699 | V-68 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J0864 | V-62 | 1 | SOUTH END | | NO | 08/21/89 | |
| 21J0865 | V-31 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J0929 | V-33 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J0942 | V-32 | 1 | SOUTH END | 142 WEST NEWTON ST. | YES | 08/10/89 | PLUGGED |
| 21J1011 | V-48 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J1038 | V-49 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALKS IN THE AREA |
| 21J1055 | V-47 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J1193 | V-55 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALKS IN THE AREA |
| 21J1376 | V-67 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J1522 | V-30 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J1549 | V-29 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALKS IN THE AREA |
| 21J1569 | V-45 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALKS IN THE AREA |
| 21J1631 | V-46 | 1 | SOUTH END | TREMONT & W. NEWTON ST. | YES | 08/10/89 | PLUGGED |
| 21J1733 | V-54 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALKS IN THE AREA |
| 21J2257 | V-44 | 1 | SOUTH END | | NO | 07/06/89 | |
| 21J2364 | V-53 | 1 | SOUTH END | | NO | 08/21/89 | |
| 21J2435 | V-59 | 1 | SOUTH END | 435 SHAWMUT AVE. | YES | 08/11/89 | WATER SERVICE |
| 21J2451 | V-58 | 1 | SOUTH END | | NO | 07/06/89 | NEW SIDEWALKS IN THE AREA |
| 21K0196 | | 3 | SOUTH END | 434 HARRASION AVE | YES | 07/31/89 | PLUGGED |
| 21K0372 | | 3 | SOUTH END | | NO | 07/31/89 | |
| 21K0879 | | 3 | SOUTH END | AT L.J. ROTCH PLAYGROUND | YES | 10/21/89 | PLUGGED |
| 21K1634 | | 3 | SOUTH END | ALBANY ST & RANDOLPH ST | YES | 10/21/89 | FAILED TEST |
| 22H0145 | | 3 | BACK BAY | CUMMINGTON & COMM. AVE | YES | 08/09/89 | PLUGGED |
| 22H0257 | | 3 | FENWAY | | NO | 07/31/89 | |
| 22H0353 | | 3 | BACK BAY | COMM. AVE & BLANSFORD ST | YES | 08/08/89 | FAILED TEST |
| 22H0767 | | 3 | FENWAY | COMM. AVE & W.CHARLESGATE | YES | 08/08/89 | WATER SERVICE |
| 22H0812 | B-1 | | BACK BAY | | NO | 08/09/89 | |
| 22H0845 | | 3 | BACK BAY | | NO | 07/31/89 | |
| 22H1094 | BB-4 | | FENWAY | RR TRACKS & BROOKLINE AVE | NO | 08/10/89 | |
| 22H1395 | | 3 | FENWAY | IPSWICH & LANSDOWNE ST. | YES | 08/10/89 | PLUGGED |
| 22H1455 | | 3 | FENWAY | 120 IPSWICH ST. | YES | 08/10/89 | PLUGGED |
| 22H1616 | | 3 | FENWAY | | NO | 07/31/89 | |
| 22H1827 | | 3 | FENWAY | 78 BROOKLINE AVE | YES | 08/10/89 | CANNOT OPEN |
| 22H1847 | | 3 | FENWAY | | NO | 07/31/89 | |
| 22H1892 | | 3 | FENWAY | ACROSS 27 YAWKEY WAY | YES | 08/10/89 | PLUGGED |
| 22H2124 | | 3 | FENWAY | 1191 BOYLSTON ST. | YES | 08/10/89 | FAILED TEST |
| 22H2212 | | 3 | FENWAY | | NO | 07/31/89 | |
| 22H2788 | | 3 | FENWAY | ACROSS 1 PETERBOROUGH ST. | YES | 08/10/89 | PLUGGED APPROXIMATELY 5 FT |

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|---|---|---|---|---|---|---|---|
| | | | | | | | DOWN |
| 2210216 | | 3 | FENWAY | 387 COMMONWEALTH AVE. | YES | 08/08/89 | PLUGGED |
| 2210312 | II-W-30 | 1 | BACK BAY | COMM AVE | YES | 08/08/89 | PLUGGED |
| 2210346 | II-W-34 | 1 | BACK BAY | COMM AVE | YES | 08/08/89 | CANNOT TEST - STANDPIPE BENT |
| 2210421 | II-W-35 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2210436 | II-W-39 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2210444 | II-W-38 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2210477 | II-W-43 | 1 | BACK BAY | 338 NEWBURY ST | YES | 08/08/89 | PLUGGED |
| 2210573 | II-W-50 | 1 | BACK BAY | ALLEY 443 927 BOYLSTON ST | YES | 08/08/89 | CANNOT OPEN |
| 2210592 | II-W-53 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2210598 | III-W-F-22 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2210612 | II-W-45 | 1 | BACK BAY | 262 NEWBURY ST | YES | 08/08/89 | PLUGGED |
| 2210649 | II-W-B-1 | 1 | BACK BAY | 829 BOYLSTON ST | YES | 08/08/89 | WATER SERVICE |
| 2210661 | II-W-54 | 1 | BACK BAY | FAIRFIELD ST | YES | 08/08/89 | FAILED TEST |
| 2210667 | III-W-2 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2210676 | III-W-F-23 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2210691 | III-W-F-5 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2210698 | III-W-F-24 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2210734 | III-W-3 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2210735 | III-W-4 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2210736 | III-W-H-1 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2210755 | III-W-F-27 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2210774 | III-W-F-25 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2210859 | | 3 | BACK BAY | IPSWICH & BOYLSTON ST | YES | 08/08/89 | FAILED TEST |
| 2210877 | | 3 | BACK BAY | | NO | 08/18/89 | |
| 2211113 | II-W-48 | 1 | BACK BAY | | NO | 07/07/89 | |
| 2211139 | III-W-F-4 | 1 | BACK BAY | | NO | 08/18/89 | IN PRUDENTIAL AREA |
| 2211184 | III-W-9 | 1 | BACK BAY | SCOTIA ST | YES | 08/08/89 | PLUGGED |
| 2211211 | II-W-49 | 1 | BACK BAY | BOYLSTON ST | YES | 08/08/89 | FAILED TEST |
| 2211216 | III-W-1 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2211218 | III-W-C-1 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2211288 | III-W-F-13 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2211295 | III-W-F-6 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2211436 | III-W-F-28 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2211479 | III-W-F-21 | 1 | BACK BAY | | NO | 08/18/89 | |
| 2211736 | III-W-8 | 1 | BACK BAY | | NO | 07/06/89 | |
| 2211913 | III-W-F-8 | 1 | BACK BAY | | NO | 07/25/89 | |
| 2211932 | III-W-F-15 | 1 | BACK BAY | | NO | 07/25/89 | |
| 2211942 | III-W-14 | 1 | BACK BAY | BELVIDERE ST | YES | 08/18/89 | PLUGGED |
| 2211952 | III-W-F-12 | 1 | BACK BAY | BELVIDERE & DALTON ST | YES | 08/18/89 | CANNOT OPEN |
| 2211965 | III-W-F-14 | 1 | BACK BAY | | NO | 07/06/89 | |
| 2211966 | III-W-F-10 | 1 | BACK BAY | | NO | 07/06/89 | |
| 2212034 | III-W-F-17 | 1 | BACK BAY | | NO | 07/06/89 | |
| 2212057 | III-W-18 | 1 | BACK BAY | | NO | 07/06/89 | |
| 2212092 | III-W-F-18 | 1 | BACK BAY | | NO | 07/06/89 | |
| 2212127 | III-W-F-1 | 1 | BACK BAY | RING RD | YES | 07/06/89 | PIEZOMETER |
| 2212133 | III-W-A-9 | 1 | BACK BAY | | NO | 07/06/89 | CONSTRUCTION IN THE AREA |
| 2212137 | III-W-19 | 1 | BACK BAY | | NO | 07/06/89 | CONSTRUCTION IN THE AREA |

