Department of Environmental Conservation

Division of Hazardous Waste Remediation

Pelham Bay Landfill

I.D. Number 203001

Bronx County, New York

Record of Decision

August 1993

New York State Department of Environmental Conservation
MARIO M. CUOMO, *Governor* THOMAS C. JORLING, *Commissioner*

DECLARATION STATEMENT - RECORD OF DECISION

PELHAM BAY LANDFILL Inactive Hazardous Waste Site
BRONX, New York
Site No. 2-03-001

Statement of Purpose and Basis

The Record of Decision (ROD) presents the selected remedial action for the **Pelham Bay Landfill** inactive hazardous waste disposal site which was chosen in accordance with the New York State Environmental Conservation Law (ECL). The remedial program selected is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300).

This decision is based upon the Administrative Record of the New York State Department of Environmental Conservation (NYSDEC) for the Pelham Bay Landfill Inactive Hazardous Waste Site and upon public input to the Proposed Remedial Action Plan (PRAP) presented by the NYSDEC. A bibliography of the documents included as a part of the Administrative Record is included in Appendix B of the ROD.

Assessment of the Site

Actual or threatened release of hazardous waste constituents from this site, if not addressed by implementing the response action selected in this ROD, presents a current or potential threat to public health and the environment.

Description of Selected Remedy

Based upon the results of the Remedial Investigation/Feasibility Study (RI/FS) for the Pelham Bay Landfill Site and the criteria identified for evaluation of alternatives the NYSDEC has selected Alternative III which is Active Gas Collection and Active Recovery, Long Term Monitoring, Groundwater Management, Leachate Management, Institutional Controls and installation of additional Extraction Wells if necessary. The components of the remedy are as follows:

- A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation, maintenance and monitoring of the remedial program

- Regrading of sections of the site to ensure proper site drainage and minimize erosion

- Installation of an actively vented impermeable final cover, consistent with Part 360, to minimize surface infiltration of precipitation and collect gases generated by the wastes. An adequate number of gas collection points will be installed throughout the landfill to prevent the uncontrolled release of gases to

the atmosphere. The major elements of the final cover will include vegetated top soil, a barrier protection layer, a drainage layer, a gas/water barrier (geomembrane) and a gas collection layer.

- Installation and operation of the gas collection and recovery system. Gases collected in the final cover system will be conveyed through piping to a central point of collection at the surface of the landfill for recovery and/or treatment.

- Operation of a leachate management system consisting of temporary groundwater extraction wells and storage tanks (referred to as the IRM/150 Day System), installed to control leachate from entering Eastchester Bay, plus a leachate collection trench along the southwestern edge of the park (the downgradient system).

- Installation of a groundwater management system which consists of a slurry wall and upgradient collector trench along the southwestern edge of the site (the upgradient system)

- Use of this site will be limited to ensure that the integrity of the remedy is not damaged or compromised. Any restrictions must be agreed to by New York State Department of Environmental Conservation, New York State Department of Health, and the City of New York and filed in the Clerks' office as part of the record of title to the property.

- A post-closure monitoring program to evaluate the performance of the remedial program. Monitoring may include, but is not necessarily limited to surface water and groundwater sampling for the target compound list parameters during the first year and may be subsequently modified depending on the results.

- Construction of additional groundwater extraction wells on the site, if required.

- Fencing to limit site access and use.

New York State Department of Health Acceptance

The New York State Department of Health concurs with the remedy selected for this site as being protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. In keeping with the statutory preference for treatment as a principal element of the remedy, most of the contaminated groundwater and leachate will be collected and treated. However, because of the size of the landfill and because there are no on-site "hot spots" that represent the major sources of contamination, the landfill material cannot be excavated and treated effectively.

August 31, 1993
Date

Ann Hill DeBarbieri
Deputy Commissioner

RECORD OF DECISION

PELHAM BAY LANDFILL SITE
BRONX COUNTY, NEW YORK
ID NUMBER:2-03-001

PREPARED BY
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION

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SECTION 1: SITE DESCRIPTION

The Pelham Bay Landfill is located at 40° 51'23" latitude, 73°48'52" longitude in the Bronx, a borough of New York City, New York (Figure 1-1). The Site is bordered by the Hutchinson River to the north and east, the Eastchester Bay("the Bay") to the east and south, the Pelham Bay Park to the southwest, and the Bruckner Boulevard Extension to the northwest. The New England Thruway (I-95) is less than one-half mile west of the Site. The Co-op City Housing Complex is approximately one-half mile northwest of the site.

SECTION 2: SITE HISTORY

SECTION 2.1 OPERATIONAL/DISPOSAL HISTORY

The Pelham Bay Landfill Site began operation on November 18, 1963 to handle mainly the waste disposal needs of the Bronx. The Landfill has remained inactive since December 31, 1978 when operations ceased. Wastes received at the site include residential waste, rubbish, street dirt, construction waste and demolition debris.

During testimony on May 6,1982, before a Senate Committee on Crime, a driver/dispatcher for the Hudson Oil Refining Company indicated that waste oil sludges, metal plating wastes, lacquer, and solvents were illegally disposed of at several New York City landfills from 1974 to 1980, including the Pelham Bay Landfill. The exact quantities and locations where the waste was dumped are unknown. It was reported that volumes ranged from 11,000 gallons to 55,000 gallon per week in 1974. During one period, mainly at the Brookfield landfill, as much as of 50,000 gallons per day were allegedly disposed in 1978.

The Pelham Bay Landfill was added to the New York State Registry of Inactive Hazardous Waste Sites in 1983 as Class 3; in 1984, it was changed to 2a, due to insufficient data. In 1987, based on information provided to the DEC regarding the disposal of hazardous waste, the site was reclassified as 2, meaning that a significant threat to the environment or public health existed at the site.

In 1986, the federal government amended the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 through the Superfund Amendments and Reauthorization Act (SARA) and the state implemented the Environmental Quality Bond Act (EQBA). As a result, in April 1990, NYSDEC and New York City entered into a Consent Order requiring that a Remedial Investigation/Feasibility Study (RI/FS) be conducted in accordance with the USEPA RI/FS Guidance Documents and Procedures.

In 1990, a lawsuit was filed by the New York Coastal Fisherman's Association against New York City for violations of the Federal Clean Water Act. As a result of this litigation, a Permanent Injunction was issued requiring the City to take measures to prevent leachate from entering Eastchester Bay. This resulted in the design and construction of a "150 day leachate collection system" consisting of 5 tanks each having 20,000 gallons storage capacity, five interceptor wells, a

force-main that takes the discharge from the interceptor wells and a nearby sump to the storage tanks and expansion of the existing french-drain system.

The New York City Department of Sanitation (NYDOS) was responsible for the management of the Pelham Bay landfill until February, 1991. After this date responsibility for this site was transferred to the New York City Department of Environmental Protection (NYCDEP). The RI/FS drilling activities began in May of 1992 and were completed in July, 1992. The Remedial Investigation Report was submitted in April 1993 and a Feasibility Study Report was submitted in June 1993.

SECTION 2.2 REMEDIAL HISTORY

In 1980 a groundwater investigation conducted at the site by the NYCDOS indicated that concentrations of nine constituents in the groundwater samples exceeded NYSDEC groundwater standards. The constituents included arsenic, barium, cadmium, chloride, chromium, lead, manganese, mercury and selenium (Geraghty & Miller,1980).

Surface water, groundwater and landfill gas samples were collected and analyzed as part of an investigation of indicator pollutant levels at New York City landfills prepared for NYCDOS (Parsons Brinkerhoff Cosulich, 1982). Samples were analyzed for 32 volatile organic compounds, polychlorinated biphenyls (PCBs), phenols, cyanide, and heavy metals. Analytical results were compared to NYSDEC Surface Water and Groundwater Quality Standards , (6 NYCRR, Part 703) and NYSDEC draft cleanup policy guidelines (1991). USEPA standards were used when New York State standards did not exist. Results from this study are summarized below:

- Mercury concentrations in surface water samples exceeded NYSDEC draft cleanup policy guidelines (1991) and silver concentrations exceeded USEPA Surface Salt Water Standards.

- Cadmium, copper, lead, mercury, zinc, phenol, cyanide, toluene and chlorobenzene concentrations in groundwater samples from on-site monitoring wells exceeded NYSDEC Groundwater Quality Standards (6 NYCRR, Part 703).

- PCB concentrations were below detection limits for all surface water and groundwater samples.

- Purgeable organics were not detected in landfill gas samples.

A flyover test of ambient air above the site was conducted by the NYSDEC in 1982. The test indicated that total non-methane hydrocarbons were not distinguishable from background concentrations.

Landfill gases were sampled and analyzed from two wells by NYSDEC in 1982. The test results indicated that concentrations of hazardous air contaminants within the landfill were low.

In the summer of 1982, NYSDEC collected hard and soft clam samples in the vicinity of the site. Follow-up samples were taken in September 1983. These samples were analyzed for PCBs, metals and priority pollutant organics. Chemical analyses by NYSDEC received in January 1984 indicated that, while most analytes were below detection limits, several were found at concentrations above these limits. However, identification of the reported contaminants could not be confirmed by mass spectrometry. NYSDEC concluded that there was reason to believe that the reported contaminants were not present in the fish at the levels reported and were not probably present at all.

In 1988, NYCDOS sampled and analyzed gas and leachate seeps emanating from the site. The results, summarized below, are based on NYCDOS's interpretation of the data.

-Measured concentrations of toxic materials did not exceed Extraction Procedure Toxicity (EPTOX) concentrations.

-Leachate quality met New York State Groundwater Standards with the exception of lead, 1,4-dichlorobenzene, napthalene, selenium and mercury.

-Concentrations of volatile organic compounds in landfill gases were within ambient air limits.

In March 1988, NYSDOH and NYSDEC collected leachate and landfill gas samples at the site. Additional landfill gas samples were collected in April 1988. NYCDOS reviewed the data and concluded the following:

-Leachate and gas samples revealed compounds that are common in leachate from other municipal solid waste landfills.

-Pollutant levels in the leachate were relatively low as compared to leachate from other landfills.

-The concentrations of most pollutants in the leachate were below drinking water standards.

-The concentrations of leachate constituents were similar to concentrations in New York City and New York State urban storm water runoff.

-Pollutant concentrations in landfill gas on the site were generally below the American Conference of Governmental Industrial Hygienists' Threshold Limit Values which are designed for protection of healthy workers having an 8-hour per day shift, 5 days per week.

In April 1988, NYCDOH sampled surface water near the site and found the water safe for swimming. Also in 1988, Cornell University collected soil samples from a senior citizens' garden located within the west side of the site and analyzed these samples for 23 metals including lead. Results indicated that lead was present at levels that made these soils unacceptable for garden use.

In November 1989, the NYCDOS installed 12 monitoring wells and completed soil borings as part of an environmental assessment of the site. This assessment also included surface water, soil, groundwater, leachate, air and sediment sampling. Four sampling events were also conducted in

January, April, July and October of 1990. These results are summarized in the Feasibility Study Report for the Pelham Bay Landfill dated June 1,1993.

SECTION 3: CURRENT STATUS

SECTION 3.1 SUMMARY OF REMEDIAL INVESTIGATIONS

The following paragraphs summarize the components and conclusions of the field investigations performed at the site. More detailed information regarding the individual investigations can be obtained by referring to the appropriate report(s) listed in the Administrative Record (Exhibit A).

In April 17,1990 the NYSDEC and the City of New York entered into a Consent Order requiring that a Remedial Investigation/ Feasibility Study (RI/FS) be conducted in accordance with the USEPA RI/FS Guidance Document. The RI/FS field work commenced in May,1992. Field work for the remedial investigation included a drilling program which began on May 11,1992 and ended on July 15, 1992. During this program 26 monitoring wells were installed at the site to provide stratigraphic information, groundwater flow and groundwater quality information. Of these wells, 20 were constructed on the perimeter of the site, 5 wells were installed at off-site locations and 1 well was installed in the middle of the landfill . Fourteen Piezometers were also installed.
The 20 monitoring wells along the perimeter were installed in well clusters at 10 locations. At each cluster on-site, 1 monitoring well was screened at the base of the overburden(native soils) just above the bedrock while the other monitoring well was screened in the bedrock. Of the 14 piezometers installed in the landfill, 8 were installed in 5 interior areas of the landfill. Groundwater/leachate characterization consisted of continuous water-level monitoring, synoptic water-level monitoring, groundwater sampling, aquifer testing (2 locations/ 2 geologic media), permeability testing and groundwater modeling. Monitoring wells were sampled from July 28,1992 to August 7,1992. A second round of sampling took place in January of 1993.

There were 9 surface water sampling locations in Eastchester Bay and 11 sediment sampling locations, 9 of which were co-located with the surface water sampling locations. Ecological investigations were also conducted to investigate the potential impact to ecological receptors. These included benthic macroinvertebrate community analyses and bioaccumulation studies (fish, shellfish [clams, mussels]).

With respect to the air monitoring program, a soil gas characterization was carried out from June 15 to July 23, 1992 and an ambient air quality monitoring program lasted from July 14 to July 23, 1992. The air samples consisted of 1) Volatile Organic Compound (VOC) analysis 2)inorganic gas analysis and 3) particulate, metals and Polynuclear Aromatic Hydrocarbons (PAH) analysis. To model off-site air quality impacts, Air Quality Dispersion Modeling was used in combination with off-site air monitoring data to evaluate long-term and short-term potential community impacts from the landfill air emissions. The Industrial Source Complex, Short-term and Long-Term Models were used.

A Supplementary Remedial Investigation (SRI) was conducted on March 31, and April 1, 1993 at the Pelham Bay Landfill. This investigation was conducted in order to address a data gap

that was identified during the RI with respect to whether off-site shallow soils have been adversely impacted by surface water runoff and/or leachate seeps from the landfill. The results of the SRI show that:

- Hotspots, or areas of grossly contaminated soils were not found during the SRI;
- VOCs, pesticides and PCBs are absent, or nearly absent in the on-site, off-site and background soil samples;
- Semi-volatile Organic (SVO) compounds, especially PAHs are ubiquitous in the Pelham Bay area. Similar SVO compounds and concentrations were detected in on-site, off-site, and background samples;
- Inorganic constituents are ubiquitous in the area. Concentrations of all inorganic analytes in off-site samples are generally similar to background concentrations;
- A connection between constituents detected in upgradient (on-site) and downgradient (off-site) surface water runoff channel soil samples could not be established; and
- Relatively high levels of Zinc (up to 1,710 mg/kg) were detected in the historic leachate seep area samples. The source of this Zinc is uncertain.

Public Information meetings were held at the beginning and end of the remedial investigation program.

Summary of Site Conditions

Groundwater Contamination - In general, groundwater contamination is greater on the east side of the landfill than on the west side. Ammonia nitrogen exceeds groundwater standards at 18 locations. Contaminant concentrations range from 1260 ppm at location MW 126 to 3 ppm at MW 109. The NYSDEC groundwater standard for Ammonia nitrogen is 2 ppm. With respect to inorganics (metals), the following exceeded groundwater standards at various locations at both shallow and bedrock levels: chromium, lead, arsenic and barium. There were no exceedances of groundwater standards for mercury. At one location, MW 118, cyanide exceeded groundwater standards. The concentrations of chlorides and sodium are high on the east side of the landfill due to Eastchester Bay while the concentrations of iron and magnesium are typical of a solid waste landfill. The landfill is the source of constituents in the groundwater/leachate that exceed NYSDEC Groundwater Standards and surface water discharge limitations. In the leachate seep samples, ammonia nitrogen,lead, arsenic, manganese, zinc and napthalene all exceeded effluent limits at various locations.

At the east seawall, 4,4 DDD and 4,4 DDE concentrations are above the NYSDEC draft sediment cleanup criteria and can be attributed to the landfill. At the south seawall, the constituents whose concentrations are above the NYSDEC draft sediment cleanup criteria and can be attributed to the landfill are 4,4-DDD, dieldrin and phenanthrene.

The source of this leachate is mostly precipitation infiltration into the waste and the leaching

of constituents from the waste. The leachate mound is also due to the groundwater flow into the waste mass from the southwest through Pelham Bay Park and the upward groundwater flow from the bedrock. This leachate mound includes groundwater within the solid waste mass and in the glacial till. The shallow groundwater flow system which consists of groundwater within the fill and till, represents the major discharge pathway from the landfill. It is estimated that approximately 70% of the flow in the shallow groundwater system discharges into Eastchester Bay; 30% into tidal wetlands across Shore Road. The volume of leachate from the landfill that is leaving the site from the saturated portion of the "fill and till" units and entering Eastchester Bay and the tidal wetlands is estimated to range from 50,000 to 75,000 gallons per day. There will be some attenuation of leachate chemicals in the shallow groundwater pathway, but it will be minimal due to the short travel time to the tidal wetlands and the surface water.

Groundwater in the bedrock aquifer can discharge into bedrock off-site, into Eastchester Bay, or upward into the fill or till. Contaminants in the bedrock flow system are expected to migrate along fractures in the bedrock. The pathways in this system are believed to be limited both horizontally and vertically. Because there is no attenuation in this aquifer, the contaminants will not be affected during this transport.

Eastchester Bay Surface Water - The tidal surface waters in Eastchester Bay, adjacent to the landfill, have been designated Class "SB" in accordance with NYSDEC, Title 6, Chapter X, Parts 700-705. The Class SB waters are suitable for primary and secondary contact recreation and any other usage for primary contact recreation and for any other use except the taking of shellfish for market purposes. These allowed activities include; swimming, diving, water skiing, skin diving, surfing, fishing and boating. Commercial and non-commercial shell fishing is not allowed in the area immediately adjacent to the landfill. However, it is recognized that some residents take shellfish illegally. There are numerous private beaches and one public facility, Orchard Beach along Eastchester Bay and the surrounding waters in this area.

Air Emissions - The landfill decomposition gases, including methane and VOC, are presently leaving the landfill through cracks in the existing cover, vent holes, and other openings. Atmospheric dispersion is the main mechanism affecting contaminant concentrations in the vicinity of the landfill. Atmospheric fate processes, such as photodegradation will not significantly affect airborne constituents concentrations in the immediate vicinity of the landfill. Short-term modeling indicates that landfill emissions typically can account for no more than 25% of the VOC concentrations measured in the community, but could account for the majority of methane concentrations measured in the community. Long-term modeling predicts annual average concentrations within the surrounding community which are less that 1% of the New York State AVG's for most VOC's. Short-term and long-term modeling predicts air constituents which are below New York State SCG's for most VOC's.

With respect to lateral movement of landfill decomposition gases, the landfill is bordered by Eastchester Bay on the North and East. Shore Road bounds the site on the West. However, a leachate collection system was previously installed along the road which acts as a passive collection system. The southwestern perimeter is bounded by Pelham Bay Park and there is a potential for migration of gases into the Park. Although there is no evidence of vegetative stress in this area there may be movement of gases after placement of the final cover.

SECTION 3.2 INTERIM REMEDIAL MEASURES

To comply with the Permanent Injunction issued by U.S. Federal Court because of Clean Water Act Violations, an Interim Remedial Measure (IRM) was initiated by the NYCDEP to reduce threats to public health and the environment due to leachate releases from the landfill. This IRM is also referred to as the "150 Day System", because it was required to be constructed within 150 days. The IRM focused on those areas where leachate seeps were visible and in areas where contact by human receptors was possible. These areas included:

1) The abandoned storm sewer (near MW-117 on Figure 1-2);

2) The rip-rap and sand shore in the park near the abandoned sewer (near MW-115 on Fig 1-2); and

3) The french drain which collected leachate from the northwest part of the landfill.

NYCDEP evaluated alternatives for collection and disposal of leachate from these three areas. As a result of recommendations in the April 1991 report, entitled " Assessment of IRM Activities for Leachate Management at Pelham Bay Landfill", the following specific actions were taken with respect to leachate containment:

Abandoned Sewer Outfall
- the end of the outfall was closed;
- a sump pump was installed at the bottom of the pipe and leachate in the pipe was collected and transported via force-main to five 20,000 gallon storage tanks. The leachate was then transported to the Hunts Point Treatment Plant.

Park Shoreline Seep
- five shallow leachate interceptor wells were constructed inside the landfill property;
- the wells are pumped and the leachate is piped via the above-mentioned force-main to the storage tanks.

French Drain Discharge Area
- a concrete sump has been constructed to collect the leachate from the french drain;
- the discharge is piped to the storage tanks.

The IRM system consists of the above mentioned measures and trucking of the leachate to the Hunts Point Treatment Plant for treatment and disposal. As an example, for the month of April, 1993, the total amount of leachate hauled from this system was 2,866,511 gallons. The ammonia nitrogen concentration of this leachate was 570 mg./liter. IRM construction activities began in January of 1992 and are almost complete. At this time the containment berms surrounding the tank pad are being repaired and the decontamination pad adjacent to the containment area is being improved. The electrical systems are also being updated. The IRM/150 Day System will be integrated into the proposed remedial action. For example, the five tanks will continue to be used for storage.