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|---|---|---|---|---|---|---|---|
| 22J0891 | III-W-21 | 1 | BACK BAY | | NO | 08/18/89 | |
| 22J0894 | III-W-27 | 1 | BACK BAY | | NO | 08/18/89 | |
| 22J0898 | V-B-1 | 1 | BACK BAY | | NO | 08/18/89 | |
| 22J1022 | III-E-32 | 1 | BACK BAY | | NO | 08/18/89 | |
| 22J1032 | III-E-E-4 | 1 | BACK BAY | | NO | 08/18/89 | |
| 22J1041 | III-E-A-3 | 1 | BACK BAY | | NO | 08/18/89 | |
| 22J1059 | V-A-4 | 1 | BACK BAY | | NO | 07/13/89 | IN THE VICINITY OF THE ORANGE LINE |
| 22J1117 | III-E-E-3 | 1 | BACK BAY | | NO | 07/13/89 | |
| 22J1131 | III-E-A-4 | 1 | BACK BAY | 223 COLUMBUS AVE | YES | 08/18/89 | WATER MAIN |
| 22J1144 | V-B-2 | 1 | BACK BAY | | NO | 07/13/89 | IN THE VICINITY OF THE ORANGE LINE |
| 22J1164A | V-A-5 | 1 | BACK BAY | | NO | 07/13/89 | IN THE VICINITY OF THE ORANGE LINE |
| 22J1164B | V-B-4 | 1 | BACK BAY | | NO | 07/13/89 | IN THE VICINITY OF THE ORANGE LINE |
| 22J1172A | V-A-6 | 1 | BACK BAY | 285 COLUMBUS AVE | YES | 07/13/89 | PLUGGED |
| 22J1172B | V-A-6A | 1 | BACK BAY | | NO | 07/13/89 | |
| 22J1174 | V-B-3 | 1 | BACK BAY | | NO | 07/13/89 | |
| 22J1265 | IV-A-1 | 1 | BACK BAY | | NO | 08/18/89 | |
| 22J1393 | IV-6 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J1447 | IV-D-1 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J1457 | IV-7 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J1515 | III-W-20 | 1 | BACK BAY | | NO | 07/13/89 | CONSTRUCTION IN AREA |
| 22J1527A | III-W-B-2 | 1 | BACK BAY | ST BOTOLPH & HARCOURT ST | YES | 08/02/89 | FAILED TEST |
| 22J1527B | III-W-B-2A | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 22J1527C | III-W-I-5 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 22J1532 | III-W-A-7 | 1 | BACK BAY | | NO | 08/18/89 | |
| 22J1565 | III-W-B-14 | 1 | BACK BAY | | NO | 08/18/89 | |
| 22J1567A | III-W-I-7 | 1 | BACK BAY | 11 HARCOURT ST. | YES | 07/13/89 | WATER SERVICE |
| 22J1567B | III-W-A-10 | 1 | BACK BAY | 13 HARCOURT ST | YES | 07/13/89 | WATER SERVICE |
| 22J1567C | III-W-37 | 1 | BACK BAY | 15 HARCOURT ST | YES | 07/13/89 | WATER SERVICE |
| 22J1568 | III-W-B-13 | 1 | BACK BAY | 17 HARCOURT ST | YES | 07/13/89 | WATER SERVICE |
| 22J1593 | V-4 | 1 | BACK BAY | 243 WEST CANTON ST | YES | 07/13/89 | WATER SERVICE |
| 22J1618 | III-W-38 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 22J1627A | V-A-3 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 22J1627B | V-A-3A | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN THE AREA |
| 22J1637 | V-66 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN THE AREA |
| 22J1692 | V-12 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 22J1749 | V-13 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 22J1825 | | 5 | SOUTH END | 62 CLARENDON ST. | YES | 11/21/89 | PLUGGED |
| 22J1832 | V-15 | 1 | BACK BAY | | NO | 07/13/89 | |
| 22J1847 | V-26 | 1 | BACK BAY | | NO | 07/13/89 | |
| 22J1878 | V-39 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J1892 | V-41 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J1915 | V-27 | | BACK BAY | 10 LAWRENCE ST | YES | 07/13/89 | WATER SERVICE |
| 22J1938 | OW-3 | 4 | SOUTH END | BERKLY & APPLETON ST. | YES | 08/18/89 | CANNOT TEST-STANDPIPE DIAMETER TOO SMALL |
| 22J1992 | V-42 | 1 | BACK BAY | | NO | 07/12/89 | |

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|---|---|---|---|---|---|---|---|
| 22J2021 | IV-4 | 1 | BACK BAY | - | NO | 07/12/89 | |
| 22J2048 | IV-C-1 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J2065 | IV-10 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J2088 | IV-9 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J2116 | IV-11 | 1 | BACK BAY | PARKING AREA AT PAUL PL | YES | 07/12/89 | PLUGGED |
| 22J2162 | IV-14 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J2181 | IV-13 | 1 | BACK BAY | NEAR EMERALD COURT | YES | 07/12/89 | PIEZOMETER |
| 22J2216A | III-W-B-3 | 1 | BACK BAY | | NO | 07/13/89 | CONSTRUCTION IN AREA |
| 22J2216B | III-W-B-3A | 1 | BACK BAY | | NO | 07/13/89 | CONSTRUCTION IN AREA |
| 22J2224 | III-W-B-12 | 1 | BACK BAY | | NO | 07/13/89 | CONSTRUCTION IN AREA |
| 22J2245 | V-A-2 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 22J2246 | V-A-13 | 1 | BACK BAY | BRADDOCK PARK | YES | 07/13/89 | WATER SERVICE |
| 22J2248 | V-63 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 22J2266 | V-9 | 1 | BACK BAY | | NO | 07/13/89 | |
| 22J2271 | V-A-12 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 22J2288A | V-A-7 | 1 | BACK BAY | BRADDOCK PARK | YES | 07/13/89 | CANNOT TEST-STANDPIPE TO SMALL |
| 22J2288B | V-A-7A | 1 | BACK BAY | BRADDOCK PARK | YES | 07/13/89 | |
| 22J2294 | V-64 | 1 | BACK BAY | BRADDOCK PARK | YES | 07/13/89 | WATER SERVICE |
| 22J2321 | V-10 | 1 | BACK BAY | | NO | 07/13/89 | |
| 22J2329 | T-7 | 9 | BACK BAY | | NO | 08/21/89 | |
| 22J2373 | V-65 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 22J2428 | V-25 | 1 | BACK BAY | ACROSS 73 DARTMOUTH ST | YES | 07/12/89 | WATER SERVICE |
| 22J2524 | V-38 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J2538 | V-40 | 1 | BACK BAY | 59 WARREN AVE | YES | 07/12/89 | WATER SERVICE |
| 22J2559 | V-37 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J2681 | V-52 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22J2832 | IV-16 | | BACK BAY | | NO | 07/12/89 | |
| 22J2841 | IV-12 | | BACK BAY | | NO | 07/12/89 | |
| 22K0151 | IV-8 | 1 | BACK BAY | TREMONT ST | YES | 07/06/89 | WATER SERVICE |
| 22K0284 | | 3 | SOUTH END | | NO | 12/27/89 | |
| 22K0875 | IV-15 | 1 | BACK BAY | | NO | 07/12/89 | |
| 22K0948 | OW12 | 4 | SOUTH END | MARGINAL & WASHINGTON ST | YES | 08/07/89 | FAILED TEST |
| 22K1524 | IV-B-1 | 1 | BACK BAY | SHAWMUT AVE | YES | 08/07/89 | CANNOT OPEN-BIT CONC OVERLAY COVERING BOLT |
| 22K1552 | IV-B-2 | 1 | BACK BAY | | NO | 07/05/89 | |
| 22K1644 | 116-H | 4 | SOUTH END | ACROSS 1000 WASHINGTON ST | YES | 08/07/89 | FAILED TEST |
| 22K1741 | 109-H | 4 | SOUTH END | HARRISON AVE & HEARLD ST | YES | 08/07/89 | FAILED TEST |
| 22K1768 | OW15 | 4 | SOUTH END | HEARLD ST & ALBANY ST | YES | 08/07/89 | FAILED TEST |
| 23H2293 | | 3 | BACK BAY | GRANBY & COMM AVE | YES | 08/07/89 | PLUGGED 12.4' DOWN |
| 23H2347 | | 3 | BACK BAY | ON GRANBY ST. | YES | 08/07/89 | PLUGGED |
| 23H2492 | | 3 | BACK BAY | ON SHERBORN ST. | YES | 08/07/89 | CANNOT OPEN |
| 23H2494 | | 3 | BACK BAY | | NO | 07/31/89 | |
| 23H2497 | | 3 | BACK BAY | | NO | 08/18/89 | |
| 23H2644 | | 3 | BACK BAY | | NO | 08/18/89 | |
| 23H2758 | | 3 | BACK BAY | RALEIGH & BAY ST | YES | 08/07/89 | PLUGGED |
| 23H2867 | | 3 | BACK BAY | CHARLESGATE & BAY ST | YES | 08/07/89 | PLUGGED |
| 23I0788 | II-W-7 | 1 | BACK BAY | BACK ST PARKING AREA | YES | 08/04/89 | CANNOT OPEN |
| 23I1189 | II-W-2 | 1 | BACK BAY | | NO | 06/05/89 | |