SECTION 3.3 SUMMARY of HUMAN EXPOSURE PATHWAYS

A Baseline Risk Assessment Report, dated June 1, 1993, was prepared which consisted of two volumes. Volume I is the Human Health Evaluation, while Volume II is the Ecological Evaluation. The Human Health Evaluation concludes that, based on the exposure pathways evaluated, the only current exposure pathway which may pose a potential long-term health concern is the exposure of landfill workers and youth trespassers to contaminated soils. However, both the risks and the populations exposed are so low that, based on the analysis presented in this risk assessment, in all probability no additional cases of cancer would result even if no remediation were to take place. Adverse noncarcinogenic health effects are not expected to occur.

SECTION 3.4 SUMMARY of ENVIRONMENTAL EXPOSURE PATHWAYS

The Ecological Evaluation made the following conclusions:

- The concentrations of eight (8) chemicals in surface soils on the Pelham Bay Landfill (as well as off-site areas) pose a potential toxicity and reproductive risk to predatory terrestrial wildlife.

- The concentrations of six (6) chemicals in groundwater/leachate from the Pelham Bay Landfill pose a potential toxicity hazard to aquatic life near seeps discharging to Eastchester Bay along the seawalls. Shellfish and other immobile animals are at greatest risk.

- The toxic effect of groundwater/leachate discharging along the south seawall is also evidenced by the reduced growth of rockweeds in that area.

- The limited extent of toxic effects on Eastchester Bay estuarine ecosystem is evidenced by the numbers and variety of estuarine aquatic life inhabiting sediments in the vicinity of the landfill.

- The laboratory analyses of fish and shellfish from areas near the landfill indicate that actual concentrations of Contaminants Of Concern (COCs) in fish tissues are lower than predicted based on bioaccumulation modeling.

SECTION 4: **ENFORCEMENT STATUS**

The following Orders On Consent have been executed by the New York City Department of Sanitation and the NYSDEC:

Date	Index Number	Subject of Order
Dec. 1985	2-0956	Remedial Investigation
Apr. 1990	2-03-001	Remedial Program

The 1985 Order On Consent was to require the City to undertake the investigation and remediation of the landfill as required under the Inactive Hazardous Waste Disposal Site Act, Article 27, Title 13 of the Environmental Conservation Law and 6NYCRR Part 375. The 1990 Order On Consent updated the 1985 Order and addressed the funding, site investigation and remediation requirements of Title 3 of the Environmental Quality Bond Act.

The following Permanent Injunction was handed down by Federal Court as a result of a suit by the New York Coastal Fishermen's Association against New York City:

Date	Index Number	Subject of Injunction
Nov 1991	90 CIV. 4721 (GLG)	Clean Water Act Viol.

SECTION 5: SUMMARY OF REMEDIATION GOALS

The remedial alternatives proposed for the site by the Department were developed in accordance with the New York State Environmental Conservation Law (ECL) and are consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), 42 USC Section 9601, et. seq., as amended by the Superfund Amendment and Reauthorization Act of 1986 (SARA). The criteria used in evaluating the potential remedial alternatives is described in the National Contingency Plan 140 CFR 300.43 and can be summarized as follows:

1. Compliance with Applicable or Relevant and Appropriate New York State Standards, Criteria and Guidelines (SCGs)-- are divided into the categories of chemical-specific (e.g. groundwater standards), action-specific (e.g. design of a landfill), and location-specific (e.g. protection of wetlands).

2. Protection of Human Health and the Environment-- This criteria is an overall and final evaluation of the health and environmental impacts to assess whether each alternative is protective. This is based upon a composite of factors assessed under other criteria, especially short/long-term effectiveness and compliance with SCGs.

3. Short-term Impacts and Effectiveness-- The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment is evaluated. The length of time needed to achieve the remedial objectives is estimated and compared with other alternatives.

4. Long-term Effectiveness and Permanence-- If wastes or residuals will remain at the site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude and nature of the risk presented by the remaining wastes; 2) the adequacy of the controls intended to limit the risk to protective levels; and 3) the reliability of these controls.

5. Reduction of Toxicity, Mobility and Volume-- Department policy is to give preference to alternatives that permanently and significantly reduce the toxicity, mobility, and volume of the wastes at the site.

6. Implementability-- The technical and administrative feasibility of implementing the alternative is evaluated. Technically this includes the difficulties associated with the construction and operation of the alternative, the reliability of the technology, and the ability to effectively monitor the effectiveness of the remedy. Administratively, the availability of the necessary personnel and material is evaluated along with potential difficulties in obtaining special permits, right of way for construction, etc.

7. Cost-- Capital and operation and maintenance costs are estimated for the alternatives and compared on a present worth basis. Although cost is the last criterion evaluated, where two or more alternatives have met the requirements of the remaining criteria, lower cost can be used as the basis for final selection.

8. Community Acceptance - Concerns of the community regarding the RI/FS reports and the Proposed Remedial Action Plan are evaluated. A " Responsiveness Summary" will be prepared that describes public comments received and how the Department will address the concerns raised. If the final remedy selected differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

The site specific goals for remediating the Pelham Bay Landfill can be summarized as follows:

- close the site in conformance with applicable, relevant and appropriate requirements (ARAR).
- treatment and/or containment of the site such that, to the extent technically feasible, the concentration of contaminants is reduced to below acceptable levels of risk or to within discharge limits.
- ensure that remedial activities do not increase the potential for the migration of contamination to the groundwater, surface water and ambient air.

- o protect people who perform recreational activities in Pelham Bay Park from the harmful effects of contaminants in the air, soil, and water.

- o prevent significant adverse environmental impacts on the surrounding flora, and fauna caused by contaminant release from the landfill.

- o control and treat landfill gas.

The following section addresses the alternatives that have been evaluated to achieve these goals.

SECTION 6: SUMMARY OF EVALUATION OF ALTERNATIVES

SECTION 6.1 SCREENING OF ALTERNATIVES

Although the NYSDEC has elected to treat the Pelham Bay Landfill Site as one "operable unit" (i.e., as one area for application of remedy), the site lends itself to the approach of examining alternatives for each of the various affected media separately, then assembling a recommended site-wide alternative from the most feasible alternative evaluated for each medium. The screening criteria focused on technologies capable of achieving control of contaminant release or migration from the site, taking into account waste characteristics and site characteristics.

SECTION 6.2 DESCRIPTION OF ALTERNATIVES

Various remedial technologies are assembled together (as discussed below) to provide alternatives that will satisfy environmental, institutional, and technical objectives for remediation and closure of the landfill.

Alternative I - No Action/Limited Action.

Under the No Action/Limited Action alternative, there would be monitoring and institutional controls for the Pelham Bay Landfill. Features included in this alternative are:

- Long-term analytical monitoring of the media of concern including air, groundwater, sediments, soil/landfill contents, storm water runoff and leachate quality;

- Deed restrictions limiting future site usage; and

- Fencing the site to limit access and installation of warning signs.

Long-term monitoring would include the collection and testing of air, storm water, sediment, groundwater, and leachate samples from the site on a semi-annual or less frequent basis. This option would include monitoring to track the direction and migration of the contaminants in these media. Deed restrictions would be obtained to limit the future use of the site and prevent public contact with landfill contents. Fencing currently exists along the inland portion of the site; however this fence would be extended to encompass the remainder of the site. More warning signs would also be posted

at discrete intervals to warn the public of hazards.

Alternative II - Capping with Gas and Water Management Technologies, Long-Term Monitoring.

Remedial Alternative II consists of the following components:

- A landfill cap;
- Fencing and institutional controls to limit site access and use;
- Active gas venting with treatment;
- Groundwater management with vertical barrier and collector drains in the southwest boundary of the site;
- Shallow groundwater/leachate equalization;
- Shallow groundwater/leachate monitoring; and
- Continuation of existing IRM/150-day system.

The landfill cap described above includes the following layering scenario (as installed from the rough-graded landfill surface upwards):

- Supplementary fill layer for final grading of landfill surface;
- Geotextile filter layer;
- Geonet gas venting layer;
- Geomembrane barrier layer;
- Geonet drainage layer;
- Geotextile filter layer;
- Protective layer constructed of loamy soil; and
- Vegetated topsoil layer.

The cap would be installed over the entire landfill surface area, which is estimated at approximately 100 acres. The supplementary fill to be placed on the landfill surface following initial rough grading and proof-rolling of the surface would be final graded to inhibit storm water flow onto the site, to control the drainage of storm water runoff, to bring landfill slopes less than 4% into compliance (to at least 4%) and to construct an access roadway around the landfill. The average slope currently

existing at the site is approximately 20% (this corresponds to a 5:1 slope, or 5 ft. horizontal to 1 ft. vertical). However, there are large portions of the landfill, in particular, on the eastern side, where the slopes approach 45% (this corresponds to a 1:1 slope).

Fencing and institutional controls, as previously described, are the elements of this alternative.

Active gas collection systems consist of several elements. These include installation of deep extraction wells, lateral well connections, header pipe, condensate systems, and gas transport systems (vacuum source). Gas extraction wells would be installed in the landfill refuse. The extraction wells would be drilled to 80% to 90% of the refuse thickness. However, the well depth would not penetrate the groundwater table or mound. The EPA method 2E would be used to determine well spacing.

Shallow groundwater/leachate management for alternative II consists of a vertical barrier and drain system along the southwest and a portion of the southern site boundary as shown in Fig. 1-9. A slurry cutoff wall would be appropriate for this portion of the site. A slurry cutoff wall constructed along the southern and southwestern border of the site would be about 1800 feet in length. The depth and width of the wall would be calculated during design. The slurry cutoff wall could be constructed either of soil-bentonite or cement bentonite with the final permeabilities expected to range between 10^{-6} and 10^{-7} cm/sec, respectively.

Collector drains are required to lower the water table that would mound because of the construction of the low-permeability vertical barrier. For this alternative, two independent drain systems are proposed. One would be constructed upgradient of and parallel to the vertical barrier to collect groundwater that would normally flow onto the site from Pelham Bay Park. This upgradient drain is shown in Fig, 1-6.) The second drain system would collect shallow groundwater/leachate from the site (downgradient drain). The segregated "clean" groundwater collected in the upgradient drain would be diverted directly into Eastchester bay. The downgradient collector drain is designed to collect water migrating from the landfill. This water would be pumped to the leachate equalization system which is described later in this section.

The two collector drains would be designed to maintain water levels at similar elevations on both sides of the cutoff wall. Currently, the estimates for the maximum volume of water collected by the upgradient drain is about 28,000 gallons per day (about 20 gpm). A similar volume would be captured by the downgradient drain.

The goal of the equalization system is to regulate leachate discharge quality and consistently meet the POTW's influent quality requirements. The equalization system described below would reduce the range of potential leachate characteristics fluctuations and therefore meet the POTW's influent requirements.

The equalization system includes three major systems. They are:

- leachate collection system;
- equalization systems; and

- leachate discharge system.

The leachate collection system consists of piping and a pumping station (if required) to convey leachate from the water collection points to the equalization tanks. Only the existing aforementioned IRM storage tanks would be used for the proposed equalization system at this time. The leachate discharge system would pump the equalized leachate from the equalization (IRM) tanks via a two-inch diameter double walled pipe force main to the nearest or most accessible POTW's sewerage system manhole. The pump station would be a prefabricated package unit. The IRM/150 Day System would continue operation as part of this alternative. Groundwater monitoring is a required part of this alternative, as it is for the no action/limited action alternative (Alternative I).

Alternative III - Capping with Gas & Water Management and Treatment, Long-Term Monitoring, and Extraction Wells.

This alternative consists of the following components:

- A landfill cap;
- Fencing and institutional controls to limit site access and use;
- Active gas venting with treatment;
- Groundwater management with the vertical barrier and collector drains in the southwest boundary of the site; extraction wells in other areas of the site;
- Shallow groundwater/leachate pretreatment and discharge to the POTW;
- Shallow groundwater/leachate monitoring; and
- Continuation of existing IRM/150 day system.

The landfill cap, fencing and institutional controls, gas management, vertical barrier, shallow leachate collector, the groundwater collector drain system, and continuation of the 150 Day System are the same in this alternative as in Alternative II. In addition, this alternative includes extraction wells along Eastchester Bay. Extraction wells for groundwater control are designed to create a cone of influence or depression such that shallow groundwater/leachate flows towards the wells. The SWIFT/386 model predicts that 12 wells are sufficient to minimize shallow groundwater/leachate discharges from the landfill. The predicted locations of the wells are shown in Fig. 1-7. The model predicts that near the southern perimeter of the landfill, the saturated thickness of the fill/till is too thin to effectively control discharges. Therefore, a drain that is about 500 feet is proposed in this area This drain is proposed to be at a depth of about 8 feet and is in addition to the drain proposed as part of Alternative II. The total volume of water predicted from the modeling to be captured by the 12 wells with the proposed collector system is about 50 gpm or about 75,000 gallons per day. This water is primarily due to infiltration and saltwater intrusion.

Alternative IV - Capping with Gas & Water Management, Treatment, Vertical Barrier and Long-Term Monitoring.

This alternative consists of the following components:

- A Landfill cap;
- Fencing and institutional controls to limit site access and use;
- Vertical Barrier with a concrete barrier/slurry cutoff wall combination, including the barrier/drain system proposed for the southwest corner of the site in Alternative II;
- Active gas venting with treatment;
- Shallow groundwater/leachate collection with drains;
- Leachate pretreatment and discharge to the POTW; and
- Continuation of the existing IRM/150 day system.

The landfill cap, fencing and institutional controls, gas management, vertical barrier, shallow leachate collector, the groundwater collector drain system, and continuation of the 150 Day System are the same in this alternative as in Alternative II. In addition, a vertical barrier would be installed around the perimeter of the landfill including the southwest border adjacent to Pelham Bay Park, as described above for alternative II.

In this alternative, a slurry cutoff wall constructed along the western and southwestern borders of the site would be about 3600 feet in length and two to three feet in width and 25 to 40 feet in depth depending on depth to bedrock, as shown in Fig. 1-8. The slurry cutoff wall constructed along the seawall would be approximately 4200 feet in length and approximately 30 to 40 feet in depth.

This alternative includes the vertical barrier and drain system along the southwest site perimeter as described for Alternative II. This same system is extended completely around the site perimeter for this alternative such that a vertical barrier and collector drain system surrounds the landfill. The collector drain for alternative IV is estimated to be 7,800 feet in length at the locations shown in Fig.1-8. This drain/ vertical barrier is additional to that proposed in alternative II. The same construction and design techniques described for the alternative II collector drains apply to this drain system. It is expected that the shallow groundwater/leachate collected with this perimeter system would be piped into the leachate pre-treatment system along with the water collected from the downgradient drain as described for alternative II. The volume of shallow groundwater/leachate collected by the perimeter drain is estimated by the swift model to be about 45,000 gallons per day (about 32 gpm).

The most likely method to be used in the construction of a vertical barrier, however, is the construction of a concrete barrier. An illustration of the proposed concrete barrier wall is contained in

figure 1-9.

The concrete barrier wall would be constructed of a 10 inch concrete unimat which is a technology available from numerous manufacturers. The concrete mat would be placed on top of a geomembrane. This geomembrane would provide a significant portion of the barrier function for the wall since the concrete is not expected to maintain its integrity as a low-permeability layer over the long-term. The geomembrane installed would be textured to increase the friction angle between itself and the underlying leveling course. This leveling course also may be constructed to provide mild undulations, if it is determined that additional friction between the leveling course and the geomembrane would be necessary to prevent slippage of the geomembrane. Anchoring of the geomembrane at the toe of the wall would be accomplished by placement of grout-filled nylon bags on top of the geomembrane. These grout-filled bags also would serve to anchor the unimat and prevent sliding. Anchoring of the geomembrane and the unimat at the intersection of the seawall and the vertical portion of the rip rap wall would be performed.

A significant amount of preparation of the existing seawall would need to be performed prior to construction of this wall. Cofferdams may need to be constructed in the bay to facilitate access to the portion of the seawall below the water level.

SECTION 6.3 EVALUATION OF ALTERNATIVES

Remediation of the Pelham Bay Landfill entails addressing the main landfill mass; landfill leachate; landfill gas; contaminated groundwater and long term monitoring. Different combinations of the feasible remedial technologies were assembled into four groups as described above in Section IV-B.

Alternative I

This alternative would not meet state ARARs for landfill closure (6 NYCRR Part 360). This alternative also does not meet ARARs for groundwater discharge into Eastchester Bay and groundwater quality standards. If the no action/limited action option is implemented, exceedances of chemical-specific ARARs would continue.

Protection of Human Health and the Environment - The site poses unacceptable risks to human health (for on-site exposures only) and the environment under current conditions. If this alternative is implemented, the shallow groundwater/leachate would continue to flow off-site, into the Bay and onto beach areas and landfill gas would continue to migrate off-site. This alternative would not be protective of human health and the environment because it would not minimize on-site and off-site migration along the contamination pathways. Also, if the institutional controls should fail (i.e. the public cutting the fence open), unrestricted use of the site could occur. The residual risks posed by the site after implementation of this alternative would only be slightly reduced.

Short-term Effectiveness - Implementation of this alternative would have little or no overall short-term impacts. Minimal short-term impacts may be associated with installing fencing on-site. Personal protective equipment as specified by the site specific Health and Safety Plan (HASP) would control exposure to workers.

Long-term Effectiveness and Permanence - The long-term effectiveness and permanence of this alternative is poor. Transport of contaminants via leachate seeps, groundwater and air would continue to occur. The adequacy of this alternative in restricting public access is uncertain. Barriers to public access (i.e. fencing,signs) are typically not very effective. Migration of leachate into the Bay would continue to occur and risks from direct contact and other pathways would remain.

Reduction of Toxicity, Mobility or Volume - This alternative would not reduce the Toxicity, mobility or volume of contamination at the site. No mass or Volume of contaminated material would be contained, treated or destroyed. Residual contamination would remain on-site.

Implementability - This remedial alternative is readily implementable, assuming deed restrictions are easily obtainable.
Over the long-term, improvements to groundwater and surface water would occur as contaminants in the landfill continue to degrade.

Alternative II

This alternative would fulfill the capping requirements under 6 NYCRR Part 360 regulations, thus meeting or exceeding the existing ARARs/SCGs for landfill closure. This alternative does provide for leachate collection and disposal. However, shallow groundwater/leachate would continue to migrate into the Bay, possibly exceeding ARARs. The active gas collection system component of this alternative would meet the requirements of 6 NYCRR Part 360 subsections 2.15, 2.16 and 2.17. Energy recovery and/or treatment systems would require state- approvals. Either flare system would meet the requirements of 6 NYCRR Part 201 and conforms to the applicable requirements of Parts 201 and 212.

Protection of Human Health and the Environment - Placement of a cap on the site would be protective of human health by preventing human contact with the wastes. The cap would also reduce the amount of infiltration of water thus reducing the quantity of leachate generated over time. Capping and implementation of a soil erosion and sedimentation plan would reduce erosion of the landfill surface which would also reduce the potential for exposure of waste materials. Capping also would result in an increase in quality of storm water runoff. Dust and odor control measures implemented during construction would provide short-term protection of human health and the environment. Monitoring of leachate and groundwater would be conducted to assure continued protection, especially in areas where groundwater collection is not proposed.

Active collection systems prevent landfill decomposition gas from migrating off-site which minimizes potential risks of fire and/or explosion due to methane accumulation. Gas destruction would facilitate compliance with the health-based ambient air quality impacts established in the ARARs. Permanent protection of human health and the environment is further assured by this alternative by restricting the future use of this site via deed restrictions.

Short-term Effectiveness - The short-term impacts associated with the placement of the cap on the landfill would be minimal. Exposure by workers and on-site personnel would occur only at the outset of construction activities, prior to the placement of the final grading layer. Health and safety practices outlined in site specific health and safety plan for the site would be strictly followed to

control this exposure. Exposure to dust would be controlled by appropriate use of personnel protective equipment and dust control systems. Short-term impacts associated with placement of a vertical barriers would be moderate. Exposure to worker and on-site personnel would be addressed in the site specific health and safety plan. Risks associated with the excavation of wastes are present with the construction and implementation of the drains system. Workers would have to take precautions to mitigate the risks from trenching, odors, and methane gas when installing the collector drains. Since the excavation may be deep in some areas, proper shoring of the trench slopes would need to be required to improve slope stability and prevent trench collapse. Gas emissions during construction would be minimized through engineering controls, such as blowers. Care would be taken during installation to keep flame sources away from open excavations and connected piping.