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|---|---|---|---|---|---|---|---|
| 2311194 | II-W-3 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2311267 | II-W-4 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2311295 | II-W-11 | 1 | BACK BAY | 334 BEACON ST | YES | 08/04/89 | PLUGGED |
| 2311333 | II-W-6 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2311334 | II-W-5 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2311397 | II-W-17 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2311441 | II-W-12 | 1 | BACK BAY | 782 EXETER ST | YES | 08/04/89 | PLUGGED |
| 2311465 | II-W-18 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2311697 | II-W-9 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2311729 | II-W-1 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2311766 | II-W-10 | 1 | BACK BAY | 448 HEREFORD ST | YES | 06/05/89 | FAILED TEST |
| 2311859 | II-W-14 | 1 | BACK BAY | 415 BEACONST ALLEY 415 | YES | 08/04/89 | PLUGGED |
| 2311862 | II-W-15 | 1 | BACK BAY | 401 BEACON ST | YES | 08/04/89 | PLUGGED |
| 2311899 | II-W-21 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2311929 | II-W-16 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2311994 | II-W-27 | 1 | BACK BAY | 261 COMM AVE ALLEY 425 | YES | 08/04/89 | PLUGGED |
| 2312066 | II-W-28 | 1 | BACK BAY | 242 MARLBOROUGH ALLEY 426 | YES | 08/04/89 | PLUGGED |
| 2312113 | II-W-23 | 1 | BACK BAY | 220 MARLBOROUGH ST | YES | 08/04/89 | PLUGGED |
| 2312318 | | 3 | BACK BAY | 515 BEACON ST. | YES | 08/07/89 | PLUGGED |
| 2312422 | II-W-13 | 1 | BACK BAY | 465 BEACON ST ALLEY 414 | YES | 08/04/89 | CANNOT OPEN-COVER PARTIALLY COVERED WITH BIT CONC PAVEMENT |
| 2312447 | II-W-19 | 1 | BACK BAY | | NO | 06/05/89 | NEW SIDEWALK IN AREA |
| 2312467 | II-W-25 | 1 | BACK BAY | 323 COMM AVE ALLEY 429 | YES | 08/04/89 | PLUGGED |
| 2312474 | | 3 | BACK BAY | OFF MARLBOROUGH ALLEY 908 | YES | 08/07/89 | PLUGGED |
| 2312518 | II-W-20 | 1 | BACK BAY | MARLBOROUGH & HEREFORD ST | YES | 08/04/89 | PLUGGED |
| 2312529 | II-W-26 | 1 | BACK BAY | | NO | 06/05/89 | |
| 2312648 | II-W-31 | 1 | BACK BAY | 284 COMM AVE | YES | 08/04/89 | WATER SERVICE |
| 2312771 | II-W-40 | 1 | BACK BAY | | NO | 07/11/89 | |
| 2312843 | II-W-41 | 1 | BACK BAY | 209 NEWBURY ST ALLEY 433 | YES | 08/04/89 | PLUGGED |
| 2312893 | II-W-A-5 | 1 | BACK BAY | | NO | 07/11/89 | |
| 2312899 | II-W-55 | 1 | BACK BAY | | NO | 07/11/89 | |
| 23J0162 | II-E-2 | 1 | BACK BAY | 200 BEACON ST | YES | 07/07/89 | PLUGGED |
| 23J0171 | II-W-8 | 1 | BACK BAY | | NO | 07/07/89 | |
| 23J0329 | II-E-7 | 1 | BACK BAY | | NO | 07/07/89 | |
| 23J0348 | II-E-6 | 1 | BACK BAY | | NO | 07/07/89 | |
| 23J0394 | II-E-11 | 1 | BACK BAY | | NO | 07/07/89 | |
| 23J0397 | II-E-C-1 | 1 | BACK BAY | | NO | 07/07/89 | |
| 23J0416 | II-E-8 | 1 | BACK BAY | | NO | 07/07/89 | |
| 23J0463 | II-E-12 | 1 | BACK BAY | MARLBOROUGH ST | YES | 07/07/89 | PLUGGED NEEDS NEW COVER |
| 23J0482 | II-E-15 | 1 | BACK BAY | 16 MARLBOROUGH ALLEY 422 | YES | 07/07/89 | PLUGGED |
| 23J0575 | II-E-1 | 1 | BACK BAY | | NO | 07/07/89 | |
| 23J0828 | II-E-10 | 1 | BACK BAY | 108 MARLBOROUGH ST | YES | 07/07/89 | PLUGGED |
| 23J0833 | II-E-5 | 1 | BACK BAY | 127 MARLBOROUGH ALLEY 419 | YES | 07/07/89 | PLUGGED NEEDS NEW COVER |
| 23J0848 | II-E-13 | 1 | BACK BAY | 134 MARLBOROUGH ALLEY 424 | YES | 07/07/89 | PLUGGED NEEDS NEW COVER |
| 23J0881 | II-W-24 | 1 | BACK BAY | 172 MARLBOROUGH ST | YES | 07/07/89 | CANNOT OPEN |
| 23J1022 | II-E-C-2 | 1 | BACK BAY | | NO | 07/07/89 | |
| 23J1024 | II-E-14 | 1 | BACK BAY | | NO | 07/07/89 | |
| 23J1129 | II-E-B-4 | 1 | BACK BAY | | NO | 08/21/89 | |

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|---|---|---|---|---|---|---|---|
| 23J1189 | II-E-B-3 | 1 | BACK BAY | 29 NEWBURY ST. | YES | 06/05/89 | CANNOT OPEN |
| 23J1216A | II-E-19 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J1216B | II-E-B-1 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J1245A | II-E-22 | 1 | BACK BAY | ALLEY 437 | YES | 06/05/89 | PLUGGED NEEDS COVER |
| 23J1245B | II-E-B-2 | 1 | BACK BAY | | NO | 06/05/89 | |
| 23J1285 | II-E-25 | 1 | BACK BAY | NEWBURY ST | YES | 06/05/89 | CANNOT TEST DAMAGED |
| 23J1386 | III-E-C-18 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J1471 | III-E-C-9 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J1476 | III-E-C-10 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J1477 | III-E-C-1 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J1478A | III-E-C-19 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J1478B | III-E-C-21 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J1488 | III-E-G-4 | 1 | BACK BAY | CHARLES ST. SOUTH | YES | 07/13/89 | WATER SERVICE |
| 23J1511 | II-W-29 | 1 | BACK BAY | 173 COMM AVE ALLEY 425 | YES | 07/07/89 | PLUGGED NEEDS COVER |
| 23J1545 | II-W-32 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J1553 | II-W-33 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J1587 | II-W-42 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J1628 | II-E-16 | 1 | BACK BAY | 120 COMM AVE | YES | 07/14/89 | CANNOT OPEN - CONCRETE OVERLAY |
| 23J1656 | II-E-20 | 1 | BACK BAY | 125 NEWBURY ST ALLEY 435 | YES | 06/05/89 | PLUGGED NEEDS COVER |
| 23J1698 | II-E-26 | 1 | BACK BAY | ALLEY 439 | YES | 08/04/89 | PLUGGED |
| 23J1723 | II-E-21 | 1 | BACK BAY | 83 NEWBURY ST ALLEY 436 | YES | 06/05/89 | CANNOT OPEN, BIT CONC OVERLAY |
| 23J1855 | II-E-27 | 1 | BACK BAY | BERKLEY ST | YES | 06/05/89 | PLUGGED |
| 23J1857 | II-E-30 | 1 | BACK BAY | | NO | 06/05/89 | |
| 23J1881 | II-E-A-5 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J1884 | III-E-B-2 | 1 | BACK BAY | | NO | 07/14/89 | CONSTRUCTION IN AREA |
| 23J1921 | II-E-D-1 | 1 | BACK BAY | ALLEY 438 | YES | 06/05/89 | CANNOT OPEN |
| 23J1939 | III-E-J-3 | 1 | BACK BAY | 302 BOYLSTON ST | YES | 08/03/89 | PLUGGED |
| 23J1966 | III-E-J-4 | 1 | BACK BAY | ARLINGTON ST | YES | 07/13/89 | CANNOT TEST - PIPE TOO SMALL |
| 23J2016 | III-E-J-2 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J2022 | III-E-C-17 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J2023 | III-E-J-1 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J2026 | III-E-C-16 | 1 | BACK BAY | HADASSAH WAY | YES | 08/01/89 | PLUGGED |
| 23J2028 | III-E-J-7 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J2031 | III-E-C-7 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J2032 | III-E-C-8 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J2046 | III-E-J-5 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J2047 | III-E-5 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J2052 | III-E-J-6 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J2053 | III-E-C-15 | 1 | BACK BAY | HADASSAH WAY & PARK PLACE | YES | 08/01/89 | WATER SERVICE |
| 23J2062 | III-E-C-6 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2066 | III-E-C-13 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2113 | III-E-C-3 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2117 | III-E-C-4 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2119 | III-E-C-12 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2121 | III-E-C-2 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2124 | III-E-C-20 | 1 | BACK BAY | | NO | 08/21/89 | |

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|---|---|---|---|---|---|---|---|
| 23J2126 | III-E-G-1 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2128A | III-E-G-5 | 1 | BACK BAY | | NO | 07/13/89 | |
| 23J2128B | III-E-C-11 | 1 | BACK BAY | CHARLES ST SO & PARK PL | YES | 07/13/89 | WATER SERVICE |
| 23J2141 | III-E-C-5 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2151A | III-E-6 | 1 | BACK BAY | PARK PLAZA | YES | 07/13/89 | WATER SERVICE |
| 23J2151B | III-E-G-6 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALKS IN AREA |
| 23J2159 | III-E-G-7 | 1 | BACK BAY | CHARLES ST SOUTH | YES | 07/13/89 | WATER SERVICE |
| 23J2161 | III-E-G-3 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 23J2193 | III-E-16 | 1 | BACK BAY | | NO | 07/13/89 | NEW SIDEWALK IN AREA |
| 23J2227 | II-W-47 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J2241 | II-W-A-3 | 1 | BACK BAY | 186 NEWBURY ST | YES | 07/14/89 | CANNOT OPEN |
| 23J2249 | II-W-A-2 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J2255 | II-W-52 | 1 | BACK BAY | 166 NEWBURY ST ALLEY 440 | YES | 07/14/89 | CANNOT TEST - STANDPIPE BENT |
| 23J2278 | II-W-A-1 | 1 | BACK BAY | BOYLSTON ST | YES | 07/14/89 | CANNOT OPEN |
| 23J2288 | III-W-6 | 1 | BACK BAY | ACROSS 655 BOYLSTON ST | YES | 07/14/89 | PLUGGED |
| 23J2291 | II-W-A-4 | 1 | BACK BAY | 655 BOYLSTON ST | YES | 07/14/89 | PLUGGED NEEDS COVER |
| 23J2357 | III-E-1 | 1 | BACK BAY | | NO | 07/14/89 | NEW SIDEWALK IN THE AREA |
| 23J2363 | III-E-2 | 1 | BACK BAY | | NO | 07/14/89 | NEW SIDEWALK IN AREA |
| 23J2367 | III-E-4 | 1 | BACK BAY | ACROSS 583 BOYLSTON ST | YES | 07/14/89 | WATER SERVICE |
| 23J2371 | III-W-7 | 1 | BACK BAY | BOYLSTON & DARTMOUTH ST | YES | 07/14/89 | PLUGGED |
| 23J2381 | III-E-B-7 | 1 | BACK BAY | DARTMOUTH ST | YES | 07/14/89 | WATER SERVICE |
| 23J2388 | III-E-7 | 1 | BACK BAY | | NO | 07/14/89 | NEW SIDEWALK IN THE AREA |
| 23J2395 | III-E-9 | 1 | BACK BAY | | NO | 07/14/89 | NEW SIDEWALK IN AREA |
| 23J2397 | III-E-8 | 1 | BACK BAY | | NO | 07/14/89 | NEW SIDEWALK IN AREA |
| 23J2412 | II-E-31 | 1 | BACK BAY | 541 BOYLSTON ST | YES | 06/05/89 | WATER SERVICE |
| 23J2425 | III-E-B-1 | 1 | BACK BAY | | NO | 07/14/89 | NEW SIDEWALK IN AREA |
| 23J2427 | III-E-I-9 | 1 | BACK BAY | CLARENDON & BOYLSTON ST | YES | 07/14/89 | CANNOT TEST - PIPE TOO SMALL |
| 23J2444 | III-E-I-7 | 1 | BACK BAY | BOYLSTON ST | YES | 07/14/89 | WATER SERVICE |
| 23J2447 | III-E-I-5 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J2448 | III-E-I-6 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J2454 | III-E-I-10 | 1 | BACK BAY | CLARENDON ST | YES | 07/14/89 | PIEZOMETER |
| 23J2458 | III-E-I-11 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J2459 | III-E-B-9 | 1 | BACK BAY | | NO | 07/14/89 | NEW SIDEWALK IN AREA |
| 23J2473 | III-E-I-12 | 1 | BACK BAY | ST JAMES AVE | YES | 07/14/89 | PIEZOMETER |
| 23J2481B | III-E-I-13 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J2481C | III-E-I-14 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J2482 | III-E-I-15 | 1 | BACK BAY | CLARENDON ST | YES | 07/14/89 | CANNOT TEST - BAILER TO LARGE FOR STANDPIPE |
| 23J2485 | III-E-B-8 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2494 | III-E-F-10 | 1 | BACK BAY | | NO | 08/18/89 | |
| 23J2496 | III-E-F-8 | 1 | BACK BAY | | NO | 08/18/89 | |
| 23J2517 | III-E-B-3 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J2548 | III-E-12 | 1 | BACK BAY | ST JAMES AVE | YES | 07/14/89 | WATER SERVICE |
| 23J2554 | III-E-13 | 1 | BACK BAY | ST JAMES AVE | YES | 07/14/89 | WATER SERVICE |
| 23J2561B | III-E-B-10 | 1 | BACK BAY | ST JAMES AVE | YES | 07/14/89 | FAILED TEST NEEDS COVER |
| 23J2571 | III-E-F-11 | 1 | BACK BAY | ST JAMES AVE | YES | 07/14/89 | WATER SERVICE |
| 23J2572 | III-E-F-9 | 1 | BACK BAY | | NO | 08/18/89 | |