Long-term Effectiveness and Permanence - The cap would provide for long-term protection of the quality of the storm water. Although any cap would not immediately result in a significant reduction in leachate generation due to the amount of water currently existing in the landfill mass, it would minimize recharge by rainwater which would ultimately reduce leachate generation. The landfill would continue to discharge leachate to off-site areas.

A complete program for maintenance of the recommended cap would be required for the post-closure period. This maintenance program would involve monthly inspection and repair as necessary. Settlement of the landfill would also need to ne monitored by periodic surveys. These surveys would be important because the landfill is expected to continue settling for many years and damage to the cap may occur, which would require timely repair to prevent infiltration of rainfall.

This alternative is anticipated to handle the landfill gas. The gas system would provide a long term effectiveness in reducing gas migration and destroying collected gas. This destruction is permanent and irreversible with minimal residual risk remaining at the site. If the energy recovery system can be implemented, benefits from useful products and energy would be obtained. This alternative would require testing, and adjustment of the gas collection and treatment system throughout its operational life.

The long-term effectiveness of the leachate equalization system should be maintained by monitoring the effluent of the system. Should POTW pretreatment standards change or the leachate quality exceed current standards, the system would need to be retrofitted to continue to attain POTW standards.

The vertical barriers would maintain their effectiveness over the long-term with proper maintenance. This would provide a barrier to flow of contaminated shallow groundwater/ leachate off-site and would minimize the flow on to the site which would reduce the quantity of water to be pumped and treated. A complete program for monitoring and maintenance of the slurry cutoff wall would be required for the post-closure period. This maintenance program would involve monthly inspection and repair as necessary. A passive drain collection system would be effective as long as the water table does not drop below the level of the drain. Thus, the effectiveness of the drain is dependent upon the level at which it is placed. With the construction of the cap, water levels in the fill would decline. Design of the drain would consider post-construction water levels.

Reduction of Toxicity, Mobility or Volume - Installation of the cap would not reduce the toxicity of

the contaminants at the site. The recommended cap would reduce over time the leachate volume but would not reduce the movement of constituents present in the wastes in the landfill into the groundwater. The volume of the landfill would decrease to some degree over time from natural degradation.

Active gas collection systems would reduce the landfill gas mobility by preventing off-site migration. Thermal treatment systems reduce gas toxicity with more than 98% destruction of non-methane organic compounds. Secondary emissions such as NOx and CO from energy recovery systems would be considered negligible. These secondary emissions would be kept to a minimum by using appropriate process equipment and stringent adherence to regulations, such as 40CFR 60 Subpart D and Air Guide 1.

Installation of a vertical barrier and collector drains around a portion of the site would not reduce the toxicity or volume of,the contaminants at the site. The barrier would reduce the mobility of the contaminants in the shallow groundwater/leachate that flow off-site.

Implementability - Construction of the landfill cap would not involve any significant implementability problems although some sections particularly the side slopes may be difficult to construct. This technology is readily available and fully demonstrated. Standard construction practices would be followed with the implementation of appropriate health and safety protection measures. Quality control during construction would be very important since the effectiveness of the cap to reduce infiltration would depend on the quality of the finished cap. Quality control during construction activities as well as the materials used in the cap would be strictly maintained and controlled.

Construction of the slurry cut-off wall is expected to be moderately difficult due to the nature of the subsurface at the site, loss of slurry and collapse of the trench may occur. Care must be taken to prevent this occurrence. Remote mixing of materials is also expected to result in difficulty in implementation. Quality control during construction would be stringent.

Construction of the collector drain system is not expected to involve any significant implementability problems. This technology is readily available and fully demonstrated. Quality control would be necessary to ensure that the drains are placed at all locations at the appropriate level and that proper construction practices are followed to minimize failure due to clogging.

Alternative III

This alternative would be in compliance with the ARARs. Compliance of this alternative with capping, vertical barriers and collector drains, shallow groundwater/leachate pretreatment and gas collection and treatment elements would be the same as Alternative II. If required, the additional extraction wells would comply with ARARs for surface water discharges. NYSDEC groundwater standards would not be attained in the on-site groundwater; however, the migration off-site of groundwater that exceeds these standards would be significantly reduced. Restricted future use, through deed restrictions, would assure that the on-site groundwater would not be used as a potable water supply source.

Protection of Human Health and the Environment - The amount to which the capping, vertical barriers, collector drains, shallow groundwater/leachate pretreatment, and gas collection and treatment elements of this alternative would be protective of human health and the environment would be the same as Alternative II.

Short-term Effectiveness - The short-term impacts associated with the capping, vertical barriers, and collector drains, shallow groundwater/leachate pretreatment and gas collection and treatments elements of this alternative are discussed in Alternative II. There would be minimal risk to the community during the construction and implementation of the water collection and treatment system. Site workers would have to take standard precautions to mitigate any risks from drilling the extraction wells in landfill waste disposal areas. Dust control measures would be provided during construction of the water equalization process.

Long-term Effectiveness and Permanence - The long-term effectiveness and permanence of the extraction wells would be assured by monitoring groundwater quality and by measuring groundwater monitoring well water levels around the perimeter of the site to track contaminant loadings and determine if the design drawdown requirements are achieved and maintained. Since on-site groundwater standards cannot be met with this alternative, deed restrictions would be necessary to ensure that the site is not used for potable water supply. The residual contamination would be decreased by the continued pumping of the wells. The cap would also minimize the infiltration thus minimizing the generation of leachate.

Reduction of Toxicity, Mobility, or Volume - The reduction of toxicity, volume, and mobility of the landfill contents, landfill gas, and shallow groundwater/leachate for the alternative is the same as Alternative II.

Implementability - The discussion of implementability in Alternative II is the same for this alternative. No implementation problems are expected for the installation and operation of the extraction wells or the leachate treatment system.

Alternative IV

This alternative would comply with the ARARs. The discussion for the capping, gas collection, and leachate treatment elements of this alternative meet ARARs would be the same as Alternative II. The slurry cut-off wall would be designed in accordance with available EPA guidance documents (USEPA, 1984). There are no other ARARs relevant to vertical barrier usage, design or construction. Collector drains would comply with surface water and off-site groundwater ARARs by reducing the volume of leachate entering Eastchester bay and the groundwater. The groundwater ARARs would not be met, but future use restriction (deed restrictions) would restrict the on-site groundwater from being used as a potable water supply.

Protection of Human Health and the Environment - The discussion for the capping, gas collection and treatment, and leachate treatment elements of this alternative is the same as Alternative II. Placing a vertical barrier and collector drains around the site would be protective of human health and the environment by minimizing the amount of flow of leachate or groundwater, thus minimizing contact and exposure with leachate and groundwater.

Short-term Effectiveness - The discussion of the short-term impacts of the capping, gas collection and treatment, and leachate treatment element of this alternative is the same as presented for Alternative II. The short-term impacts associated with placement of a vertical barrier would be expected to be moderate. Exposure by workers and on-site personnel would occur during excavation activities for the vertical barrier as well as for the work conducted in the Bay area for construction of the concrete wall. Health and safety practices as outlined in the health and Safety Plan for the site would be strictly followed to minimize this exposure.

Risks associated with the excavation of wastes would occur during the construction and implementation of the drain system. Workers would have to take precautions to mitigate the risks from trenching, odors and methane gas when installing the collector drains. Since the excavation would be deep in some areas, proper shoring of the trench slopes would be required to insure proper slope stability and prevent trench collapse.

Long-term Effectiveness and Permanence - The long-term effectiveness and permanence of the cap, gas collection and treatment, and leachate treatment elements are the same as for Alternative II. The vertical barrier are expected to maintain their effectiveness over the long-term with proper maintenance, providing a barrier to flow of contaminated shallow groundwater/ leachate off-site and minimizing the flow on the site which would reduce the quantity of water needed to be pumped and/or treated. A complete program monitoring and maintenance of the slurry cutoff wall and the concrete barrier would be required for the post-closure period. This maintenance program would involve monthly inspection and repair as necessary.

A passive drain collection system is expected to be effective as long as the water table does not drop below the level of the drain. As such, the effectiveness of the drain is dependent on the level at which it is placed. With the construction of the cap, water levels in the fill would decline. Design of the drain would consider post-construction water levels. There may be difficulty with the initial trenching for the collector drains. Periodic maintenance would be necessary to ensure that siltation and iron and manganese precipitation do not cause blockage of the collector drains. This maintenance schedule would be determined during the final design. A drain system associated with the barrier wall would require operation for as long as the barrier wall causes ponding water upgradient of it. Maintenance of the cap is essential in reducing the volume of water that has to be collected by the drain.

Reduction Of Toxicity, Mobility or Volume - The discussions of the reduction of toxicity, mobility, and volume by the cap, gas collection and treatment, and leachate treatment elements of this alternative is the same for Alternative II. Installation of a vertical barrier and collector drains around a portion of the site would not reduce the toxicity or volume of the contaminants at the site. The barriers would reduce the mobility of contaminants in the leachate and groundwater from flowing off-site.

Implementability - Discussions of the implementability of the cap, gas collection and treatment, and leachate treatment elements of this alternative are discussed in Alternative II. Construction of the slurry cutoff wall is expected to be moderately difficult; due to the nature of the subsurface at the site, loss of slurry and collapse of the trench may occur. Care must be exercised to prevent this. Remote mixing of materials is also expected to result in difficulty in implementation. Quality control

during construction must be stringent.

Construction of the concrete barrier wall is expected to be moderately difficult. The excavation of soil would be difficult, because it would be through refuse and fill. Working on the seawall inside a cofferdam adjacent to the bay is expected to be affected by dewatering problems. Access to work area by barge due to the shallowness of the Bay, and proximity to bedrock outcrops or by truck due to difficult mobility conditions at the site. The primary difficulty with construction would be the trenching through the waste and if necessary, the rip rap wall. This is the same difficulty as with implementing the containment wall. Collector drains should capture the shallow groundwater/leachate and depress the water table which would reduce the pressure on the containment wall.

SECTION 6.4 SELECTION OF ALTERNATIVES

With respect to the threshold criteria Compliance with ARARs and Protection of Human Health and the Environment, Alternative I does not meet Federal or State ARARs nor is it protective of Human Health or the Environment. Alternatives II, III and IV all attain ARARs for landfill closure; gas management and treatment and water pretreatment while not attaining ARARs for on-site groundwater.

Alternatives III and IV would be protective of Human Health and the Environment with monitoring and future use restrictions while Alternative II would be protective of Human Health and the environment with monitoring and future use restrictions but it does not prevent groundwater/leachate discharge in most areas of the site. The only difference between Alternatives II and III would be the construction of at least 12 extraction wells on the site which are predicted to intercept more than 90% of the shallow groundwater/leachate that is generated by percolation of precipitation and movement of groundwater from Pelham Bay Park through the landfill. It is the contention of the NYSDEC that an engineered landfill cap and the reduction of the inflow of groundwater from the park due to the slurry wall/ collector drain system in the southwest corner of the landfill would be able to significantly reduce the generation of leachate which contains contaminants that exceed SPDES limits for the receiving water, Eastchester Bay.

In considering Short-term effectiveness criteria, Alternative I would have minimal short-term impacts, as expected, but would require a Health and Safety Plan (HASP). Alternatives II and III would have negligible short-term impacts. With dust control and precautions taken in the construction of the Part 360 cap and excavation for the slurry wall/collector drain system in the southwest portion of the landfill there would be minimal risk to the community and site workers.

There may be moderate impact in the short-term with Alternative IV because of the need for excavation through the waste for the construction of the vertical barrier and collector drains around the entire site. Stringent adherence to the HASP should minimize dust control.

Alternative I would not be effective in the long-term nor is it permanent because there would continue to be off-site migration of contaminants in the shallow groundwater/leachate and the air. The cap and slurry wall in Alternatives II, III and IV would provide long-term effectiveness by reducing leachate generation. Long-term effectiveness would be provided in these alternatives by the active gas

venting system with treatment. Therefore, with maintenance and monitoring Alternatives II, III and IV would continue to be effective in the long-term. Consideration of the final three criteria, Reduction in Toxicity, Mobility or Volume , Implementability and cost clearly exposes the differences among the four alternatives. Alternative I would achieve no reduction of TMV, would be easy to implement and would cost $869,000. On the other hand Alternative IV would achieve reductions in mobility for all media; toxicity for gas and volume for shallow groundwater/leachate. This Alternative would present much difficulty in implementation because of the construction of a vertical barrier and collection drain around the entire site, consequently it would be the most expensive at $63,000,000.

Alternatives II and III are similar in providing reductions in volume for shallow groundwater/leachate and reductions in toxicity of gases, but they are dissimilar in providing reductions in the mobility of landfill contaminants. They are both implementable through commercially available processes with minimal expected problems and are similar in price with Alternative II costing $49,000,000 and Alternative III costing $51,000,000.

As reflected in the above discussion and as is evident in Tables 5, Alternative I should be removed from consideration as a remedial option. Alternative IV should also be removed from consideration because of greater difficulties in implementability and the much higher cost.

Alternatives II and III are similar in many respects with the exception of two criteria, The Reduction of Toxicity, Mobility and Volume and the Protection of Human Health and the Environment. This exception is due to differences with respect to shallow groundwater/leachate control. The proposed construction of the extraction wells will increase the amount of leachate captured.

In recognition of this fact, the **NYSDEC recommends the adoption of Alternative III with stayed construction of the extraction wells.**

SECTION 7: SUMMARY OF SELECTED ALTERNATIVE

Based upon the results of the Remedial Investigation/Feasibility Study and remedy selection criteria, the NYSDEC is proposing to implement Alternative III Capping with **Active Gas Collection and Active Recovery, Long Term Monitoring, Groundwater Management, Leachate Management, Institutional Controls and stayed construction/installation of extraction wells.** The estimated Total cost to implement this remedy is $49,000,000,. The elements of the selected remedy are as follows:

1. A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation, maintenance and monitoring of the remedial program.

2. Regrading of sections of the site to ensure proper site drainage and minimize erosion.

3. Installation of an actively vented impermeable final cover, consistent with Part 360,to minimize surface infiltration of precipitation and collect gases generated by the wastes. An adequate number of gas collection points will be installed around the

perimeter and interior of the site to prevent the uncontrolled release of gases to the atmosphere. The major elements of the final cover will include vegetated top soil, a barrier protection layer, a drainage layer, a gas/water barrier (geomembrane) and a gas collection layer.

4. Installation and operation of the gas collection and recovery system. Gases collected in the final cover system will be conveyed through piping to a central point of collection at the surface of the landfill for recovery and/or treatment.

5. Installation of a groundwater management system which consists of a slurry wall and upgradient collector trench along the southwestern edge of the site [the upgradient system].

6. Operation of a leachate management system consisting of the existing 150 Day System, plus a leachate collection trench along the southwestern edge of the park [the downgradient system].

7. Restriction on the use of this site will be limited to ensure that the integrity of the remedy is not damaged or compromised. Any restrictions must be agreed to by New York City and put in the deed for the site.

8. A post-closure monitoring program to evaluate the performance of the remedial program. Monitoring would include surface water and groundwater sampling for the Target Compound List parameters during the first year and may be subsequently modified depending on the results.

9. Construction of leachate extraction wells on the Landfill, if required.

10. Fencing to limit site access and use.

SECTION 7.1

Two significant issues brought forth from written and oral public comments on the PRAP, regarding the collection and disposal of the leachate, require further discussion. Specifically, these issues involve (1) the need and timing of the installation of additional groundwater interceptor wells around the landfill perimeter, and (2) the construction and effect on the local residents of a force main to transport the leachate to the Hunts Point Sewage Treatment Plant.

In the PRAP, Alternative III was recommended with the stipulation that the decision to construct the additional groundwater interceptor wells along the Eastchester Bay perimeter of the landfill be deferred until after the placement of final cover on the landfill and the construction of the groundwater interceptor trench along the perimeter of the landfill adjacent to Pelham Bay Park. The purpose of this deferral was to determine the effectiveness of the remedial measures selected to minimize the generation of leachate, which is being discharged through leachate weeps into Eastchester Bay. The total amount of leachate generated from all areas of the landfill is projected to be reduced up to 70% through the placement of final cover and the installation of the trench along

the southwest perimeter by Pelham Bay Park. The remaining significant source of leachate will be from the saltwater intrusion into the landfill, which is estimated to affect about a 125 foot width around the landfill that "touches" Eastchester Bay. It is estimated that the leachate that will be generated from this tidal flushing will be significantly "cleaner" because the leachate from the interior portion of the landfill will be drastically reduced by the capping and the leachate from the 125 foot perimeter area has been flushed for years; most of the contaminants in this area have been removed. Therefore, the contaminants in this leachate will decrease after closure.

In deferring the installation of the interceptor wells, it is important to have periodic monitoring of both the leachate weeps and the groundwater monitoring wells along Eastchester Bay to determine if the pollutants in the groundwater are diminishing. This will be required in the post-closure monitoring of the landfill. In addition, the city will be required to install a test well and undertake groundwater modeling to locate the interceptor wells, if needed. This will minimize the time required to install the wells, if post-closure monitoring indicates their need.

Another question was raised concerning the city's willingness to install these wells in future years. In response, the city is under an existing Order On Consent with the NYSDEC; the NYSDEC will monitor post-closure activities at the landfill. In addition, as stated at the June 30 public meeting, the resumption of leachate discharges in the future would also constitute a violation of the Federal Court Order. Therefore, the city is obligated to maintain the facility for the post-closure period. The deferral of the interceptor wells is appropriate.

In regard to the method of transporting and treating the leachate, concerns were raised in regard to the capacity of the treatment plant, the capacity of the laterals proposed to transport the leachate and the treatability of the leachate at a municipal sewage treatment facility. Specifically, the public brought forth that the existing collection system in the surrounding neighborhoods cannot adequately handle flows during periods of rain. The existing sewers are combined, meaning they handle both sewage and stormwater runoff. During present storms the lines are not sufficient and flooding ensues. At the hearing, several residents stated that flooding occurs near or at their homes, presumably from the backing-up of the sewers. This problem occurs in many areas of New York City. The proposed force main will take the leachate about one-half mile from the landfill, which is approximately three-quarters of a mile from Spencer Estates and the Country Club area. This force main is not connected to any sewers or any other pipes during its one-half mile length. At the discharge point of the force main, it does appear that the leachate may combine with local laterals, which may include the sewage generated from the above mentioned neighborhoods. In regard to the capacity of the collection system and the Hunts Point Sewage Treatment Plant, the proposed leachate volume is 150,000 gallons per day, which is less than 0.5% of the capacity of the plant. The DEP has advised this agency that the plant has ample capacity to handle the leachate. However, to ensure that the leachate flow does not cause backup in the neighborhoods close to the landfill, nor any other neighborhood, the landfill will be required to store the leachate on-site during periods of rain. The leachate will then be discharged after the rain event from the storage tanks into the forcemain and the downstream laterals.

In regard to treatability, landfill leachate has been and is being treated in numerous municipal sewage treatment plants throughout the state. At present, over 50,000 gallons per day of leachate from this landfill is being transported to the Hunts Point Treatment Plant. As part of the issuance of

the Part 364 Industrial Waste Hauler Permit for the hauling vehicles, this waste was approved by the DEC for treatment at this plant. The maximum projected amount of leachate for this landfill is estimated to be 150,000 gallon per day, which should also be acceptable for the treatment facility. Therefore, the disposal of leachate at the Hunts Point Treatment Plant is acceptable.

SECTION 8: HIGHLIGHTS OF COMMUNITY PARTICIPATION

In addition to participation by members of the public, community participation connected with this site has been highlighted by the participation of three groups, the first one being the Pelham Bay Landfill Task Force which was started in February of 1989. It was initially an Ad Hoc group that was started by Assemblyman John Dearie. Bronx Borough President Fernando Ferrer made it an official body and asked John Dearie to be its first chairman. The second group is the Scientific Advisory Committee (SAC) , whose formation was also initially the idea of Assemblyman Dearie. The first three advisors were signed up by the NYCDOS with the additional members recruited by the NYCDEP, making a total of eight. The SAC had its first meeting in 1989 with the first three members. The third community group which has had a major impact on the remedial process is the New York Coastal Fishermens Association.

The Pelham Bay Landfill Task Force is comprised of Community representatives and politicians who strive to see that the interests of the communities surrounding the landfill are served at all times during the remedial investigation process. The task force tries to focus the attention of other politicians and public officials on the presence that the landfill has in the community.