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|---|---|---|---|---|---|---|---|
| 23J2573A | III-E-39 | 1 | BACK BAY | | NO | 08/18/89 | |
| 23J2573B | III-E-F-7 | 1 | BACK BAY | | NO | 08/18/89 | |
| 23J2584 | III-E-F-4 | 1 | BACK BAY | | NO | 08/18/89 | |
| 23J2592 | III-E-B-11 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2595 | III-E-20 | 1 | BACK BAY | | NO | 08/21/89 | |
| 23J2631 | III-E-15 | 1 | BACK BAY | | NO | 07/14/89 | |
| 23J2748 | III-E-21 | 1 | BACK BAY | ARLINGTON ST | YES | 07/14/89 | PLUGGED |
| 23J2753 | III-E-D-1 | 1 | BACK BAY | 250 STUART ST | YES | 07/14/89 | CANNOT OPEN |
| 23J2766 | III-E-D-2 | 1 | BACK BAY | | NO | 07/14/89 | NEW SIDEWALK IN AREA |
| 23J2831 | III-E-G-9 | 1 | BACK BAY | STUART ST | YES | 07/13/89 | WATER SERVICE |
| 23J2897 | III-E-27 | 1 | BACK BAY | 2 MELROSE | YES | 07/14/89 | FAILED TEST NEEDS COVER |
| 23K0385 | | 5 | CHINATOWN | ON AVENUE DE LAFAYETTE | YES | 12/26/89 | PIEZOMETER |
| 23K0443 | | 5 | CHINATOWN | 34 CHAUNCY STREET | YES | 12/27/89 | WATER MAIN |
| 23K0712A | | 5 | DOWNTOWN BOSTON | ACROSS FROM 99 HIGH ST. | YES | 12/26/89 | PLUGGED. BOTTOM OF WELL IS 20 FEET DOWN THE WELL |
| 23K0712B | | 5 | DOWNTOWN BOSTON | ACROSS FROM 99 HIGH ST. | YES | 12/26/89 | DEEP WELL |
| 23K0722 | | 5 | DOWNTOWN BOSTON | 126 HIGH STREET | YES | 12/26/89 | CANNOT TEST - PIPE TOO SMALL |
| 23K0733 | | 5 | DOWNTOWN BOSTON | 125 PEARL STREET | YES | 12/26/89 | TWO SMALL WELLS LOCATED IN THIS WELL SPOT. DIAMETER OF WELLS |
| 23K0776 | | 5 | DOWNTOWN BOSTON | ON PURCHASE STREET | YES | 12/26/89 | PLUGGED 10' DOWN WELL. NO GWT |
| 23K0777 | | 5 | DOWNTOWN BOSTON | ON PURCHASE STREET | YES | 12/26/89 | CAN NOT OPEN, NEW BRICK SIDEWALK |
| 23K0995 | | 5 | CHINATOWN | ON ESSEX STREET | YES | 12/26/89 | NEAR ESSEX STATION - DEEP WELL |
| 23K1012 | | 5 | CHINATOWN | 569 WASHINGTON STREET | YES | 12/26/89 | DEEP WELL. PVC TUBE IN WELL |
| 23K1036 | | 5 | CHINATOWN | ON AVENUE DE LAFAYETTE | YES | 12/26/89 | PIEZOMETER |
| 23K1792 | | 5 | CHINATOWN | 75 HARRISON AVE. | YES | 11/30/89 | CANNOT OPEN |
| 23K1845 | | 3 | CHINATOWN | 52 BEACH ST | YES | 08/18/89 | CANNOT OPEN |
| 23K1886 | | 5 | CHINATOWN | 3 HUDSON ST. | YES | 11/22/89 | PLUGGED 3.8 FEET DOWN |
| 23K1889 | | 5 | CHINATOWN | 13 HUDSON ST. | YES | 11/22/89 | PLUGGED |
| 23K1929 | | 3 | CHINATOWN | 88 LINCOLN ST | YES | 09/18/89 | FAILED TEST |
| 23K1982 | | 5 | CHINATOWN | 144 LINCOLN ST. | YES | 11/22/89 | WATER SERVICE |
| 23K2047 | | 5 | CHINATOWN | 123 SOUTH ST. | YES | 11/22/89 | PLUGGED |
| 23K2048 | | 5 | CHINATOWN | 90 SOUTH ST. | YES | 11/22/89 | FAILED TEST |
| 23K2217 | III-E-G-10 | 1 | BACK BAY | CHARLES ST | YES | 11/30/89 | PLUGGED |
| 23K2526 | | 5 | CHINATOWN | 18 HUDSON ST. | YES | 11/30/89 | WATER SERVICE |
| 23K2566 | | 5 | CHINATOWN | ON KNEELAND ST. | YES | 11/22/89 | CANNOT OPEN |
| 23K2624 | | 3 | CHINATOWN | 182 LINCOLN ST | YES | 07/25/89 | FAILED TEST |
| 23K2647 | | 5 | CHINATOWN | ON KNEELAND ST. | YES | 11/22/89 | COULD NOT OPEN |
| 23K2668 | | 3 | CHINATOWN | SOUTH ST | YES | 11/30/89 | PLUGGED |
| 23K2741A | | 5 | CHINATOWN | ACROSS FROM 179 SOUTH ST. | YES | 11/30/89 | WATER SERVICE |
| 23K2741B | | 5 | CHINATOWN | ACROSS FROM 179 SOUTH ST. | YES | 11/30/89 | WATER SERVICE |
| 23K2775A | | 5 | CHINATOWN | ON KNEELAND ST. | YES | 11/30/89 | FAILED TEST |
| 24J0537 | I-3 | 1 | LOWER BEACON HILL | 137 CHARLES ST | YES | 07/24/89 | CANNOT OPEN |
| 24J0542 | I-2 | 1 | LOWER BEACON HILL | 32 EMBANKMENT ROAD | YES | 07/24/89 | DAMAGED |

* DATA SOURCE: 1 - H&A GROUNDWATER BACK BAY; 2 - CHRISTIAN SCIENCE CENTER; 3 - USGS HYDROLOGIC ATLAS-513; 4 - MASS TURNPIKE AUTHORITY; 5 - IDENTIFIED BY STONE & WEBSTER; 6 - GAZILBASH; 7 - GEO. ENG. INC.; 8 - URBAN ENGINEERING; 9 - BRA; 10 - ZINER & ROSSETTI INC; 11 - MUSEUM OF FINE ARTS; 12 - NORTHEASTERN UNIVERSITY; 13 - R.M. BRADLEY; 14 - GILBERT SMALL & CO.; 15 - BOSTON WATER & SEWER; 16 - BRIGHAM & WOMAN'S HOSPITAL

TABLE 3

NON FUNCTIONING OBSERVATION WELL SUMMARY

| S&W NO. | PREVIOUS NO. | (*) DATA SOURCE | NEIGHBORHOOD | LOCATION | FOUND (YES/NO) | TEST DATE | COMMENTS |
|---|---|---|---|---|---|---|---|
| 24J0577 | I-5 | 1 | LOWER BEACON HILL | | NO | 06/02/89 | |
| 24J0583 | I-4 | 1 | LOWER BEACON HILL | ACROSS 112 REVERE ST | YES | 07/24/89 | PLUGGED |
| 24J1196 | I-8 | 1 | LOWER BEACON HILL | | NO | 06/02/89 | |
| 24J1217 | I-6 | 1 | LOWER BEACON HILL | | NO | 06/02/89 | |
| 24J1234 | I-7 | 1 | LOWER BEACON HILL | 127 CHARLES ST | YES | 07/24/89 | PLUGGED |
| 24J1285 | I-A-2 | 1 | LOWER BEACON HILL | | NO | 06/02/89 | |
| 24J1894 | I-10 | 1 | LOWER BEACON HILL | | NO | 06/02/89 | |
| 24J1933 | I-9 | 1 | LOWER BEACON HILL | | NO | 06/02/89 | ROAD RECENTLY PAVED - MAY HAVE BEEN BURIED |
| 24J1973 | I-11 | 1 | LOWER BEACON HILL | BRIMMER ST | YES | 07/26/89 | PLUGGED |
| 24J1976 | | | LOWER BEACON HILL | CHESTNUT STREET | YES | 08/15/89 | NEEDS KEY TO OPEN |
| 24J2045 | OW-7 | 1 | LOWER BEACON HILL | CHARLES & CHESTNUT ST | YES | 06/02/89 | PLUGGED |
| 24J2482 | II-E-4 | 1 | BACK BAY | BERKELEY ST | YES | 07/11/89 | FAILED TEST |
| 24J2595 | II-E-9 | 1 | BACK BAY | ARLINGTON ST | YES | 06/02/89 | PLUGGED |
| 24J2624 | I-13 | 1 | LOWER BEACON HILL | 71 BRIMMER ST. | YES | 12/27/89 | CANNOT OPEN |
| 24J2626 | I-14 | 1 | LOWER BEACON HILL | | NO | 06/02/89 | |
| 24J2627 | | 5 | LOWER BEACON HILL | BRIMMER ST | YES | 08/15/89 | FAILED TEST |

* DATA SOURCE: 1 - H&A GROUNDWATER BACK BAY; 2 - CHRISTIAN SCIENCE CENTER; 3 - USGS HYDROLOGIC ATLAS-513;
4 - MASS TURNPIKE AUTHORITY; 5 - IDENTIFIED BY STONE & WEBSTER; 6 - QAZILBASH; 7 - GEO. ENG. INC.; 8 - URBAN ENGINEERING;
9 - BRA; 10 - ZINER & ROSSETTI INC; 11 - MUSEUM OF FINE ARTS; 12 - NORTHEASTERN UNIVERSITY; 13 - R.M. BRADLEY;
14 - GILBERT SMALL & CO.; 15 - BOSTON WATER & SEWER; 16 - BRIGHAM & WOMAN'S HOSPITAL

## APPENDIX A

## THE GROUNDWATER TRUST

Members

Chairman William Rizzo, Beacon Hill Civic Association

Trustee Alden Gifford, Greater Boston Real Estate Board

Trustee James Knox, Neighborhood Association of the Back Bay

Trustee Galen Gilbet, Fenway Community Development Corporation

Trustee Todd Saunders, Vault Coordinating Committee

Vacant - Representative of the Back Bay Association

EX officio

Thomas Mc Nicholas, Commissioner of the Inspectional Services Department,

Councillor David Scondras, designee of the president of the Boston City Council,

William Corcoran, representative of the Collector-Treasurer of the City of Boston,

Peter Scarpignato, representative of the City of Boston Department of Public Works

## 1.0 SCOPE

This scope of work details the technical and quality assurance requirements for the installation of shallow observation wells throughout the City of Boston

The work consists of drilling borings to an estimated depth of 20 ft., installing observation wells and performing slug tests.

The observation wells will be installed at street intersections at the most convenient sidewalk location. Certain areas of the City may require observation wells at locations other than at intersections, such as the back alleys of Chinatown and the Back Bay.

## 2.0 APPLICABLE DOCUMENTS

The following documents are a part of this specification to the extent specified. Unless otherwise stated, the issue in effect on the date of the order shall apply. In the event of conflict between the referenced document and this specifications, the conflict shall be referred to the Engineers for resolution.

American Society of Testing and Materials

ASTM D 1586 1967 Penetration Test and Split-Barrel Sampling of Soils

### 2.1 Definitions

The following definition shall apply to this specification:

Engineers - The authorized engineering representative of the City

The City - The Inspectional Services Department of the City of Boston

## 3.0 REQUIREMENTS

### 3.1 Safety

(To be provided by the City)

### 3.2 Underground Utilities

Before drilling is performed, the Contractor shall locate all existing underground utilities adjacent to the location of the observation wells. The Contractor shall consult with the Dig Safe Center before proceeding with any drilling activities.

3.3 Restoration of Surfaces, Underground Utilities and Property

The Contractor shall take reasonable precaution against damaging adjacent or adjoining surfaces, paving, utilities or property. The Contractor shall promptly repair at his own expense all such damage to the satisfaction of the City and the property owner. All excess soil and debris from the borings shall be properly disposed of and all surfaces shall be restored to their original condition by the Contractor at no additional expense to the City.

3.4 Test Borings

3.4.1 General

Equipment may consist of power-driven rigs of the type or types approved by the Engineers and capable of driving casing or augering and of taking split-barrel samples.

The use of drilling fluids other than water may be permitted with the approval of the Engineer. The drilling fluid shall be either water or a self destructing drilling fluid such as "Revert," or equal as approved by the Engineer.

The necessary equipment and supplies shall be provided to recirculate or clarify return water. Pump supply lines shall be equipped with a bypass valve so that when pumped water is not being used for drilling, it may be discharged at a suitable location.

The Contractor shall measure the depth that the groundwater table is first encountered in each boring.

The Engineer will maintain a log as a part of Attachment 1 for each subsurface exploration. The Contractor shall assist the Engineer in obtaining the information required to complete this log.

3.4.2 Access and Setup for Borings

The Contractor shall be responsible for setting up all drilling, pumping, and associated equipment at each borehole location. The Contractor shall obtain approval from the Engineer before attempting to gain access to any location.

3.4.3 Split-Barrel Sampling

3.4.3.1. General

The purpose of these samples is to determine the soil classification of the various soil strata as they exist in the ground. It is necessary to locate and record the depth at which any change in stratification occurs and to obtain and classify samples representative of the material comprising each stratum as it exists in the ground.

3.4.3.2 Boring Procedure

Each boring shall be advanced by using either a cutting or chopping bit or a hollow stem auger with a minimum inner diameter of 4 inches. The borehole shall have a minimum diameter of 4 in nominal.

A casing shall be advanced closely following the bit to exclude overlying soils from the boring. Casing may be omitted if drilling mud is used or where a hollow stem auger is used.

3.4.3.3 Sampling Procedure

Equipment for obtaining split-barrel samples shall conform to the requirements of ASTM D 1586.