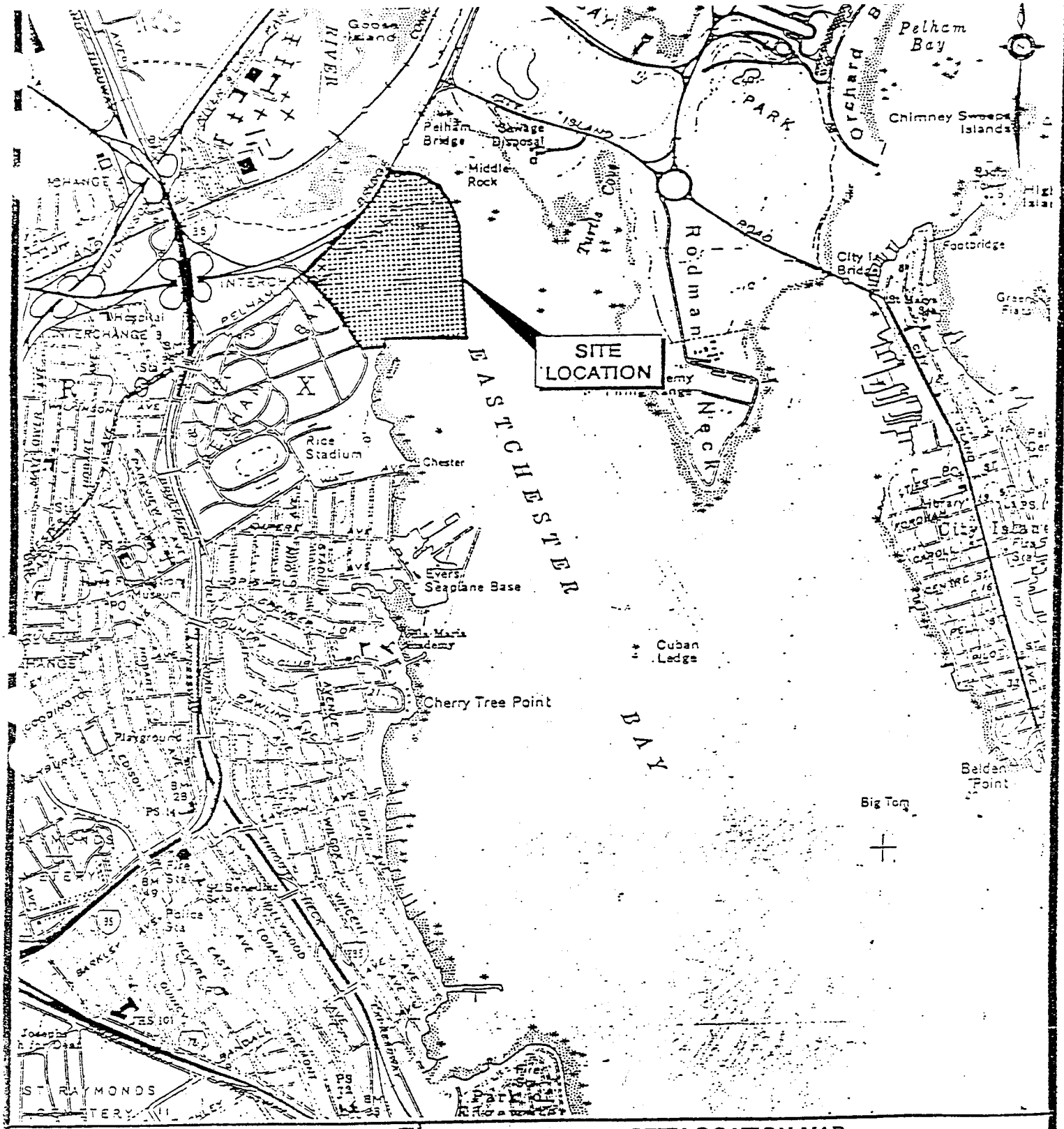
The NYCDOS and the NYCDEP assembled a team of eminent scientists and engineers in the Environmental field, particularly Environmental health, to provide oversight with respect to the RI/FS process. Their main focus with respect to this process was the health related aspects, particularly the health risk assessments and the question of whether and how much has the landfill impacted the general health and well-being of individuals who live close to the landfill. Early in the process their input was general in nature, but over time the SAC reviewed and provided comments on all the documents generated as a result of the RI/FS process and made helpful suggestions particularly with respect to indoor sampling.

The New York Coastal Fishermens' Association, headed by Wilma Turnbull, is the group that filed suit against the City of New York In Federal Court with respect to Clean Water Act Violations i.e. landfill leachate going directly into Eastchester Bay. The IRM was designed to comply with the permanent injunction that was issued with respect to the suit. It should be noted that some members of this group are also members of the Pelham Bay Landfill Task Force.

There were many public meetings which were organized to keep members of the public informed of the RI/FS process and the results thereof. In particular there was an RI/FS meeting on April 28,1993 at which the results of the RI/FS were presented and a PRAP meeting on June 30,1993 at which the proposed remedial solution for the site was presented. In attendance at these meetings were members of the SAC, Task Force and the Coastal Fishermens' Association. These meetings were well attended.

The citizens of the Bronx also participated in the process through writing comment letters on the RI/FS documents which were made available to them in the various repositories which consisted of Public Libraries and the Offices of elected officials.

FIGURES

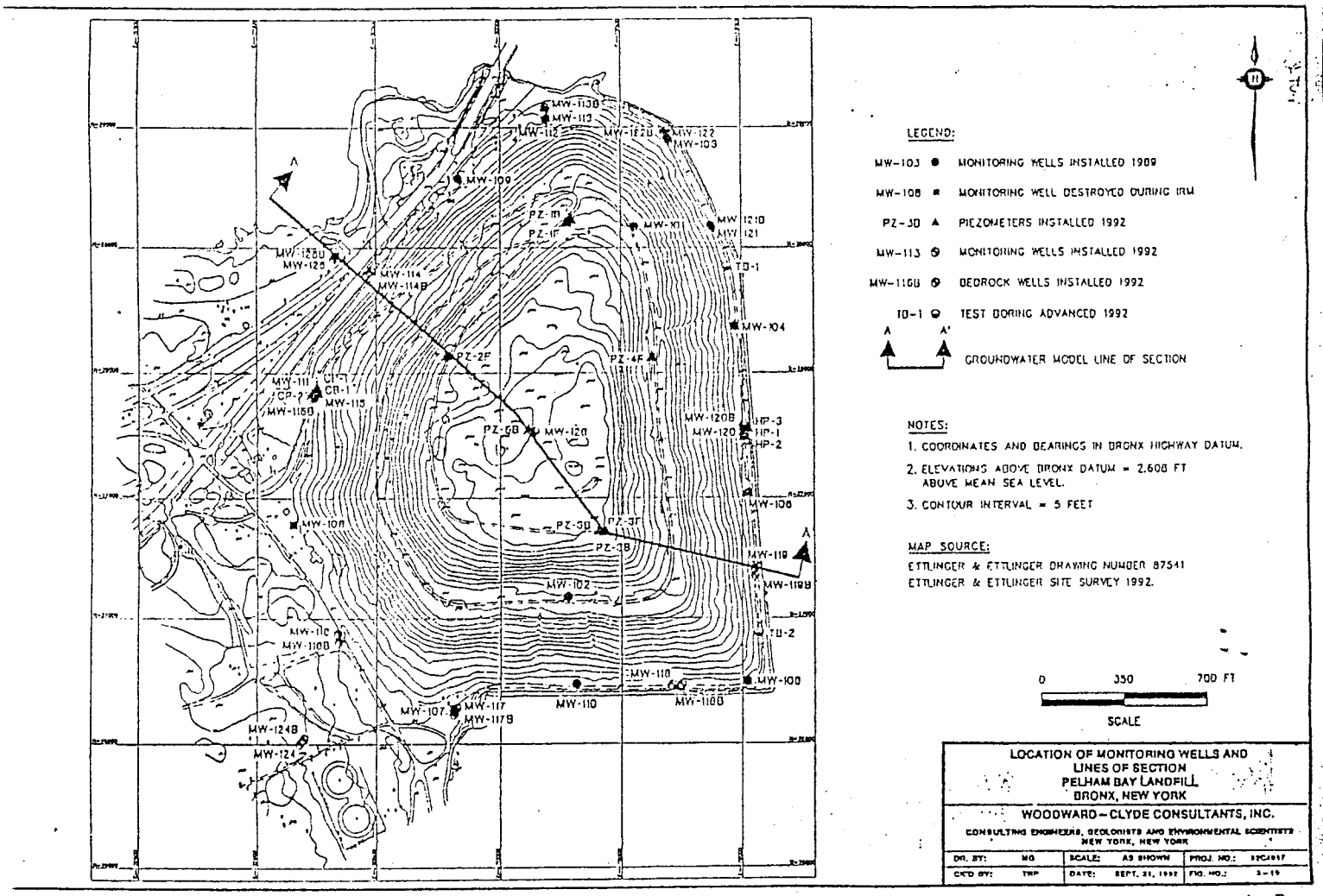


SITE LOCATION MAP
PELHAM BAY LANDFILL
BRONX, NEW YORK

WOODWARD—CLYDE CONSULTANTS, INC.
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
NEW YORK, NEW YORK

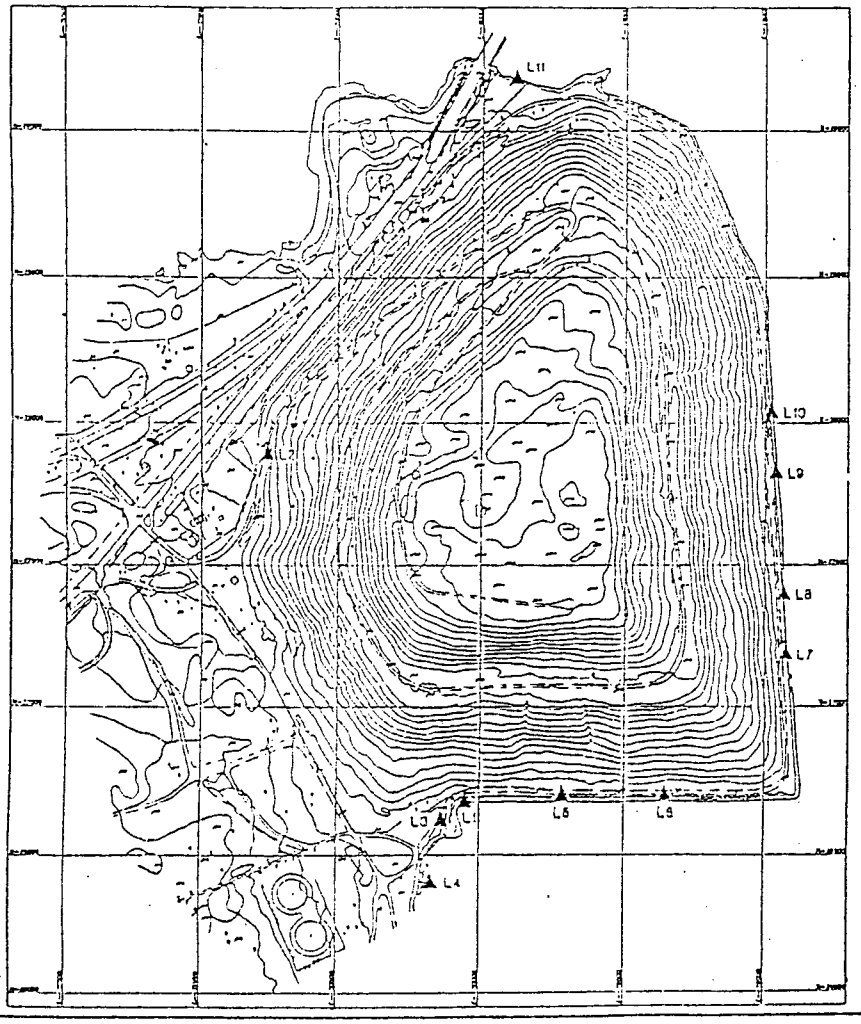
DR. BY: KJF	SCALE: AS SHOWN	PROJ. NO.: 92C4087	
CK'D BY: MEC	DATE: SEPT. 29, 1992	FIG. NO: 1-1	

MAP SOURCE:
FLUSHING, N.Y. USGS QUADRANGLE MAP, 1979.


LEGEND:
MW-103 ● MONITORING WELLS INSTALLED 1989
MW-108 ■ MONITORING WELL DESTROYED DURING IRM
PZ-3D ▲ PIEZOMETERS INSTALLED 1992
MW-113 ⊕ MONITORING WELLS INSTALLED 1992
MW-116B ⊕ BEDROCK WELLS INSTALLED 1992
TD-1 ⊖ TEST BORING ADVANCED 1992
A A' GROUNDWATER MODEL LINE OF SECTION
NOTES:
1. COORDINATES AND BEARINGS IN BRONX HIGHWAY DATUM.
2. ELEVATIONS ABOVE BRONX DATUM = 2.608 FT ABOVE MEAN SEA LEVEL.
3. CONTOUR INTERVAL = 5 FEET
MAP SOURCE:
ETTLINGER & ETTLINGER DRAWING NUMBER 87541
ETTLINGER & ETTLINGER SITE SURVEY 1992.
0 350 700 FT
SCALE
LOCATION OF MONITORING WELLS AND LINES OF SECTION
PELHAM BAY LANDFILL
BRONX, NEW YORK
WOODWARD-CLYDE CONSULTANTS, INC.
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
NEW YORK, NEW YORK
DR. BY: MG SCALE: AS SHOWN PROJ. NO.: 92C4017
CK'D BY: TMP DATE: SEPT. 21, 1992 FIG. NO.: 3-19

1-2

FIGURE 1-3



LEGEND:

L1 ▲ LEACHATE SEEP LOCATION

NOTES:

1. COORDINATES AND BEARINGS IN BRONX HIGHWAY DATUM.
2. ELEVATIONS ABOVE BRONX DATUM = 2.600 FT ABOVE MEAN SEA LEVEL.
3. CONTOUR INTERVAL = 5 FEET

MAP SOURCE:

ETTLINGER & ETTLINGER DRAWING NUMBER 87541
ETTLINGER & ETTLINGER SITE SURVEY 1992.

0 350 700 FT

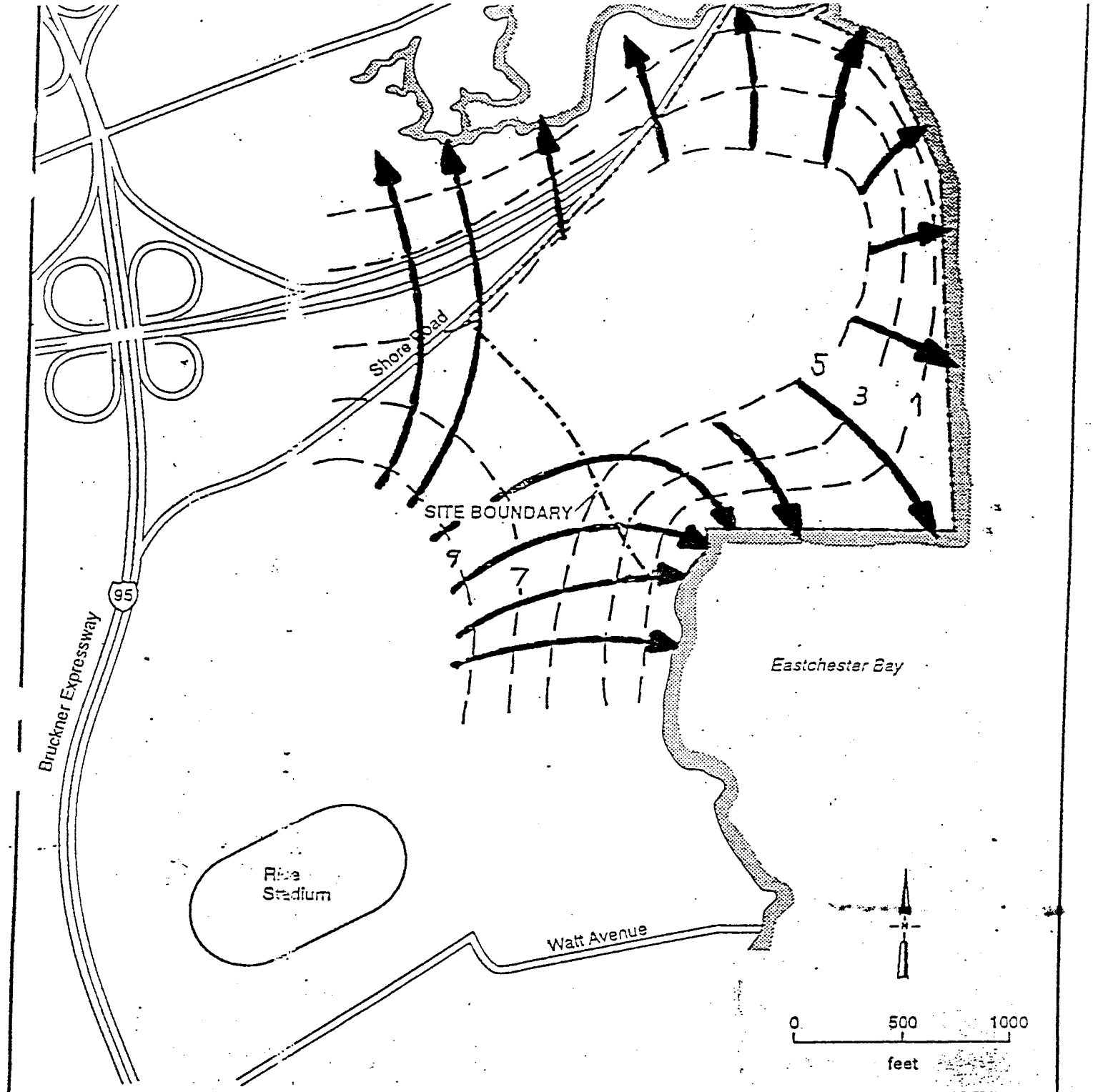
SCALE

LEACHATE SEEP LOCATIONS
PELHAM BAY LANDFILL
BRONX, NEW YORK

WOODWARD—CLYDE CONSULTANTS, INC.
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
NEW YORK, NEW YORK

DR. BY:	MG	SCALE:	AS SHOWN	PROJ. NO.:	92C4917
CKD BY:	TMP	DATE:	SEPT. 21, 1992	FIG. NO.:	1-3

1-3



LEGEND

— — — Groundwater Elevation Contours

→ Direction of Groundwater Flow

SHALLOW GROUNDWATER FLOW
PELHAM BAY LANDFILL
BRONX, NEW YORK

Woodward-Clyde Consultants
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR. BY:	SCALE: AS SHOWN	PROJ. NO.: 92C4087
CK'D BY:	DATE: 20 NOV 1992	FIG. NO.: 1-4

24087-3046/012093

FIGURE 1-5

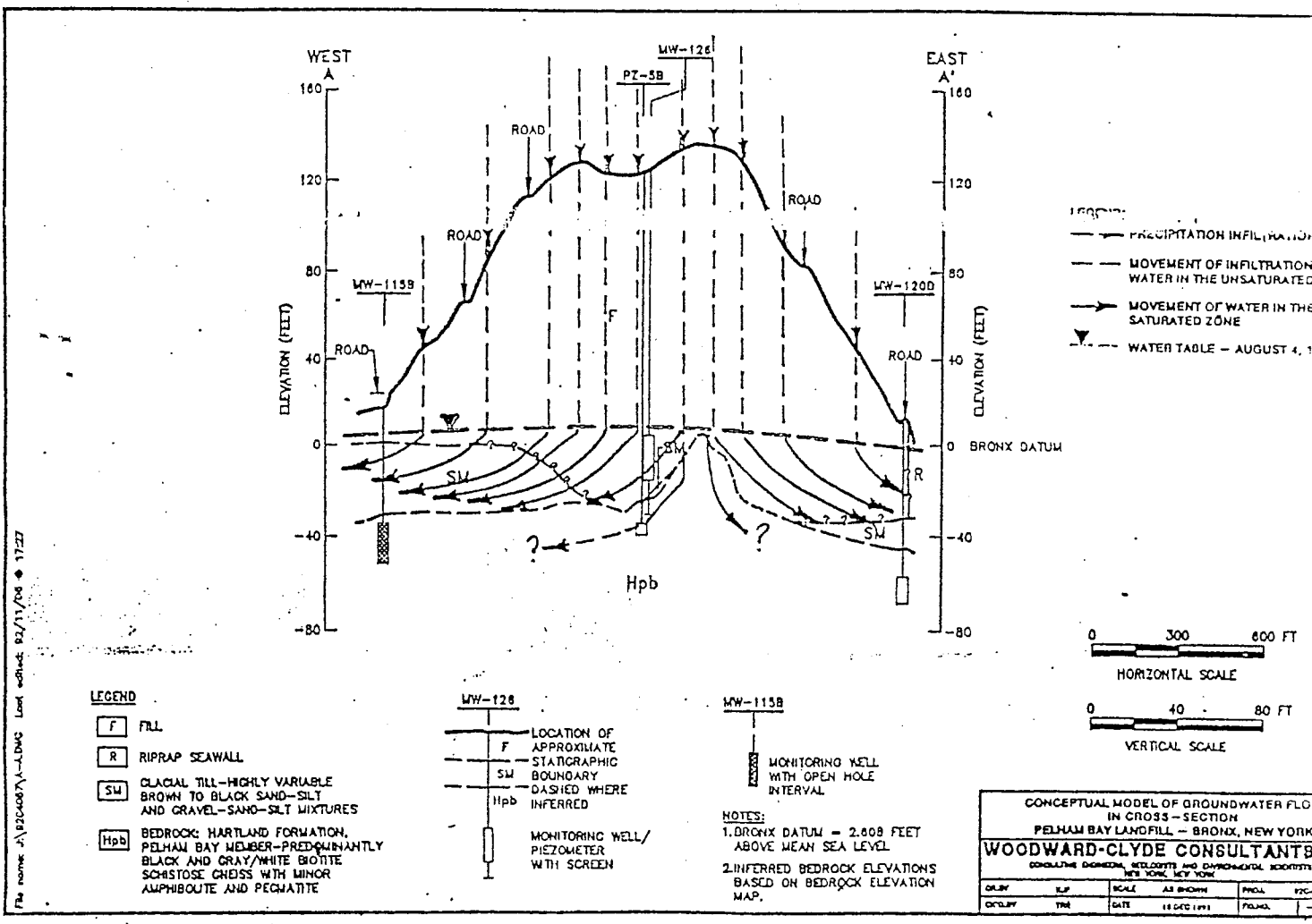
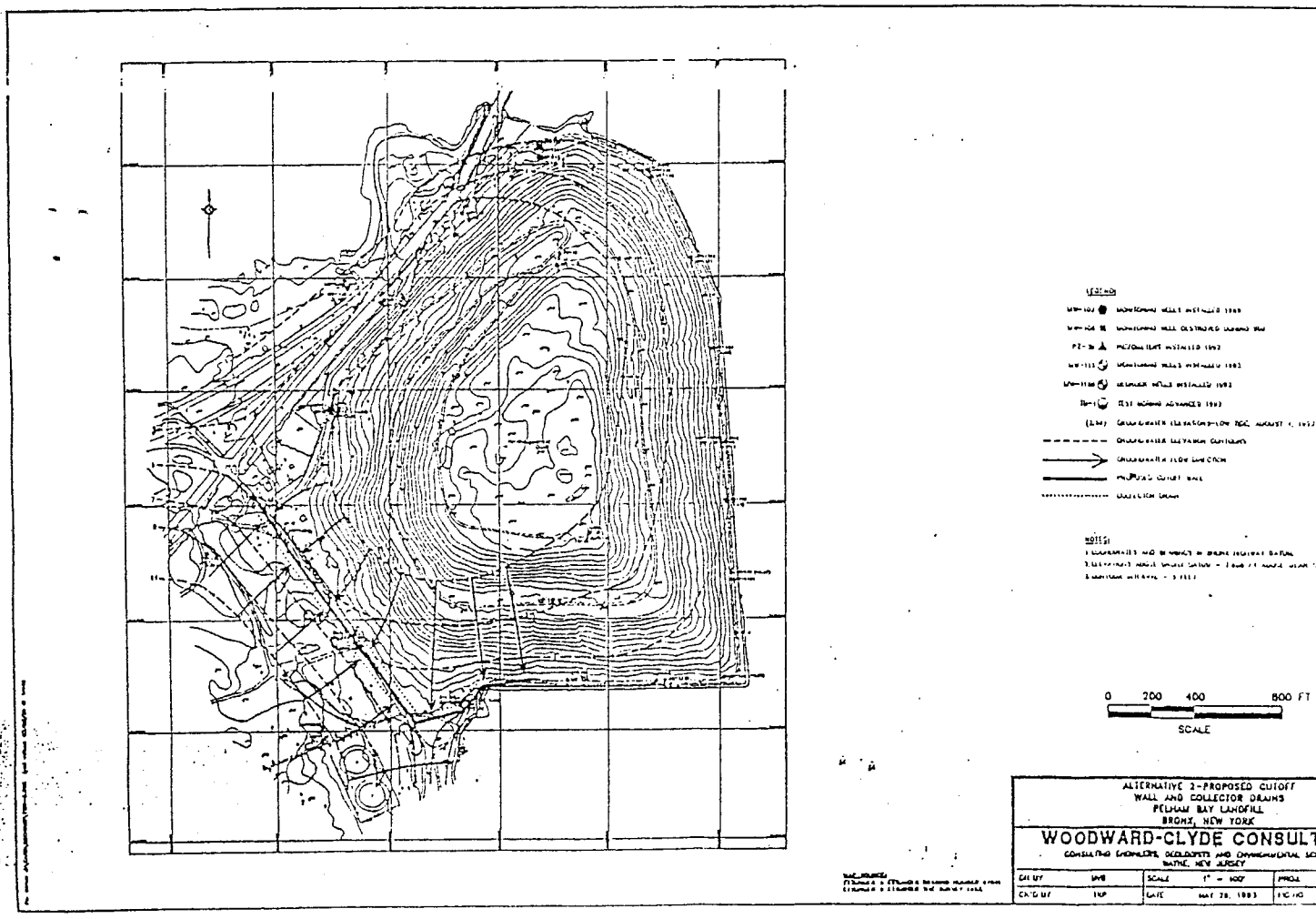
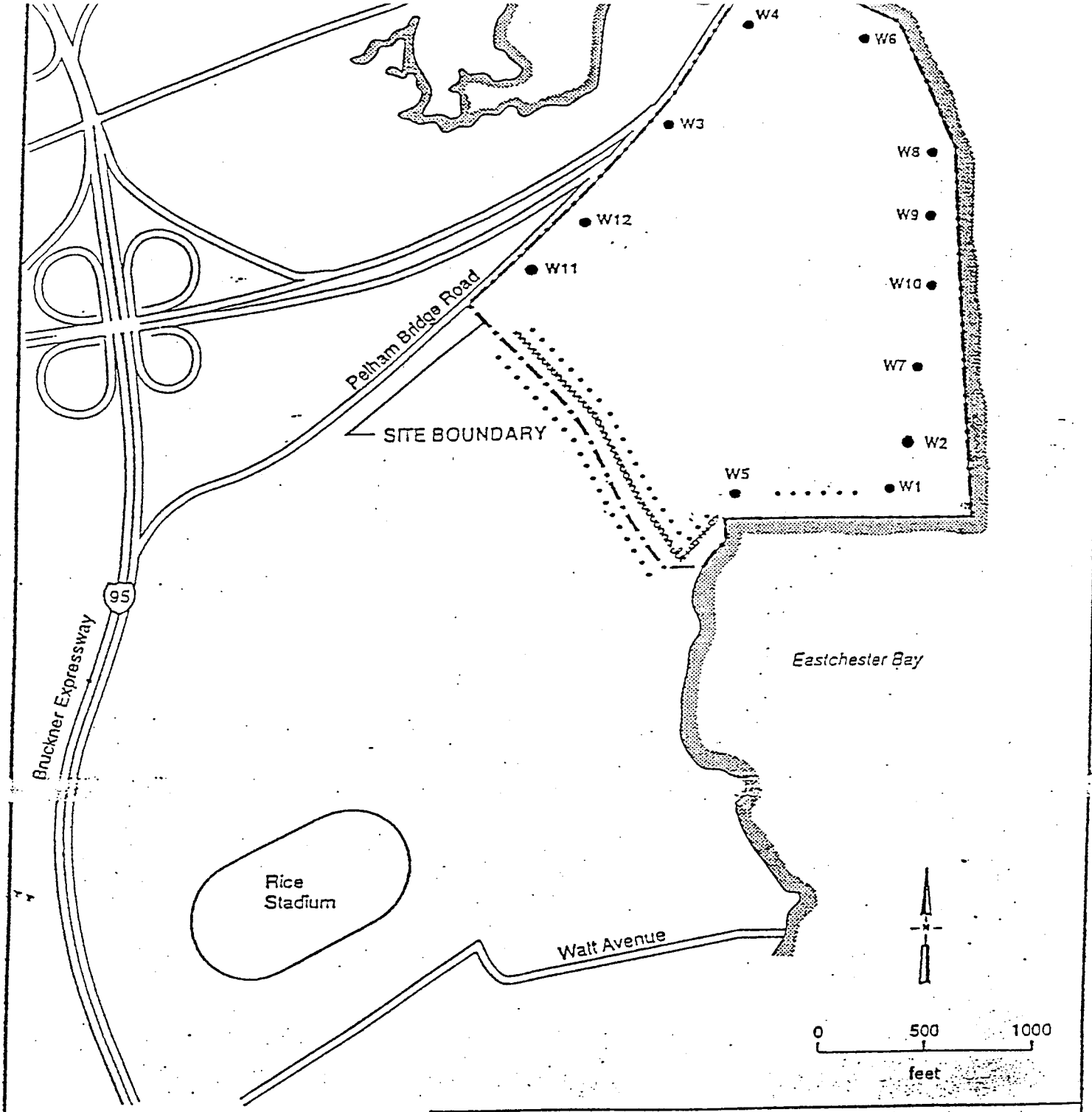

WEST
A
EAST
A'
MW-126
PZ-5B
ROAD
MW-115B
MW-120D
F
SW
R
Hpb
ELEVATION (FEET)
160
120
80
40
0
-40
-80
BRONX DATUM
MOVEMENT OF INFILTRATION WATER IN THE UNSATURATED
MOVEMENT OF WATER IN THE SATURATED ZONE
WATER TABLE – AUGUST 4,
0
300
600 FT
HORIZONTAL SCALE
0
40
80 FT
VERTICAL SCALE
LEGEND
F FILL
R RIPRAP SEAWALL
SW GLACIAL TILL–HIGHLY VARIABLE BROWN TO BLACK SAND–SILT AND GRAVEL–SAND–SILT MIXTURES
Hpb BEDROCK: HARTLAND FORMATION, PELHAM BAY MEMBER–PREDOMINANTLY BLACK AND GRAY/WHITE BIOTITE SCHISTOSE GNEISS WITH MINOR AMPHIBOLITE AND PEGMATITE
MW-126
LOCATION OF APPROXIMATE STATIGRAPHIC BOUNDARY
DASHED WHERE INFERRED
MONITORING WELL/ PIEZOMETER WITH SCREEN
MW-115B
MONITORING WELL WITH OPEN HOLE INTERVAL
NOTES:
1. BRONX DATUM = 2.608 FEET ABOVE MEAN SEA LEVEL
2. INFERRED BEDROCK ELEVATIONS BASED ON BEDROCK ELEVATION MAP.
CONCEPTUAL MODEL OF GROUNDWATER FLO
IN CROSS–SECTION
PELHAM BAY LANDFILL – BRONX, NEW YORK
WOODWARD-CLYDE CONSULTANTS

FIGURE 1-6


0 200 400 800 FT
SCALE
ALTERNATIVE 2-PROPOSED CUTOFF WALL AND COLLECTOR DRAINS
PELHAM BAY LANDFILL
BRONX, NEW YORK
WOODWARD-CLYDE CONSULT

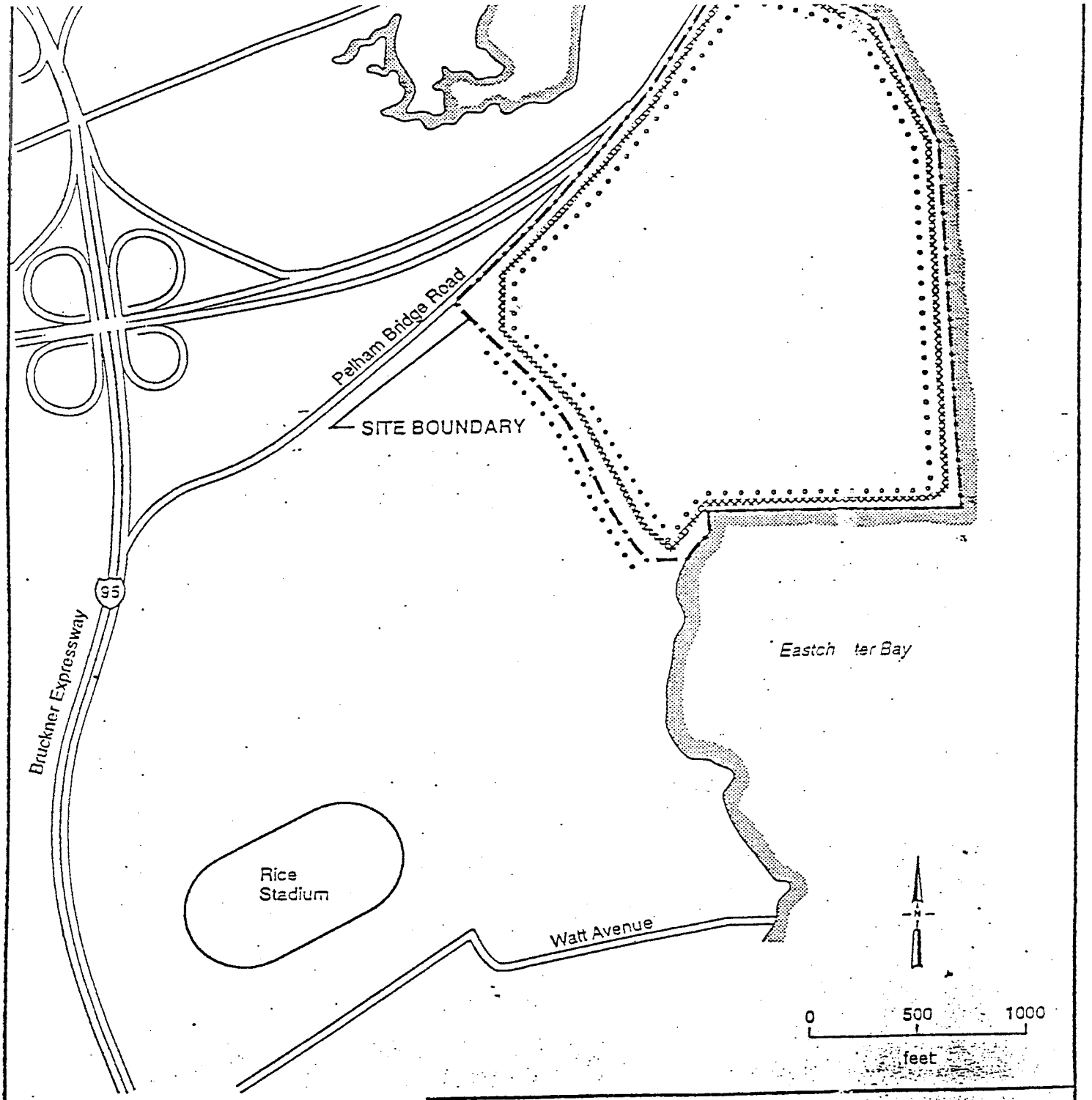


ALTERNATIVE 3 – PROPOSED GROUNDWATER COLLECTION WELLS, CUTOFF WALL AND DRAINS
PELHAM BAY LANDFILL
BRONX, NEW YORK

Woodward-Clyde Consultants
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR. BY:	BAS	SCALE:	AS SHOWN	PROJ. NO.:	92C4087
CK'D BY:	TRP	DATE:	16 MAY 1993	FIG. NO.:	1-7

92C4087-3046/012093



LEGEND

Cutoff wall

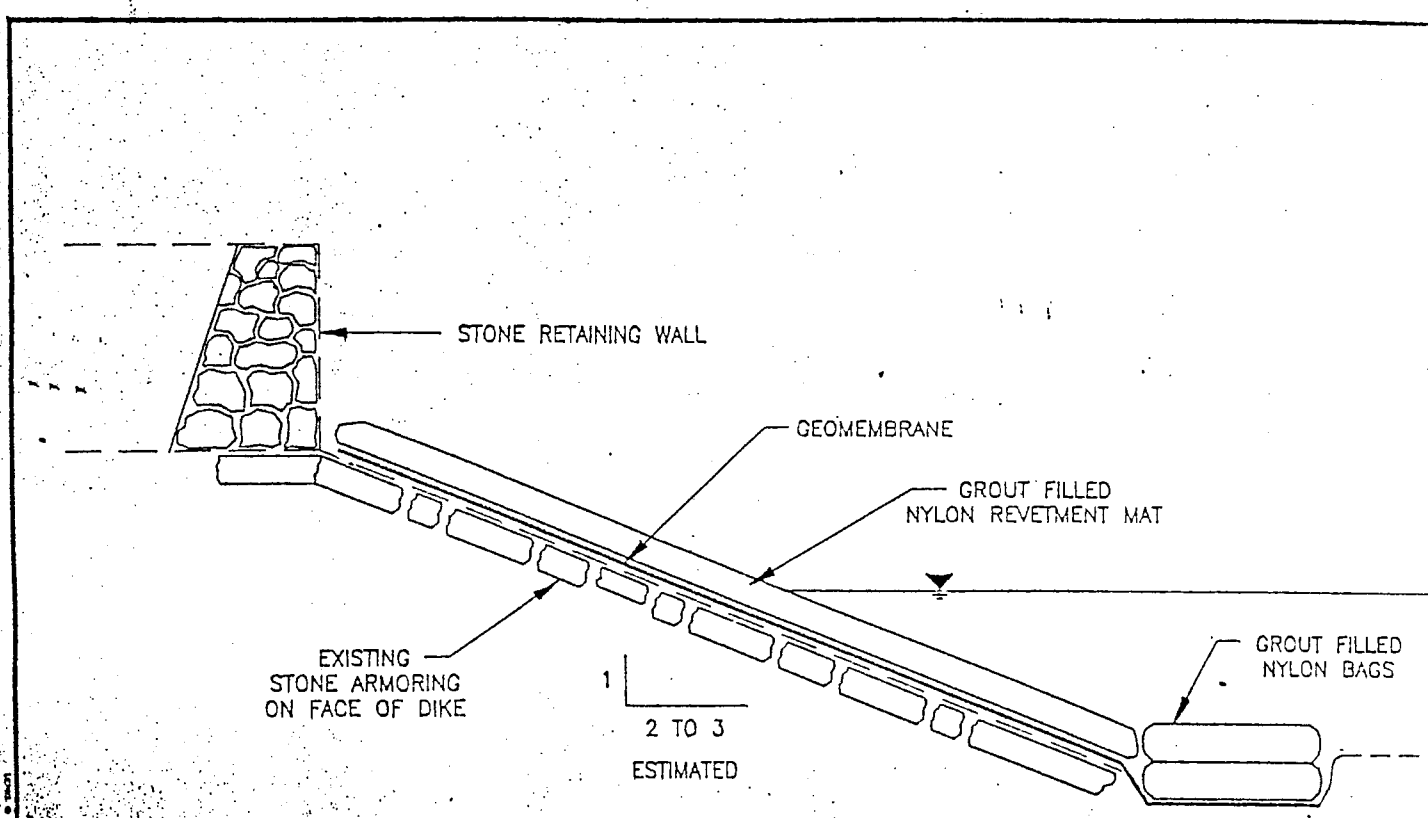
Drain

ALTERNATIVE 4 – PROPOSED DRAIN AND CUTOFF WALL
PELHAM BAY LANDFILL
BRONX, NEW YORK

Woodward-Clyde Consultants
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR. BY:	BAS	SCALE:	AS SHOWN	PROJ. NO.:	92C4087
CK'D BY:	TRP	DATE:	16 MAY 1993	FIG. NO.:	1-8

92C4087-3046/012093

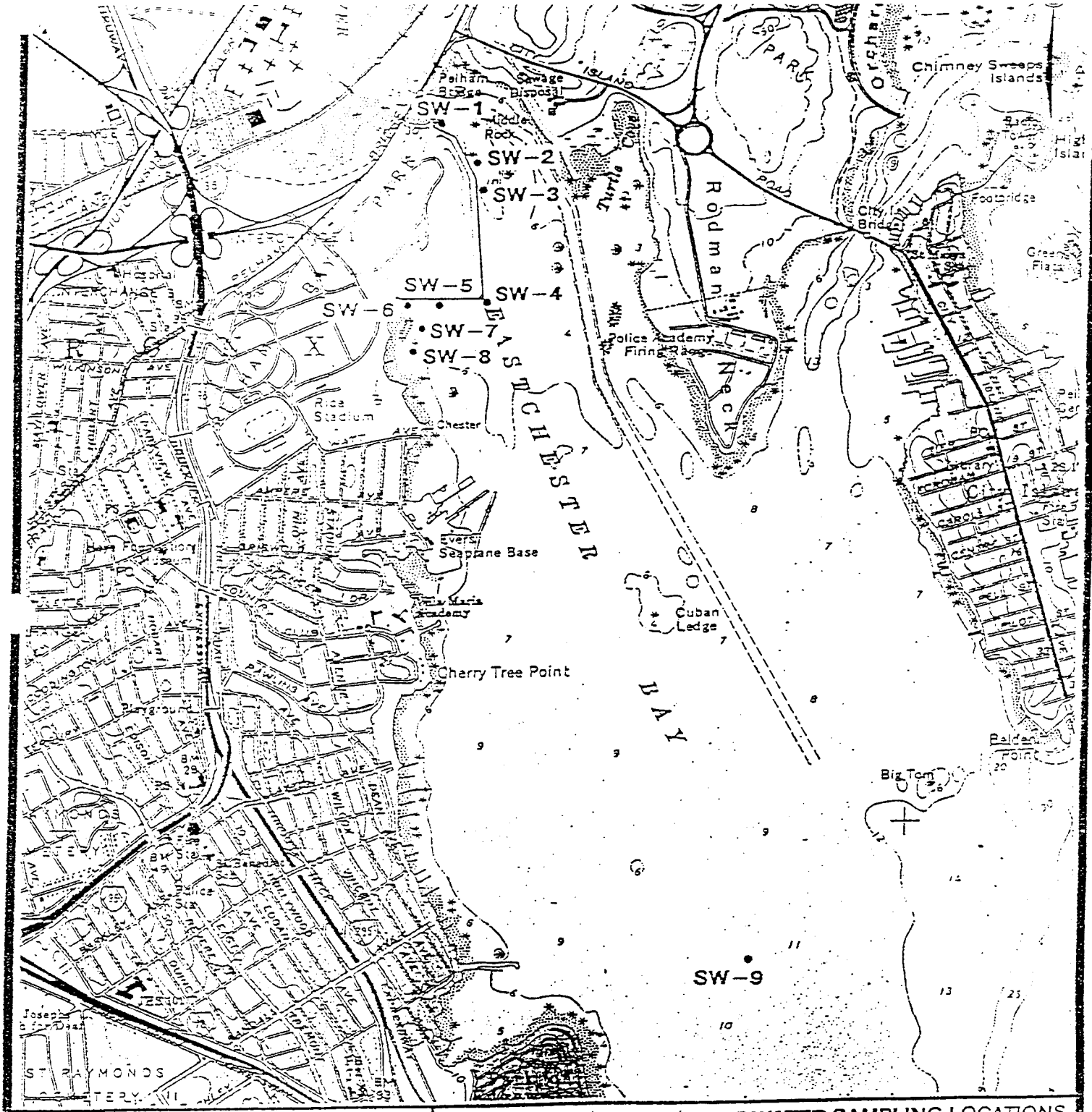


CONCRETE BARRIER WALL

WOODWARD-CLYDE CONSULTAN

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR.BY	BTM	SCALE	NONE	PROJ.	92C4
CK'D.BY	T.A.M.	DATE	MAY 25 1993	FIG.NO.	F-6



LEGEND:

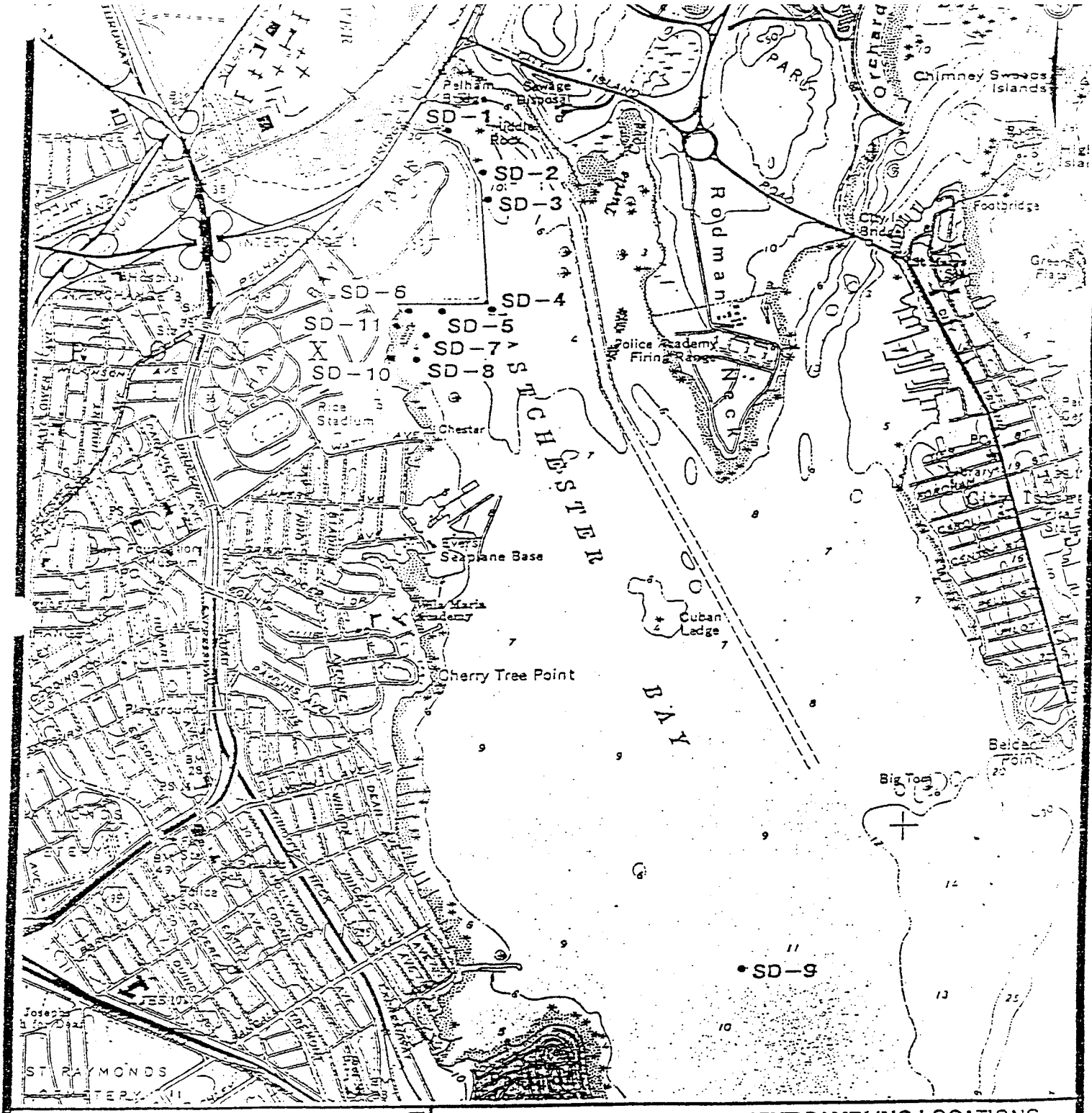
• SURFACE WATER SAMPLING LOCATION

MAP SOURCE:
FLUSHING, N.Y. USGS QUADRANGLE MAP, 1979.

EASTCHESTER BAY SURFACE WATER SAMPLING LOCATIONS
PELHAM BAY LANDFILL
BRONX, NEW YORK

WOODWARD—CLYDE CONSULTANTS, INC.
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
NEW YORK, NEW YORK

DR. BY: KJF	SCALE: AS SHOWN	PROJ. NO.: 92C4087
CK'D BY: ABB	DATE: SEPT. 24, 1992	FIG. NO: 1-10



LEGEND:

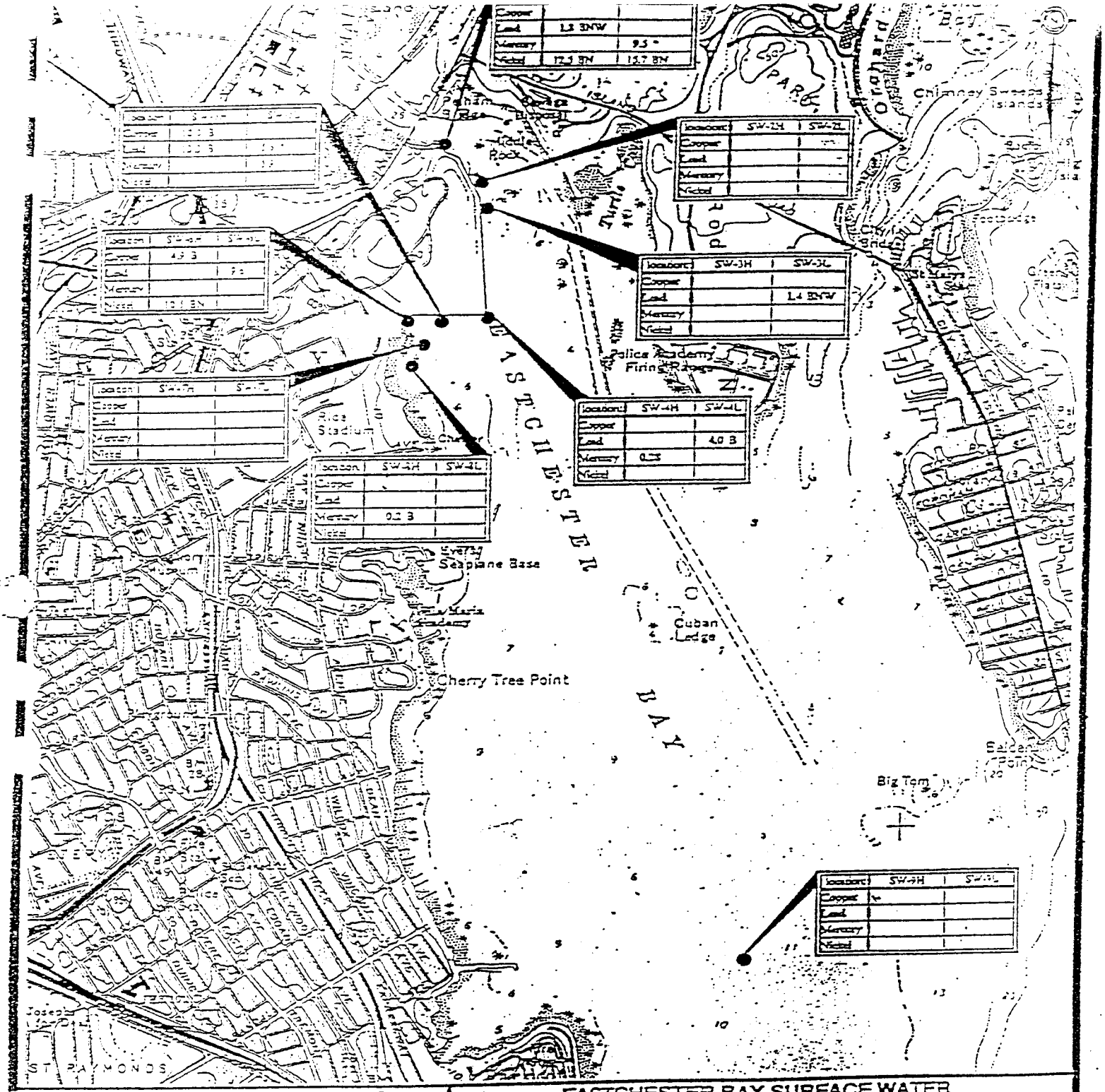
- SEDIMENT SAMPLING LOCATION

MAP SOURCE:
FLUSHING, N.Y. USGS QUADRANGLE MAP, 1979.

EASTCHESTER BAY SEDIMENT SAMPLING LOCATIONS
PELHAM BAY LANDFILL
BRONX, NEW YORK

WOODWARD–CLYDE CONSULTANTS, INC.
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
NEW YORK, NEW YORK

DR. BY: KJF	SCALE: AS SHOWN	PROJ. NO.:	92C4087
CK'D BY: ABB	DATE: SEPT. 24, 1992	FIG. NO:	1-11



Ni - 7.1 Pb - 2.0 Not for SB
Cu - 2.9
Pb - 8.6 Standards

LEGEND

● SURFACE WATER SAMPLING LOCATION
ALL CONCENTRATIONS IN µg/L

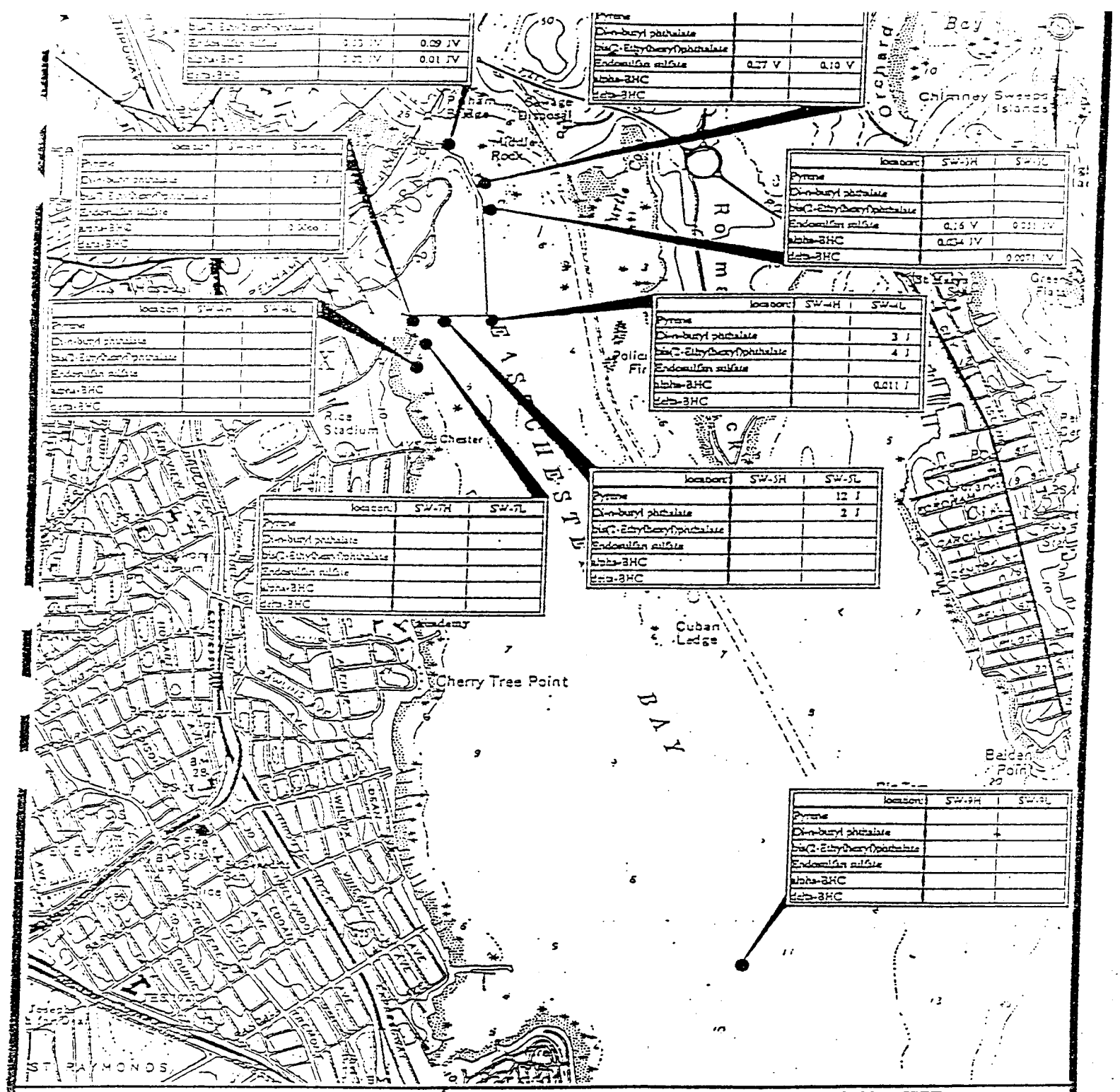
MAP SOURCE:
FLUSHING, N.Y. USGS QUADRANGLE MAP, 1979.

EASTCHESTER BAY SURFACE WATER SELECTED METALS DATA SUMMARY PELHAM BAY LANDFILL BRONX, NEW YORK

WOODWARD—CLYDE CONSULTANTS, INC.

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
NEW YORK, NEW YORK

DR. BY: KJF	SCALE: AS SHOWN	PROJ. NO.: 92C4087	
CK'D BY: RTG	DATE: JAN. 28, 1993	FIG. NO.:	1-12



location:	SW-1H	SW-1L
Pyrene		
Di-n-butyl phthalate		
bis(2-Ethylhexyl)phthalate		
Endosulfan sulfate		
alpha-BHC		
beta-BHC		

location:	SW-2H	SW-2L
Pyrene		
Di-n-butyl phthalate		
bis(2-Ethylhexyl)phthalate		
Endosulfan sulfate	0.27 V	0.10 V
alpha-BHC		
beta-BHC		

location:	SW-3H	SW-3L
Pyrene		
Di-n-butyl phthalate		
bis(2-Ethylhexyl)phthalate		
Endosulfan sulfate		
alpha-BHC		
beta-BHC		

location:	SW-4H	SW-4L
Pyrene		
Di-n-butyl phthalate		3 J
bis(2-Ethylhexyl)phthalate		4 J
Endosulfan sulfate		
alpha-BHC		0.011 J
beta-BHC		

location:	SW-5H	SW-5L
Pyrene		
Di-n-butyl phthalate		
bis(2-Ethylhexyl)phthalate		
Endosulfan sulfate	0.16 V	
alpha-BHC	0.034 JV	
beta-BHC		0.0071 JV

location:	SW-6H	SW-6L
Pyrene		
Di-n-butyl phthalate		
bis(2-Ethylhexyl)phthalate		
Endosulfan sulfate		
alpha-BHC		
beta-BHC		

location:	SW-7H	SW-7L
Pyrene		
Di-n-butyl phthalate		
bis(2-Ethylhexyl)phthalate		
Endosulfan sulfate		
alpha-BHC		
beta-BHC		

location:	SW-8H	SW-8L
Pyrene		12 J
Di-n-butyl phthalate		2 J
bis(2-Ethylhexyl)phthalate		
Endosulfan sulfate		
alpha-BHC		
beta-BHC		

location:	SW-9H	SW-9L
Pyrene		
Di-n-butyl phthalate		
bis(2-Ethylhexyl)phthalate		
Endosulfan sulfate		
alpha-BHC		
beta-BHC		

EASTCHESTER BAY SURFACE WATER ORGANIC CHEMICALS DATA SUMMARY PELHAM BAY LANDFILL BRONX, NEW YORK

WOODWARD—CLYDE CONSULTANTS, INC.

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
NEW YORK, NEW YORK

DR. BY:	KJF	SCALE:	AS SHOWN	PROJ. NO.:	92C4087
CK'D BY:	RTG	DATE:	JAN. 28, 1993	FIG. NO.:	13

TABLES

ABLE
SUMMARY OF THE EVALUATION OF ALTERNATIVES

Criterin	Alternative 1 No Action Limited Action	Alternative 2 Cap with Gas and Water Management and Treatment	Alternative 3 Cap with Gas and Water Management and Treatment with Extraction Wells	Alternativ Cap with Gas a Management, T and Vertical
Compliance with ARARs	Does not meet Federal or State ARARs	Attains ARARs for landfill closure; gas management and treatment; water pre-treatment; does not attain ARARs for on-site groundwater	Attains ARARs for landfill closure; gas management and treatment; water pre-treatment; does not attain ARARs for on-site groundwater	Attains ARARs for closure; gas manage treatment; water pre does not attain ARA site groundwater
Protection of Human Health and the Environment	Not protective of human health and the environment	Protective of human health and the environment with monitoring and future use restrictions - does not prevent groundwater/leachate discharge in most areas of the site.	Protective of human health and the environment with monitoring and future use restrictions	Protective of human the environment wit monitoring and futu restrictions
Short-term Effectiveness	Minimal short-term impacts; requires HASP.	Effective with HASP, dust control, and precautions	Effective with HASP, dust control, and precautions	Requires a HASP, du precautions
Long-term Effectiveness and Permanence	Not effective or permanent; continued migration off-site	Effective with maintenance and monitoring	Effective with maintenance and monitoring	Effective with mainte monitoring
Reduction of Toxicity, Mobility, or Volume (TMV)	No reduction of TMV	Reduction in volume for shallow groundwater/leachate; reduction in toxicity for gas; reduction in mobility of landfill contents	Reduction in volume for shallow groundwater/leachate; reduction in toxicity for gas; reduction in mobility of landfill contents	Reduction in mobili media; reduction in gas; reduction in vol shallow groundwater
Implementability	Easy to implement	Commercially available, minimal expected problems	Commercially available, minimal expected problems	Commercially availat difficult to construct barrier
Cost	$869,000	$49 million	$51 million	$63 million

Pelham Bay Landfill
Bronx, New York

	Cancer Risk	Subchronic Hazard Index	Chronic Hazard Index
WORKER - ONSITE			
Inhalation of VOCs	1.23E-07		5.56E-02
Ingestion of GROUNDWATER/LEACHATE	1.45E-08		8.19E-05
Ingestion of ON-SITE SURFACE SOILS **	1.40E-06		9.39E-03
Dermal Contact with ON-SITE SURFACE SOILS	1.46E-06		9.81E-03
	3.00E-06		7.49E-02
YOUTH TRESPASSER - ONSITE			
Inhalation of VOCs	3.83E-08	*	4.83E-02
Ingestion of GROUNDWATER/LEACHATE	1.02E-08	9.84E-05	1.61E-04
Ingestion of ON-SITE SURFACE SOILS	1.13E-06	4.75E-03	2.10E-02
Dermal Contact with ON-SITE SURFACE SOILS	1.68E-06	7.06E-03	3.13E-02
	2.86E-06	1.19E-02	1.01E-01
CHILD - OFFSITE RESIDENT			
Ingestion of FISH/SHELLFISH	*	*	3.87E-01
Inhalation of AIR (MODELED VALUES)	6.85E-09	2.18E-03	7.76E-02
	6.85E-09	2.18E-03	4.64E-01
ADULT - PARK USER - OFFSITE			
Inhalation of AIR (MODELED VALUES)	4.90E-08		7.94E-03
Ingestion of GROUNDWATER/LEACHATE	1.46E-08		2.95E-05
Ingestion of SURFACE WATER	*		*
Dermal Contact with SURFACE WATER	*		*
Ingestion of SEDIMENT	2.22E-08		7.93E-05
Dermal Contact with SEDIMENT	9.27E-08		3.31E-04
	1.79E-07		8.38E-03
CHILD - PARK USER - OFFSITE			
Ingestion of GROUNDWATER/LEACHATE	1.07E-09	9.23E-05	1.51E-04
Ingestion of SURFACE WATER	*	*	*
Dermal Contact with SURFACE WATER	*	*	*
Ingestion of SEDIMENT	3.70E-09	9.25E-04	9.25E-04
Dermal Contact with SEDIMENT	2.40E-09	6.01E-04	6.01E-04
	7.17E-09	1.62E-03	1.66E-03
ADULT - POLICE/PARK WORKER - OFFSITE			
Inhalation of AIR (MODELED VALUES)	7.44E-09		3.37E-03
	7.44E-09		3.37E-03
YOUTH - PARK USER - OFFSITE			
Inhalation of AIR (MODELED VALUES)	1.42E-08		2.31E-02
Ingestion of GROUNDWATER/LEACHATE	3.58E-09		7.22E-05
Ingestion of SURFACE WATER	*		*
Dermal Contact with SURFACE WATER	*		*
Ingestion of SEDIMENT	1.24E-08		4.44E-04
Dermal Contact with SEDIMENT	9.85E-09		3.52E-04
	4.01E-08		2.39E-02
ADULT - OFFSITE RESIDENT - OFFSITE			
Ingestion of FISH/SHELLFISH	*		2.65E-01
Inhalation of AIR (MODELED VALUES)	7.92E-08		1.28E-02
	7.92E-08		2.78E-01

* The only chemical of concern for these complete pathways was lead. These risks were evaluated qualitatively, see Section 6.4 Lead Risk Assessment.

** This pathway was also evaluated using Monte Carlo Analysis, see Section 6.6 and Table 6-2

TABLE 3

Remedial Alternative III with stayed construction/installation of new extraction wells.

	Alternative 3
Capital Cost	41,658,000
Annual Cost	953,000
Present Worth of annual cost (10%) for 15 years	7,246,000
Total Cost	48,904,000

APPENDIX A

RESPONSIVENESS SUMMARY

Responses to Questions and comments raised at the public meeting of June 30,1993 and comments received by mail thereafter concerning the Proposed Remedial Action Plan for the Pelham Bay Landfill

Prepared by the New York State Department of Environmental Conservation

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1. **Proposed Technology for Capping the Pelham Bay Landfill**

Q. **Questions concerning the final cover to be placed on the landfill** including; What is this 360 cap? Is there a detail plan on this cap?

A. The "(Part) 360 cap" refers to final cover as defined in 6NYCRR Part 360, Solid Waste Management Facilities. Final cover is placed on landfills as part of closure. This cover is a layered system that is designed to keep precipitation (rainfall, snowfall etc.) out of the waste and to prevent leachate and landfill decomposition gases from discharging through the top or the side slopes. Attached is a section view of final cover.

Q. **Questions concerning the geomembrane liner to be placed as part of the final cover** including; What are the components used in the manufacture of the impermeable cover? Who is the manufacturer and where is the plant located? What kind and how much waste will be generated in the manufacturing process? Will it be toxic? How will the waste (generated by the construction of the geomembrane liner) be disposed of? Can we as concerned people resolve our problems by contributing to contamination elsewhere? How much (geomembrane liner) will be ordered for the landfill? Will fumes emanate from the material while being stored and once it is in place? (air quality) How will accidental fire (on the surface of the landfill) affect the cover? toxic smoke etc. Will the cover be affected by extreme weather conditions? (softening, separating, hardening or cracking)

A. The impermeable component of the landfill cover can be either a low permeability soil or an artificial liner, known as a geomembrane. The liners can vary in thickness from 30 mils to 60 mils. (A mil is one thousandth of an inch.) The types of liner can be made of different materials, each having different properties. Two popular types are Hypelon liners and high density polyethylene (HDPE) liners. HDPE liners are used for bottom liners in composite lined landfills; in some situations they can also be used in the final cover liner. The selection of the type of liner will be dependent upon the design criteria, which in the case of this landfill will include the anticipated settlement and the side slopes (steep).

The HDPE membrane is manufactured of resin pellets, carbon and antioxidants which are mixed, heated and cast into sheets. The waste materials from the manufacturing process are not toxic and are recycled. There are a significant number of manufacturers of HDPE products. Their manufacturing facilities are located in many states. Among the manufacturers is Gundle Lining Systems, Inc. located at 19103 Gundle Road, Houston, TX.

The landfill covers an area of approximately 100 acres and the placement of the impermeable membrane is expected to extend beyond the edges of the landfilled area. Therefore, between about 4 million and 4.5 million square feet of membrane is expected to be ordered. No, fumes will not emanate from the materials while they are stored or are in place. The heat of fire will cause the material to melt, shrink, and curl. The position of the of the membrane in the landfill, totally surrounded by soil, makes it unlikely to be affected by fire. No toxic fumes will emanate from the materials upon burning or melting. When laid on the ground, prior to placement of the soil cover, the liner will stretch in warm weather and shrink in the cold. When covered with the soil the liner will be effected by the constant landfill

temperature and there will be minimal expansion or contraction.

Q. **Questions concerning the placement of the final cover on the landfill** including; Right now the capping of the landfill, how long does it take to cap the landfill? Is there going to be movement in the landfill, disruption in the landfill? What guarantee are you going to give the community as far as disrupting a lot of stuff that's been laying there for many , many years? You're going to put it over the trees? How long does this take, and what's going to protect us in the meantime? You bring the soil in big trucks right? You are going into the community in those big trucks? How long do you anticipate it will take? So for two years we're going to have construction of[sic] the landfill? Every day? ... as part of the capping process, are you considering digging trenches around the perimeter, and putting in a lining? As someone said before, there is going to be some leaches in the cap. I assume you have to bring trucks or something out there to pick that leach up. The landfill poses no risk as it is now, and the Science Advisory Committee has backed that up. The landfill poses minimal risk right now. What happens when you start getting trucks coming out there, what happens when there is a disturbance, as in the Woodward-Clyde Study. There is an example, when you opened it up, toxic substances were in there. Every front section of the folders in the repository says that. What's going to happen if there is a disturbance? What happens if what is down there is disturbed by the trucks? I assume you're going to put several feet of dirt that's going to compress this, that's going to move whatever is down there. But like I said before, you have four feet, five feet of sewer, that's heavy stuff. It will affect something down there.

A. In responding to the questions in general, it should be noted that the design and construction activities, including logistics, will be subject to public comment and input later in this process. All questions raised are being answered with the caveat that there may be changes based on the ensuing stages of design and construction.

There may be some disruption due to regrading, because of the need to address the steep side slopes and fill in the depressions on the top of the landfill for the purpose of enhancing the drainage. The goal on the top portion of the landfill is to achieve a minimal slope of 4% (4 feet vertical per 100 feet horizontal) on top of the landfill and where ever possible 1(vertical) to 3(horizontal) slopes on the sides of the landfill. Air monitoring by using OVA and an HNU devices, combined with maximum allowable air concentrations will provide safety for the residents.

Construction activities with respect to closing the landfill are expected to take up to 2 years; these activities are scheduled to commence on April 1, 1994. Topsoil and fill for regrading and capping will be transported in 8 to 15 cubic yard trucks to the site. These trucks will run predominantly along major highways (i.e. I 95) then will travel only a short distance to the landfill. The trees will be removed prior to placing the cap. For a substantial portion of construction time, work will be performed within the landfill boundaries. The loading or surcharge on the bottom layers of the landfill is minimal compared to the existing loading of the waste already placed. There will be no appreciable loading from the four feet of soil (cover) nor the equipment.

Q. **Questions concerning the effect of hazardous waste on the final cover** including; There has been testimony that there is toxic drums there. What's going to happen?

A. Neither the RI/FS nor any other previous investigations have located any 55-gallon drums or any liquid hazardous waste. Post-closure monitoring of the groundwater monitoring wells, landfill decomposition gasses, leachate, and surface water will continue for at least 30 years. If the results of the sampling indicates the presence or release of hazardous wastes then additional remedial activities, such as the installation of the perimeter groundwater interceptor wells will occur. Therefore, the cover will not have to be removed.

Q. **Questions concerning post-closure monitoring of the landfill**, including; If I may use Your Words, the gentleman used " jumping through hoops." I don't want to see this community jumping through hoops for thirty years. Who is responsible for the long-term guarantee on the maintenance of this landfill? Is it New York City, is it New York City Sanitation, or is it you, as New York State? The thirty year study, nobody ever told us what City Agency is going to do the monitoring? Who makes the Record of Decision?

A. The New York City Department of Environmental Protection (NYCDEP) is responsible for the long-term maintenance and monitoring at the site under the Order On Consent presently in effect. Violations of this order would result in new enforcement against the city (NYCDEP). In regard to the Record of Decision, the New York State Department of Environmental Conservation (NYSDEC) is responsible for this document.

2. <u>The Cost of the Pelham Bay Landfill Remediation</u>

Q. **Questions concerning Remedial Construction and future maintenance and monitoring of the landfill**, including; What is the final estimated cost (security, fencing,testing and maintenance for the next 30 years)? What is the monetary value of the land that will be lost to Pelham Bay Park and public access forever? Is that all built into the budget, the thirty-year -- I mean, how is this, money-wise, in thirty years? Is this all built in, are you going to hit us later on we overspent, ten years from now, we have to cut back? Where is the funding coming from? This money we're talking about is to close the landfill right now. What about for the thirty years to come, where is the money going to come from? Where is it written, what type of contract are we going to have to guarantee?

A. The total cost for remediation plus post-closure activities for 30 years is $90,000,000.The final estimated cost for remediation is $ 49,000,000. The New York State Department of Environmental Conservation (NYSDEC) through the Environmental Quality Bond Act (EQBA) will supply 75% of the Capital Costs with respect to the remediation of this site, which is approximately $ 36,750,000, 75% of $48 million. If needed, the extraction wells will cost an extra $2,000,000. The required funding to properly close and maintain the Pelham Bay Landfill has been applied to future budgets by the New York City office of Management and Budget. For the thirty years, the City of New York will supply the Operation and Maintenance (O & M) budget for this site.

At this time the value of the land that will be lost to the Pelham Bay Park can only be estimated, which is in the millions. However, it should be noted that the remedial solution could be done in such a way to make green spaces available to the residents for passive recreation such as birdwatching, and nature trails.

3. <u>Ecological Assessment for the Pelham Bay Landfill</u>

Q. **Questions concerning the change in environment quality after the closure of the landfill.** Specifically, will the Landfill closure and capping produce measurably greater environmental quality around the landfill? This could be demonstrated by three simple but basic measures: i) Increased biological diversity quantified in terms of species present; ii) Increased developmental capacity of the ecological systems adjacent to the landfill quantified in terms of numbers of trophic levels, food chains, and frequencies of specific plant and animal groups compared to analogous nearby areas; iii) Increased water quality measured in terms of decreases in ammonia nitrogen, BOD, hydrocarbons, heavy metals, and coliform bacteria. Will Eastchester Bay and the Hutchinson River be cleaner after the expenditure of funds in the landfill closure procedure? Landfill Remediation, for all intents and purposes, is still a science in its infancy stage. There seems to be new technology emerging all the time. Do the laws which commit funds for landfill closure in no way benefit these citizens (who swim in the Hutchinson River and Eastchester Bay) who utilize the resources of this great City and State?

A. Capping of the Pelham Bay Landfill will result in reduced leachate discharges into Eastchester Bay and will in turn result in lower concentrations of leachate chemicals of concern (COCs) in adjacent surface water areas. Lower COC concentrations will effectively result in greater environmental quality around the landfill. This improvement in surface water quality should have a positive effect on biological diversity. There will more trophic levels and food chains, higher frequency of occurrence within specific plant and animal groups. Therefore, the funding granted to the city to remediate this landfill will benefit the people who use the surface waters in the general area.

Please note that measuring the landfill closure-related response of such indicators of the environmental quality in Eastchester Bay may not be practical because of the complexity of this estuarine environment and the number of other sources of these COCs that contribute to the overall quality of the Bay. Monitoring of selected media, such as air and groundwater is planned as part of a continuation of the baseline studies conducted as part of the Remedial Investigation/Feasibility Study (RI/FS). The reduction of the Chemicals of Concern (COCs) and a related increase in water quality will remove an unnatural stressor on the resident (benthic and pelagic) communities.

Q. **Questions concerning wetlands**, including; Why is there no mention of wetlands in any of the alternatives? Do the Laws and protocols of New York State on landfill closure in no way address and protect the bodies of water around toxic landfills where children of the states' citizens are brought in our coastal waters?

A. There is no mention of wetlands in any of the alternatives because the technology with respect to the construction of artificial wetlands is still in its infancy. At the present time the DEC is reviewing data from a Hawk Engineering Study of the construction of Artificial Wetlands at a site in upstate New York. There are two drawbacks generically in this area of the country with respect to the use of artificial wetlands for leachate treatment: (i) Excessive uptake of inorganics may poison the plants in the wetland and kill them (ii) Wetlands may not function in the wintertime due to cold weather conditions which result in frozen water bodies. This would impede the uptake of contaminants from the water. In addition, the remedial activities such as capping and the installation of the leachate collection trench will greatly reduce the amount of leachate generated, thus eliminating the consideration of an artificial wetland for this landfill. The Laws and Protocols of the State of New York do protect the bodies of water around landfills under Article 17 of the Environmental Conservation Law.

4. Health / Risk Assessment For the Pelham Bay Landfill

Q. **Questions regarding the epidemiology study**, including; if indeed, there was anything in the original budget for epidemiology study at all; Was it written in? There is no money set aside for that, there is no money set aside for that at all?

A. In the original Cost Summaries submitted by Woodward-Clyde Consultants Inc. (WCCI), it was proposed that there be an Epidemiology Study performed as part of the RI/FS. According to the New York City Department of Environmental Protection (NYCDEP), two events have occurred that did not indicate that this study was needed. First, the results of the Leukemia Study of October 1988 conducted by the NYCDOH did not reveal that there was excess number of cases of leukemia in relation to the rest of New York City. Second, the preliminary results of the NYCDOH Cancer Study does not reveal that there is an excess number of cancer cases near the landfill compared to the rest of New York City. It is understood that the results of these two studies will be incorporated in a Federal ATSDR Study. The final RI/FS budget did not include the Epidemiological Study. If the ATSDR study has results different from the two aforementioned studies, this issue will be revisited.

Q. **Questions concerning the Federal Agency for Toxic Substances and Disease Registry (ATSDR) Public Health Assessment, dated June, 1993.** In 1989 Congressman Engel requested a Federal Study from the Agency for Toxic Substances and Disease Registry. We just got notified yesterday, as a matter of fact, that the federal government has completed their report,and that the state DEC and the City were supposed to have made comments, the 30 day period ending yesterday. In light of what was discussed here this evening, I was wondering if the state and/or the city have made their comments, and what their opinions are of the study?

A. The NYSDOH has reviewed the June 2, 1993 draft of the Public Health Assessment (PHA) for the Pelham Bay Landfill prepared by the U.S. Agency for Toxic Substances and Disease Registry (ATSDR). As indicated during the June 28,1993 public meeting, the June 2, 1993 draft PHA does not contain the results of the 1993 Remedial Investigation. Therefore, many of the conclusions in the draft PHA are outdated. NYSDOH shared this concern with

ATSDR and also provided comments on the accuracy of the report. ATSDR is deciding whether to distribute the PHA to the public with or without the RI data. If it is forwarded without the RI data, it is most likely that ATSDR will at a later time have to distribute another PHA that includes the 1993 RI data.

Q. **Questions concerning Baseline / Residual Risk Assessments**, including; I know we're under a Consent Order here, but there is an EPA guideline that says that you do a baseline risk assessment, then a residual risk assessment for its effects on public health, as in the lead case. Isn't there a regulation that says we do a baseline, as we've done here, and then do a second assessment of the alternatives, and how they are going to affect public health? This is supposedly an EPA guideline. Has anyone looked into this? Did you realize that you might have to do another study on public health, how the alternatives presented here are going to affect public health, and how this fits into the consent order? Isn't there supposed to be another assessment? I keep hearing everyone saying currently as it is, minimal risk now.

A. NYSDOH does not believe there is a need to produce a Residual Risk Assessment at this time. The remedial alternatives were reviewed and a determination as to whether they would increase or decrease the human health risks identified in the Baseline Risk Assessment was made. The Pelham Bay Landfill BRA was done according to USEPA guidelines and identified risks as either "unacceptable" or "acceptable". Unacceptable health risks were identified for on-site workers and "youth" trespassers. As discussed during the April 28, 1993 public meeting, these risks are associated with direct contact to contaminated soils on-site. The remedial alternative proposed by the state will reduce, if not eliminate, direct contact to on-site contaminated soils and, therefore, reduce these risks. The Pelham Bay Landfill BRA identified the current risks associated with different exposure scenarios to air emissions and leachate seeps from the Pelham Bay Landfill as acceptable. The State's proposed remedial action should reduce air emissions and the discharge of leachate. Therefore, the associated exposures and corresponding risks should be decreased. In summary, whether the NYSDEC requires New York City to prepare a Residual Risk Assessment or not, NYSDOH has already done an evaluation that provides the equivalent information and concluded that the State's proposal is protective of public health. In addition, sampling will be performed during and after implementation of the remedial action (post-closure monitoring) to monitor contaminant releases and human exposure. This sampling is required as part of the states' proposed remedial alternative. The workplan for sampling will be developed at a later time. The NYSDOH will participate in the development of the plan and review the results of all sampling to ensure the preferred remedial alternative is indeed protective of public health.

5. <u>Leachate/Groundwater Management for the Pelham Bay Landfill</u>

Q. **Questions concerning the extraction wells**, including; Question one is, the possibility of additional extraction wells, if needed, is that part of Alternative III? That phase-in possibility is explicitly built-in? And are there explicit criteria for determining that, or will there be more of an ad hoc thing? As you're monitoring it you will make a decision about that? With the leachate, we're collecting now, there's twenty-six trucks going to the site now, collecting

leachate. Once you cap this, you're going to be collecting a lot more leachate from the site. Are we going to be able to handle it with what we have now? And is it going to be constantly tested like it is now? In terms of the groundwater discharge that would be eliminated in most areas in 3 to 6 years, can you tell us how that is going to be monitored, what methods are you going to use to monitor that? And then, since the construction will be completed in March,1996, six years hence would be 1999, will you then go back in and rip up the construction that you did, or will you just be able to fill extraction wells? How would you then remedy the problem? In the beginning you mentioned that you're not going to put in a barrier to the bayside.In the April 28th photos and the diagrams, most of the -- leaches toward the Bay. And then you also mentioned something earlier, there is some kind of a barrier was there in place. Yet the design of this landfill was to self-wash. Now, are the wells that are going to be put in there going to be capable of taking out the salt water encroachment on this area? Otherwise all you'll be doing is taking the methane off, taking samples of the wells on the other side, but whatever else is going out, your wells won't be able to contain it or capture it.

A. After completion of the placement of the final cover and the construction of the groundwater diversion trench, the amount of leachate generated from the landfill will decrease by an estimated amount of 70%. The decision to install the interceptor wells along the landfill perimeter will be based on the results of environmental sampling, including groundwater monitoring wells, leachate seeps (if observed), collected leachate (from the existing trenches and groundwater extraction wells). This sampling will be included in post-closure monitoring requirements. The samples will be analyzed for parameters indicative of landfill chemicals and hazardous waste. If the leachate analysis reveals the presence and concentration of chemicals indicative of hazardous waste or the groundwater monitoring wells indicate significant releases of chemicals, the DEC will require the installation of the interceptor wells. This enactment of this requirement does not have to wait for three to six years; it can occur at any time. The period of three to six years was needed to monitor the leachate generated to ensure that both the volume of leachate in the seeps and the leachate strength (meaning the concentration of the chemicals) were diminishing.

The placement of these interceptor wells would be such that the cone of depression of each well would overlap with the adjacent wells; all the leachate would be collected, along with an amount of salt water from the bay. The consultants for the city (WCCI) have estimated that salt water from the bay flows into the landfill during high tide as much as 125 feet. This will have an effect of the location of the wells in order to minimize the amount of salt water collected and treated. The installation of these wells would be through the final cover. This would require the resealing of the geomembrane around each interceptor well, which can be accomplished.

Q. **Questions concerning the transportation and treatment of the leachate at the Hunts Point Treatment Plant**, including; But you're putting this into the sewer lines. What about the chemicals? Are you ready to handle it? The sewer lines can handle all these chemicals? You're talking about tying it into the sewage system; am I right? We have sewage outflows through Throgs Neck. There is no sewage system that goes to Hunt's Point. Also, before you mentioned that there might be a force(main) built to work in tandem with the existing 150-day

system which now collects leachate, and then it is pumped out into tanks and then trucked out to Hunt's Point. One of the alternatives is to build a pipe to Hunt's Point.Is another alternative that you're considering an on-site treatment plant that would then discharge into the Bay , or is that not even in the discussion phase yet? So if you pump it into the sewer system, it's coming out to the Bay. And when the Bay water is high, we have had sewers backing up into peoples' basements.If hypothetically you do build a force main, are there still going to be tanks there that are going to hold it, or are you going to envision that there is going to be this constant flushing? This is an environmentally sensitive area to us. We are speaking for Country Club Civic Association, we are very much against in the remedial design any use of the existing sewer system for the leachate. Right now we are undergoing a calendar of development and of construction to the year 2006, I believe it is , with laterals every year from Lake Matthew all the way into Spencer. Each year there is going to be sewer construction. We are a double-chambered sewer community. We do not have separated-- right now we do not have separated sewers, we are a one-sewer system. Right now to impact on us we have had situations where well intentioned contractors have left bulkheads in, and homes on an entire block have been deluged with sewage. Please, do not take what you are pumping into those containers right now and put it into the existing sewer line. That's unfair to the communities , both Spencer Estates and Country Club to the south. Lets get our feet on dry land first before you started[sic] messing with our homes again. We have gone through enough water, enough problems just with water, not to mention the landfill. So please don't impact it by putting that leachate that you're pumping out into our existing sewer system.

A. At present, the leachate generated from the landfill is stored and trucked to the Hunts Point Sewage Treatment Plant for treatment; the daily average is about 51,000 gallons of leachate. Since the start of the leachate collection program at the Pelham Bay Landfill Site in January,1992, NYCDEP's state-certified (ELAP) laboratory has analyzed leachate collected at the site on a weekly basis. The results of the analysis of this leachate have consistently demonstrated compliance with Industrial Pretreatment standards established by the New York City Sewer ordinance. As long as the leachate meets the ordinance and the treatment plant meets its discharge standards pursuant to its State Pollution Discharge Elimination System (SPDES) permit, the leachate can be treated at the Hunts Point facility. Treatment of landfill leachate at municipal sewage treatment plants is occurring throughout New York State.

In regard to the effect of the leachate on the sewage collection system, meaning the pipes, the discharge of leachate into municipal laterals (local sewers) is being done in many systems in the state. In several different areas of the city, landfill leachate is being transported to POTWs' for treatment, without deterioration of the pipes. It must also be noted that in many urban areas, industries have been discharging industrial wastes (sometimes pretreated) into the sewer systems without affecting the pipe. These wastes are "stronger" than the landfill leachate and do not adversely affect the sewer pipes.

In response to the questions and concerns regarding the effect of the volume of the leachate to be transported in the municipal collection system, the system is discussed in more detail in this paragraph and the paragraph below. The leachate collected from the trenches and the existing extraction wells is stored in five tanks, whose total capacity is approximately 100,000 gallons. A force-main will be constructed from the landfill to a 30 inch diameter combined

sewer located on Hutchinson Parkway East between Colonial Avenue and Burr Avenue. This location is more than half a mile away from the landfill on the other side of the Bruckner Expressway and about three-quarters of a mile from Spencer Estates. This sewer becomes a 24 inch by 22 inch (box) sewer, then a 60 inch diameter sewer in a matter of 2 blocks (see attached drawing). The DEP reviewed this matter and concluded that the amount of projected flow from the landfill (even if doubled) would have little or no effect on this combined sewer system.

It is estimated that there will not be a need for the construction of extra leachate storage facilities at the Pelham Bay Landfill Site. As mentioned above, the storage capacity of the tanks on site is slightly more than 100,000 gallons. In periods of greater than average precipitation, the leachate will be stored in the five tanks presently at the landfill to preclude the overloading of the combined sewer system. After the precipitation event, the tanks would then be emptied after the flow in the sewer system subsided. This system would be evaluated during the post-closure monitoring to determine whether additional tanks are needed.

Q. **Questions concerning the source of leachate in the landfill,** including; Mr. Mankiewicz of the GAIA Institute also stated that up to half the volume of water entering the landfill appears to be from tidal influence.

A. The rise of the tide, through a piezometric head, "pushes" water into the waste along the perimeter of he landfill. This water flows or discharges outward, during the period from high tide to low tide. This does cause a leachate flow from the landfill. However, a larger source of leachate is caused by the rainfall percolating through the waste and from the groundwater flow into the landfill from Pelham Bay Park. These two sources will be minimized through the remedial activities. The leachate from the tidal action is expected to be "cleaner" then the leachate from the rainfall that has percolated from the rainfall, because the approximately 125 foot perimeter area effected by the tidal action has been flushed for many years, which has removed a significant amount of the pollutants.

6. <u>Landfill decomposition gas management for the Pelham Bay landfill</u>

Q. **Questions concerning technologies for the incineration of the decomposition gases,** including; When you say flare of(off) the methane as a possibility, we know it's well known already that the reason the methane is so low you can't use it as a generating source. It is an old, old landfill. It has past it's prime for energy reduction. It sounds like the alternative is flaring. If its flaring, what is that going to look like? And how many flares are we talking about?

A. The final design of the landfill gas management system depends on the results of the on-going field study. This study will determine the amount of methane being generated and the feasibility of burning the methane for the generation of electricity. If this is not recommended and flaring is the option selected, the initial indication is that two (2) flares will be needed. These flares would be enclosed with no visible flames, low noise, and high overall efficiency. A typical representation of the enclosed flare system is shown in the attached figure.

Q. **Question concerning the recommendation of the ATSDR.** In the Draft Public Health Assessment (PHA), the Agency for Toxic Substances and Disease Registry (ATSDR) made the following recommendation " The ATSDR recommends that a gas venting system be installed to provide an effective means for venting the methane held within the landfill"

A. The selected remedial option includes a provision for the active venting of the gas generated by the landfill. After the gas is collected it will be destructed through flaring.

7. **Land use after closure of the Pelham Bay Landfill**

Q. **Questions concerning the use of the landfill.** Leslie Boden of the Bronx Borough Presidents' Office is concerned about the ultimate use of the site. I notice that part of the plans of the City is going to limit access to the site. Well, up until today the City of New York has not limited access to that dump, they're unable to keep people and vehicles off that dump. I am wondering if you are going to do this, you're going to do that. If you allow access to that dump what's going to happen to your plant?

A. It should be noted that the design of the remedial solution could be done in such a way to make green spaces available to the residents of surrounding communities for passive recreation such as birdwatching and nature trails etc. All these alternatives must be approved however by the NYCDEP and the New York City Department of Parks and Recreation.

8. **Proposed technologies for remediation of the Pelham bay Landfill**

Q. **Questions concerning the consideration of other alternatives for the remediation of the landfill,** including; What I wanted to know is the four proposals that you presented to us tonight, are they the only proposals that you have considered or looked into, and do you have the mechanism to investigate other technologies for closing the landfill without putting a cap on it that may treat the material that is in the landfill and lower the garbage[sic] table faster than it would have if a cap was on it for thirty years? Have other alternatives been given enough serious consideration? Would other alternatives require the introduction of new state legislation? In reference to the remedial alternative that was chosen, page 15, have any or all of these suggestions been done in this country on any landfill anywhere, anyhow? What is it based on, theory, drawing board or what? In addition to this, are any of these landfills on water, such as Pelham Bay, or on land?

A. During the Feasibility Study, different technologies were reviewed for consideration for use in the remediation of the landfill. The four proposals selected (excluding the No Action Alternative) were the best or most viable of the technologies reviewed. Other remedial alternatives have been given serious consideration. The introduction of these alternatives would not require the introduction of new state legislation. All the remedial alternatives mentioned have been done at landfills in this country on the recommendations of various regulatory agencies, such as the USEPA and the NYSDEC. A large number of these landfills are adjacent to, or abutting on waterways.

Q. **Questions concerning bioremediation specifically.** Both the GAIA Institute and Wilma Turnbull, New York Coastal Fishermen's Association expressed much interest in the concept of biological remediation and they both stated that they believe that there are drums buried at the landfill site.

A. In all investigations performed to date, there are no indications that there are drums present at the site. Biological remediation, including the use of artificial wetlands is a new field. More information is being gathered on this subject, but at this time not enough is known about this technology to determine with confidence that it can be applied to a project as large as the remediation of the Pelham Bay Landfill Site.

9. **Questions or issues raised that have been determined not to pertain specifically to the Pelham Bay Landfill Remediation process.**

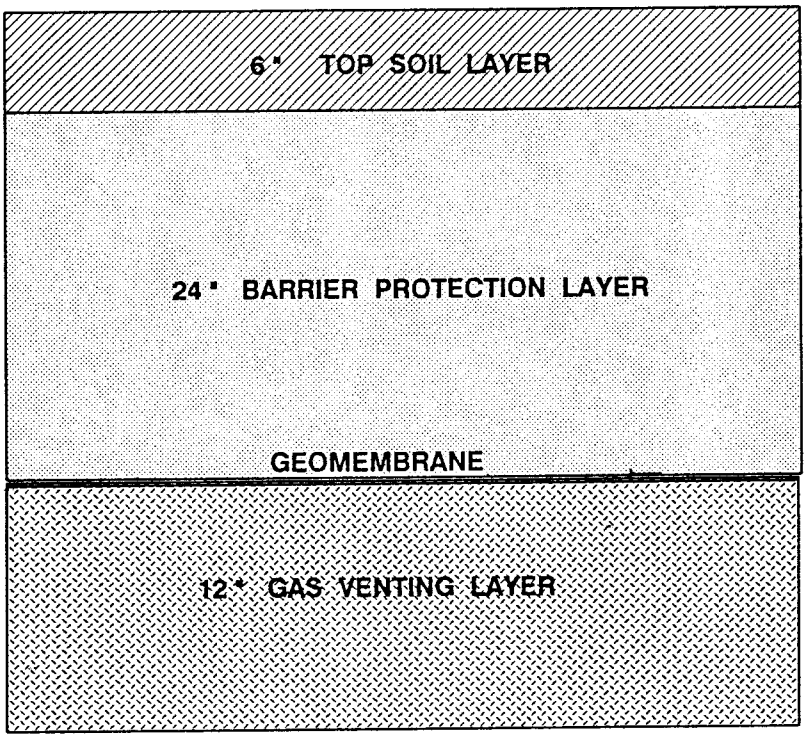
Q. Iris Soave, in a letter dated June 30,1993, addressed to Nigel N. Crawford, Project Manager, NYSDEC, Pelham Bay Landfill, expressed her concerns about the deteriorating conditions of Palmer Inlet in Spencer Estates, Bronx, New York.

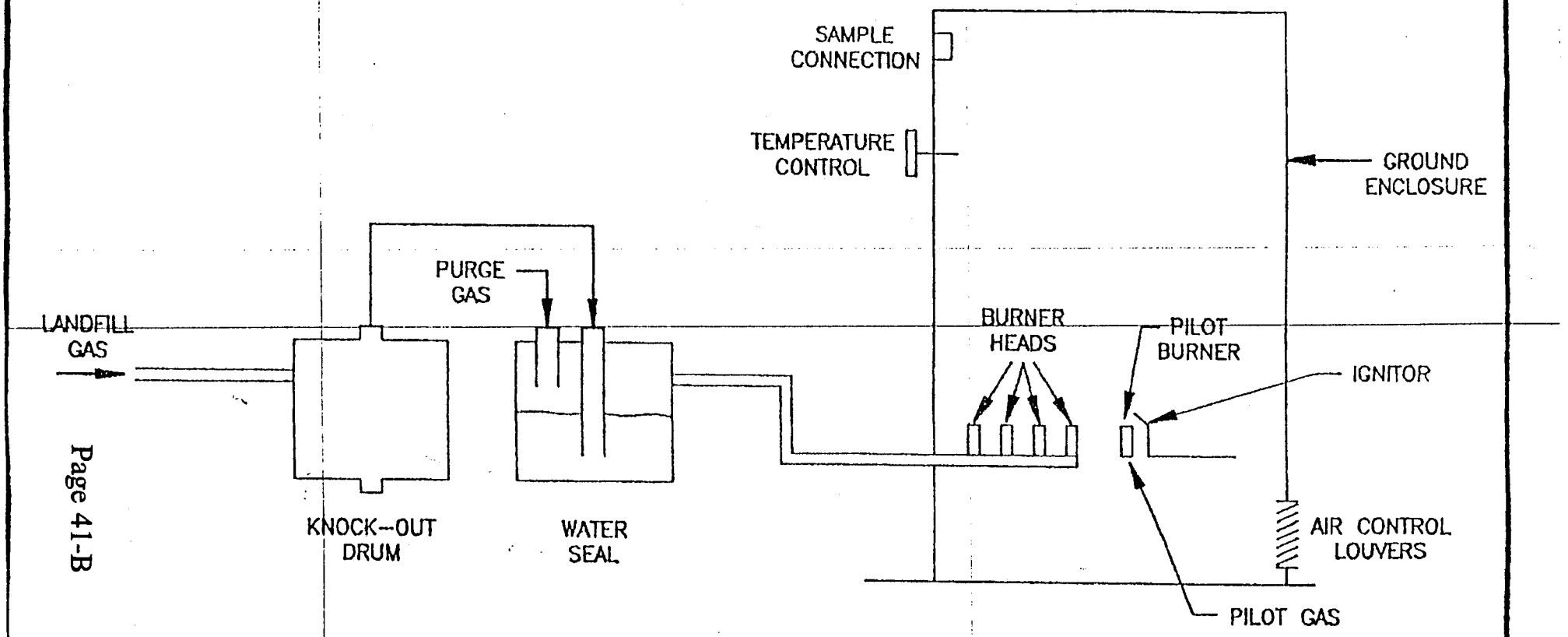
A. The nature of the 100-year storm and the heavy wave action is the cause of the deposition of sediment (black mud) in the inlet, it should be noted that this situation is not unique to this inlet because the same situation occurred at Jamaica Bay. Thus, it cannot be stated definitively that the Pelham Bay Landfill has filled up the creek with sediment. The odor of the sediment (black mud) does smell bad, which is normal. The classic description of this odor is that of rotten eggs, which is H_2S. Anaerobic bacteria breaks down the organic matter in the carbon cycle, which reduces sulfur. There is no carcinogenic risks from the naturally occurring material in the sediment (black mud).

Dredging and bulkheading would not preserve the wetland and prevent runoff. Natural vegetation and mudflats are a natural defense against erosion and flooding. Wetland plants act as biological filtration, by the uptake of pollutants from the soil. Dredging will possibly reduce the viability of existing marshes.

PELHAM BAY LANDFILL

PART 360 CAP



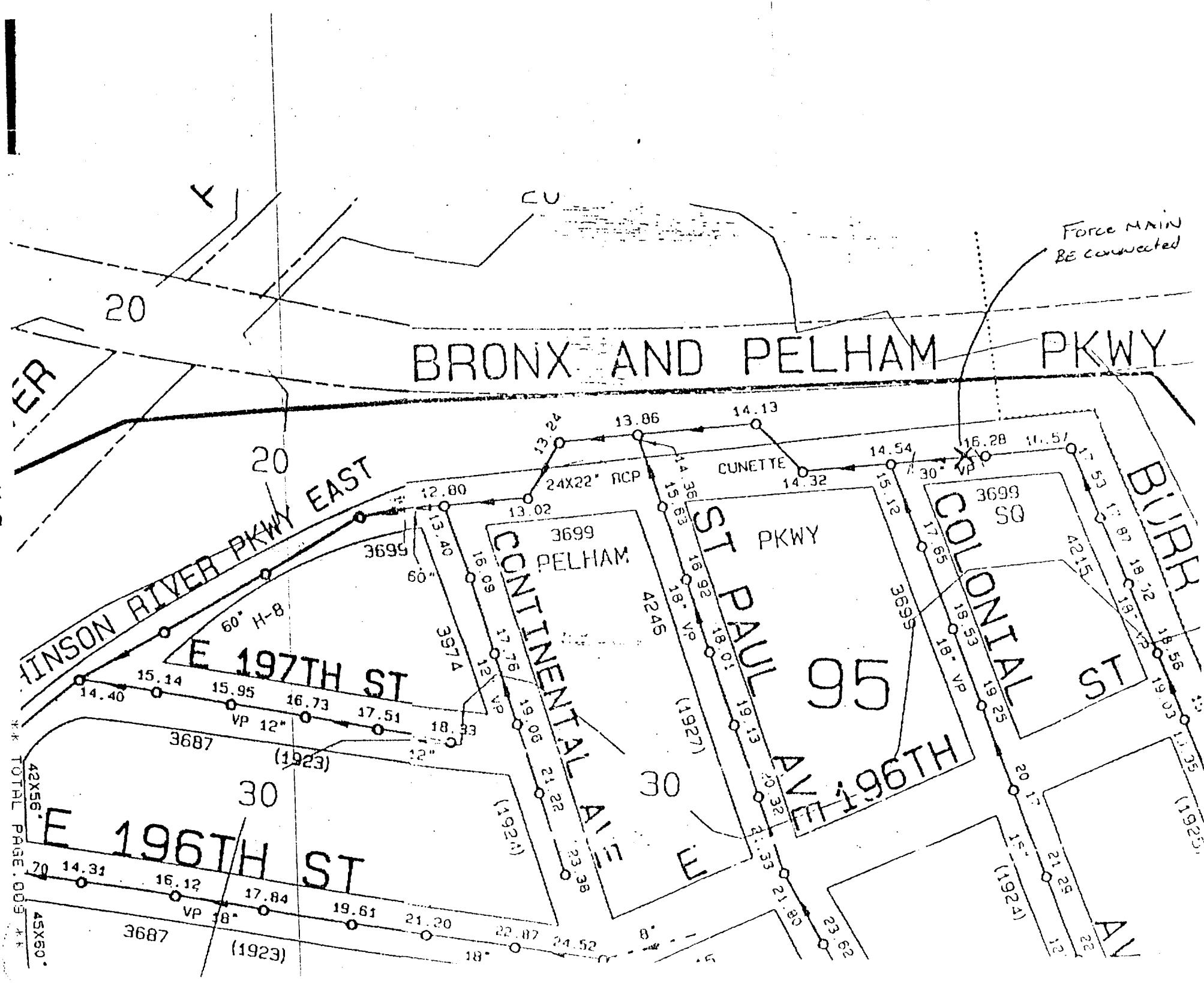


TYPICAL ENCLOSED FLARE

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR.BY	BTM	SCALE	NONE	PROJ.	92C4067
CK'D.BY	T.A.M.	DATE	MAY 25 1993	FIG.NO.	


Force main
BE connected
BRONX AND PELHAM PKWY
20
20
ER
HINSON RIVER PKWY EAST
60" H-8
E 197TH ST
3687
(1923)
30
E 196TH ST
3687
(1923)
42X56"
45X60"
TOTAL PAGE.003
24X22" RCP
CUNETTE
30" VP
3699
PELHAM
CONTINENTAL AVE
3974
4245
(1927)
ST PAUL PKWY
95
AVE
196TH
3699
SQ
4215
COLONIAL ST
BURK
(1924)
(1925)
(1924)

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ADMINISTRATIVE RECORD
PELHAM BAY LANDFILL SITE
SITE # 203001

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