Samples shall be taken at depths designated by the engineers. The sample interval shall not exceed depths of 5 ft.

Before taking a sample, the boring shall be cleaned using equipment that will not disturb the material to be sampled. The drill bit shall be withdrawn slowly to prevent loosening of the soil around the borehole. The level of drilling fluid in the boring shall be kept at, or slightly above, the natural groundwater level during sampling operations. When casing is used, it shall not be advanced below the top elevation of the next sample.

With the sampler resting on the bottom of the borehole, the sampler shall be driven with blows from the drive hammer falling 30 inches. The drive hammer shall be lifted by a rope wrapped around a rotating drum or "cathead." The sampler shall be driven 18 inches or until 75 blows have been applied for a penetration of 12 inches or less.

If sample recovery is unsatisfactory, a second attempt shall be made before advancing the borehole.

The Engineers may request deviations from the above procedures. In very hard soils, a drive hammer of nominal 300 lb weight may be employed to increase sample recovery.

3.4.3.4 Sample Deposition

When the sampler is brought to the ground surface, the sample shall be carefully removed. The top of the sample will generally be disturbed due to the cleaning out of the borehole and shall be discarded. The remaining sample shall then be classified according to the Uniform Soil Classification System, by an individual experienced in soil classification. The samples may then be discarded.

3.5 Installing Observation Wells

3.5.1 General

Observation wells shall be installed in specific locations designated by the

Engineers. The Contractor shall supply all materials required for the observation wells. Installation and testing records will be kept by the Engineer, (Attachment 1), and the Contractor shall assist the Engineer in obtaining the data required.

3.5.2 Materials

The observation well shall consist of a commercially available slotted PVC plastic pipe, schedule 40, with a nominal 2 in OD. The length of the screened area shall be determined by the Engineer. The slotted screen shall have factory cut slots between 0.01 and 0.02 inches in width. Unslotted 2 in OD PVC plastic pipe, schedule 40, shall be used to complete the piezometer to ground surface.

The pipe shall be protected by a cast iron road box, with a minimum 5.25" ID, 25" long, furnished with a lid fastened by a five-sided bolt.

Filter sand shall be a clean, well graded coarse to fine sand with 3 % passing the number 200 mesh sieve.

3.5.3 Installation Procedure

The depth at which the observation well tip is to be set will be determined by the engineer, but typically will be between 20 and 25 ft. The following paragraphs outline a recommended installation method. Modification of these procedures may be permitted or required for certain soil conditions. The Engineers will give detailed instructions at the time of installation should any such changes be required.

a. The borehole shall be flushed with a side discharge bit to develop a clean and uniform hole. Flushing shall be continued until the return water is clear. The drilling fluid shall be water or a self-destructing drilling mud ("Revert' or equal as approved by the Engineers). No casing shall be left in the borehole unless specifically requested by the Engineers.

b. The borehole may be grouted or backfilled with sand filter to the piezometer tip elevation as directed by the Engineers.

c. The depth to the piezometer tip shall be controlled by measuring the standpipe as it is inserted.

d. The borehole shall be backfilled with clean, dry, medium to coarse sand to a depth specified by the Engineers.

   The depth to the top of the sand backfill shall be measured using a weighted measuring tape. The Engineers may require that the sand backfill be placed in increments and tamped with a tamping hammer.

e. After the sand filter has been placed, the piezometer standpipe shall be filled with clean water and the drop in water level shall be observed to ensure that the piezometer is functioning. If the water level does not drop at a rate consistent with the soil type at the tip, the piezometer shall be removed and the borehole washed before the piezometer is

reinstalled.

f. A seal consisting of bentonite pellets may be required on top of the sand. The Engineers will give detailed instructions at the time if sealing off of the tip is required.

g. The remaining length of borehole shall be backfilled with sand to within approximately 2 ft. of the ground surface. Alternatively, the borehole may be tremie grouted to the surface.

h. A roadbox of the type shown in Attachment 1 shall be placed flush with the road/sidewalk grade, to protect the observation well and allow easy access for groundwater measurements. At the completion of the installation, a detailed sketch shall be made of the observation well location.

ATTACHMENT 1

# OBSERVATION WELL INSTALLATION REPORT

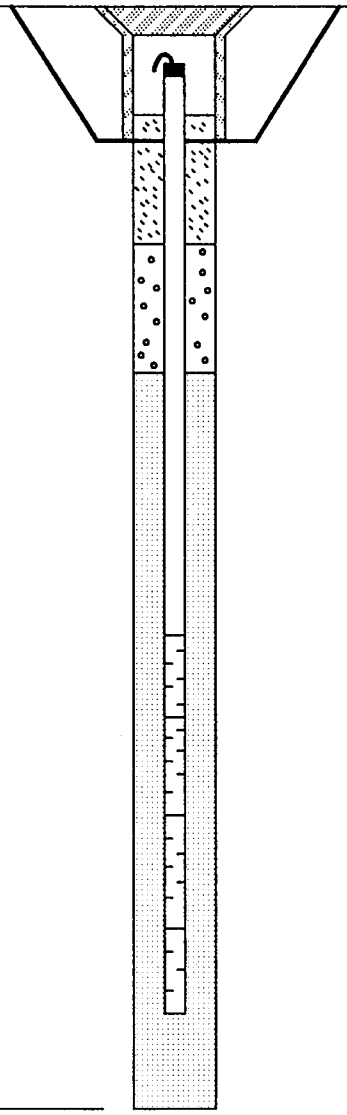
## STONE & WEBSTER CIVIL AND TRANSPORTATION SERVICES, INC.

| | |
|---|---|
| LOCATION | MAP NO. |
| | WELL NO. |
| | J.O. NO. |

SURVEY DATUM _____

SURFACE ELEVATION =

SOIL CONDITION SUMMARY (NOT TO SCALE)



THICKNESS OF GROUT _____

THICKNESS OF SEAL _____

LENGTH OF FILTER PACK _____

LENGTH OF SOLID RISER _____

LENGTH OF SCREENED INTERVAL _____

LENGTH OF FILTER PACK BELOW RISER _____

**WELL DATA**

| |
|---|
| Method of Drilling |
| Diameter of Borehole |
| Depth of Borehole |
| Riser Material |
| Riser Diameter |
| Screen Guage |
| Type of Filter Sand |
| Elev./Depth to Well Point |
| Elev./Depth to Groundwater |

**ROADBOX DATA**

| |
|---|
| Roadbox Designation |
| Roadbox Diameter |
| Roadbox Length |

**SLUG TEST DATA**

| Elapsed Time | Groundwater Level |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |