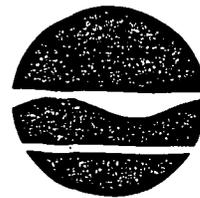


## TABLE OF CONTENTS

	<u>Page No.</u>
Introduction	1
Chronology of Events	5
Remedial Action Components	9
Groundwater Collection and Treatment	9
Landfill Capping	14
Leachate Collection and Treatment Enhancement	20
Landfill Gas Collection and Treatment Enhancement	21
Cost Summary	24

New York State Department of Environmental Conservation  
50 Wolf Road, Albany, New York 12233



Thomas C. Jorling  
Commissioner

SEP 27 1993

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Karl J. Leupold, P.E.  
Commissioner, Department of Public Works  
Town of Oyster Bay  
Syosset, NY 11791-5699

Dear Commissioner Leupold:

Re: Site Code 1-30-001  
Old Bethpage Landfill  
Nassau County

The Department conducted a final inspection of the remedial action activities at the site referenced above on September 14, 1993. As a result of this inspection, the Department has determined that the remedial action (35-acre encapsulation, construction of a groundwater treatment system and improvements to the gas collection system) has been completed in accordance with the Consent Decree.

The Town should follow procedures outlined by the draft May 1993 post-closure operation and maintenance (O&M) manual (especially Section 2.3 and the vegetation fertilization effort scheduled to be executed in October 1993) which is presently under Department review. The comments on this site's O&M manual will follow shortly.

If you have any questions, please call me or John Grathwol at (518) 457-9280.

Sincerely,

Robert C. Knizek, P.E.  
Chief, Eastern Field Services Section  
Bureau of Construction Services  
Div. of Hazardous Waste Remediation

cc: G. Suchman, DOL  
L. Thantu, USEPA Region II

**OYSTER BAY SOLID WASTE DISPOSAL COMPLEX**

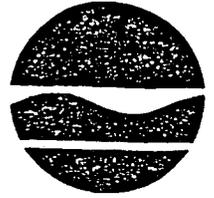
**NPL SITE NO. 130001**

**REMEDIAL ACTION REPORT**

Prepared By: Lockwood Kessler & Bartlett, Inc.  
One Aerial Way  
Syosset, New York 11791

September, 1993

New York State Department of Environmental Conservation  
50 Wolf Road, Albany, New York 12233



Thomas C. Jorling  
Commissioner

SEP 27 1993

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## INTRODUCTION

The Oyster Bay Solid Waste Disposal Complex (OBSWDC) is located in Old Bethpage, Town of Oyster Bay, Nassau County, New York. The site is owned by the Town of Oyster Bay (TOB) and comprises 134 acres, 72 of which were utilized for the disposal of municipal solid waste and limited amounts of industrial waste. The OBSWDC began landfilling operations in 1958 and continued through April, 1986, at which time landfilling was discontinued.

In 1979, local, state and federal investigations were initiated to determine the groundwater quality beneath and adjacent to the OBSWDC and the site's potential impact to the public health and safety of the area's residents. The data obtained from these investigations indicated that disposal of industrial waste at the landfill could be hazardous, and this condition could lead to volatile organic compound contamination of local drinking water. In addition, during the early 1980's, methane gas was detected in the subsurface soil, both on and off site. In September 1983, as a result of these findings, the site was placed on the United States Environmental Protection Agency's (USEPA) National Priorities List (NPL Site No. 130001) for hazardous waste sites.

The NPL designation and concern for public health and safety lead the TOB, the USEPA and the New York State Department of Law (NYS DOL) to institute a remedial investigation and a subsequent Remedial Action Plan to address and control immediate, definable conditions. In May 1984, the TOB and NYSDOL entered into an interim Consent Decree. This Consent Decree required the Town to complete certain remedial activities that were in progress, including the capping of some 29 acres on the northern and western faces of the landfill, the completion and continuous operation of a gas control system to prevent migration of landfill gas and the completion of a leachate collection and treatment system. The TOB was also required, as part of the

landfill gas and the completion of a leachate collection and treatment system. The TOB was also required, as part of the interim Consent Decree, to undertake a remedial investigation/feasibility study (RI/FS) to determine the extent of off-site groundwater contamination and define the means by which any contamination might be contained and/or corrected. As part of the investigation, six exploratory borings were drilled and 23 groundwater monitoring wells were installed in Bethpage State Park. The drilling and monitoring well installation program was completed and the extent of the landfill leachate plume was defined through a sampling program that measured inorganic chemical parameters, which are typical of sanitary landfill leachate.

During June, July and October, 1985, and January and April, 1986, water-quality samples were obtained from the 23 monitoring wells and other select wells. The samples were analyzed for metal and volatile organic compounds (VOC's) to define the extent of the VOC plume. In addition, samples and water-level measurements were taken in three wells directly upgradient of the landfill to assess the effects of mounding. Water-level data from off-site wells clearly indicated that the groundwater flow under the landfill was to the south-southeast; water-level data from the three upgradient wells indicated that mounding did not cause a reversal of flow.

The results of the investigation indicated the approximate lateral extent of the landfill leachate plume to be, at the middle depth, some 2,000 feet from the landfill; the approximate vertical extent is some 200 feet. The results also indicated that the landfill leachate plume contained inorganic compounds and volatile (halogenated and non-halogenated) organic compounds (VOC's). The most dominant halogenated organics, in terms of concentration and distribution, were 1,2-dichloroethene, 1,1-dichloroethene, vinyl chloride, methylene chloride, trichloroethene and chloroethene. The non-halogenated organic

compounds occur in a smaller area of the plume than do the halogenated compounds. The most dominant compounds of this group were benzene, toluene, ethyl benzene and isomers of xylene.

Upon completion of the remedial investigation, a feasibility study was initiated, wherein seven alternatives were evaluated for the effective remediation of the volatile organic and leachate plume emanating from the OBSWDC. The alternative chosen allowed for the largest number of beneficial effects to the environment and consisted of the installation, operation and maintenance of five groundwater recovery wells, a groundwater treatment plant and effluent discharge system to collect, treat and recharge groundwater contaminated by the OBSWDC. The groundwater removal system (five barrier pumping wells) would have a combined pumping capacity of 1.5 mgd. The water would then be conveyed through underground piping to a treatment facility located at the OBSWDC; organic constituents would be removed utilizing air stripping technology (and carbon adsorption, if necessary); and the water recharged upgradient of the landfill.

In addition to the groundwater collection treatment and recharge system, the feasibility study and subsequent Remedial Action Plan and Record of Decision required that: the landfill be capped to prevent further rainfall infiltration and generation of leachate; the existing gas control system be enhanced and continue to operate to prevent the subsurface migration of landfill gases to off-site areas; and the existing landfill leachate collection and treatment system be enhanced, as appropriate, and continue operation to ensure adequate handling and disposal of on-site leachate.

These requirements, along with specific design, system performance criteria, operational monitoring requirements for ambient air quality, air and water emissions and soil gases and a program implementation schedule were formalized and set forth in

a final Order on Consent that the Town of Oyster Bay signed in June 1988. In July 1988, in accordance with the terms of the final Order on Consent, the Town initiated a program to design and construct each of these systems.

Design and approval efforts were carried out from 1988 through the end of 1992. All construction activities were completed in 1993 and all systems are presently operational. Ongoing monitoring programs to measure system performance and effectiveness are presently being used.

## CHRONOLOGY OF EVENTS

Remediation activities at the OBSWDC were initiated by the Town of Oyster Bay well before the site's designation, in September, 1983, as a National Priorities List (NPL) site by the United States Environmental Protection Agency. These remediation activities included:

- the installation, in June 1982, of a gas control system (Phase 1) along the Nassau County Fireman's Training Center/Landfill property boundary for the purpose of controlling subsurface gas migration;
- the installation of an on-site leachate collection and treatment system to control the accumulation and off-site migration of landfill leachate. The system began operation in September 1983.

In addition, construction of two other remediation systems were initiated prior to the site's NPL designation. These included:

- construction of a gas control system along the landfill's eastern property boundary (Phase 2) to control the subsurface migration of landfill gas beneath Winding Road;
- placement of an impermeable clay cap on the eastern and northern slopes of the landfill (an area of approximately 29 acres) in compliance with the requirements of 6NYCRR Part 360.

The Phase 2 gas control system was completed in April, 1984 and found to successfully control the migration of subsurface gas along the landfill's eastern boundary. The eastern and northern slope clay cap was completed in mid 1984 and remains effective in preventing the infiltration of rainfall/runoff through these slopes.

In May 1984, the Town entered into an Interim Consent Decree with the NYSDOL to complete and continue to operate the existing remediation systems (summarized above) and to undertake a remedial investigation/feasibility study (RI/FS) to determine the extent of off-site contamination and to define the means by which to control and/or contain any groundwater contamination. The RI was initiated in 1984 (after signing of the Interim Consent Decree) and completed in late 1986. The FS was then prepared in July 1987 and a Remedial Action Plan was prepared in September 1987. The Remedial Action Plan was followed by publication of the Record of Decision in March 1988 and the execution, by the Town of Oyster Bay and the NYSDOL in July 1988, of the final Order on Consent, which obligated the Town to implement specific remedial actions. Concurrent with development of the above document, the Town of Oyster Bay continued to upgrade and/or extend existing remediation activities, as follows:

- Relocation and upgrade of the blower station and thermal oxidizer serving the perimeter landfill gas collection system. This activity was completed in April 1986;
- In 1987, initiation of Phase 3 of the perimeter landfill gas collection system, which was designed to control subsurface gas migration along the edges of the western slopes. This activity was completed in early 1988.

After signing the final Consent Decree in June 1988, the Town began implementing the final remedial activities, as set forth in the Record of Decision, as follows:

- Groundwater Collection and Treatment Facility
  1. System design completed by LKB and approved by NYSDEC in December 1989.
  2. Contract awarded to Tyree/Pratt in April 1990.
  3. Construction completed in March 1992.
  4. Operational testing - December 1991 through March 1992.

5. Continuous system operation commenced in April 1992.
6. Final inspection completed and system approved in September 1993.
7. First year performance monitoring completed in April 1993.

- **Landfill Capping - Town Forces - Area "D" Slopes**

1. Design completed by LKB in July 1988.
2. Construction initiated by town forces in June 1988.
3. Plans/specifications approved by NYSDEC in October 1988.
4. Construction completed in June 1990.
5. Final inspection completed and construction approved in September 1993.

- **Landfill Capping - Contract 86-415C - Remaining Landfill Slopes**

1. Design completed by LKB and approved by NYSDEC in July 1990.
2. Contract awarded to J.D. Posillico in November 1990.
3. Construction completed in May 1992.
4. Final inspection completed and construction approved in September 1993.

- **Landfill Capping- Contract 86-415D - Landfill Plateau**

1. Design completed by LKB and approved by NYSDEC in September 1991.
2. Contract awarded to J.D. Posillico in March 1992.
3. Construction completed in January 1993.
4. Final inspection completed and construction approved in September 1993.

- **Landfill Perimeter Gas Control System Enhancement**

1. Design completed by LKB and approved by NYSDEC in mid 1992.
2. Contract awarded to Centrum Construction Company in September 1992.

3. Construction completed in December 1992.
4. Final inspection completed and construction approved in September 1993.
5. Performance testing completed in June 1993.

- **Leachate Treatment Enhancement**

1. Two Leachate treatment collection wells and transmission piping were installed as part of Landfill Capping Contract 86-415C. This work was completed in May 1992.
2. Final inspection completed and construction approved in September 1993.

## REMEDIAL ACTION COMPONENTS

The actual efforts that were undertaken to implement each of the remedial activities called for in the Consent Decree are described in the following paragraphs. The descriptions are organized and presented by remedial activity, as follows:

- Groundwater Collection and Treatment
- Landfill Capping
- Leachate Collection and Treatment Enhancement
- Landfill Gas Collection Treatment Enhancement

As part of each of the remedial activity contracts, the TOB established overall health and safety criteria to guide construction activities. These criteria provided a description of existing conditions, identified environmental conditions that might be encountered during construction and provided that a Health and Safety Plan be prepared and implemented by the contractor during the construction activities. The plan was established to protect worker health and safety and to ensure the protection of the surrounding environs. It provided for daily record keeping, the monitoring of work areas for hazardous conditions, the provision of safety equipment, as necessary, and the screening of incoming materials used in construction, as necessary. Accordingly each construction contractor developed a plan, which was monitored for compliance with criteria established by the Town.

### GROUNDWATER COLLECTION AND TREATMENT

The Remedial Action Plan for groundwater remediation incorporated the following activities in compliance with the terms and conditions of the final Consent Decree.

1. Install a system of groundwater recovery wells in the area to be remediated.

2. Operate and maintain the groundwater recovery wells, to create a hydraulic barrier. Demonstrate that groundwater meets established standards or that the zero slope condition and other termination criteria have been met.
3. Treat and discharge the extracted and collected groundwater in compliance with all regulations.
4. Carry out and comply with the requirements for sampling, analysis and health and safety.

#### Performance Standards and Construction Quality Control

The system's construction and performance standards, including health and safety standards, were established in the design plans and specifications. These standards addressed: groundwater extraction well depths; screen location and pumping rates; treatment system hydraulic requirements; air stripper performance criteria, specifically related to VOC air and liquid discharge requirements; and system performance monitoring that addressed air, liquid and hydraulic performance criteria. Each of the construction standards were monitored carefully during construction by LKB to ensure compliance with requirements. Operational performance standards, which were also established in the final Consent Decree, were monitored during performance testing, which took place for approximately three months, after nearly all systems were constructed and found to be in compliance with the requirements of the Consent Decree.

#### Construction Activities

Construction began on April 23, 1990. The scope of work included drilling and installing four groundwater production wells and rehabilitation of one existing production well. The average depth of the five wells is 280 feet. The treatment plant, which is located on the landfill site, was constructed on a pile foundation with a methane ventilation system, process control

equipment and interconnecting piping. The building houses wetwells where groundwater is collected from the transmission line and then pumped to the air stripper. The treated water is then transported to another wetwell where it is pumped to the diffusion wells via the forcemain. At the base of the discharge basin, there are eight diffusion wells that are interconnected by a twelve-inch pipe. Each well is ten feet in diameter and placed to a depth of 30 feet. Construction activities for each of these systems were completed in May 1992.

### Final Inspection

There were no major problems or significant encounters with methane gas and/or hazardous conditions during the course of construction. However, Hurricane Bob struck the project site in August 1990. The intensity of the storm created tremendous runoff, which flooded one of the production wells. The resultant water damage required extensive corrective work. During the course of start-up of the treatment plant, there were numerous lightning strikes in the area of the five production wells. These strikes caused damage to telemetry and processing equipment. In light of this problem, surge and lightning protection devices have been installed. Final inspection was made in September 1993, and the system was found to be successfully operating in compliance with all requirements.

### Certification that Remedy is Operational and Functional

The Groundwater Treatment Facility began operation on April 1, 1992. At that time, a monitoring program was designed and implemented pursuant to the terms of the Consent Decree. Each calendar quarter, the progress of the remediation effort is reported to the regulatory agencies. These reports indicate the location and extent of the volatile organic plume, as determined by extensive groundwater monitoring. In addition, comprehensive on-site laboratory data demonstrating the high degree of treatment attained was also provided.

On the basis of the quarterly hydrogeological studies, it has been determined that the volatile organic plume has been and remains contained. During the initial operating year (April 1, 1992 through March 31, 1993), treatment efficiency, as measured by the degree of volatile organics removed from the groundwater, has averaged greater than 99%, meeting effluent standards established in the Consent Decree (see Table 1). Therefore, no additional treatment units are required at this time.

The monitoring program has demonstrated that the treatment system is working effectively to remove VOC's from the groundwater; however, it has also shown that the extraction wells are intercepting a second VOC contaminated groundwater plume. The results of chemical analyses of groundwater extracted from wells 4 and 5 show high levels of tetrachloroethene (PCE). United States Environmental Protection Agency (USEPA) studies have shown large amounts of PCE in a groundwater plume emanating from the the Claremont Polychemical hazardous waste site, which is moving in the direction of the Town collection system, specifically toward extraction wells 4 and 5. The groundwater collected from wells 4 and 5, which is comprised primarily of PCE, contributes approximately 50 percent of the VOC loading into the Town's Groundwater Treatment Facility. Although the existing treatment system is presently able to accept the additional loading and treat the VOC's, this loading may impact treatment efficiency and air and water discharge characteristics, wherein it may contravene established performance criteria in the future.

In addition to groundwater and liquid discharge monitoring, quarterly air stripper, air emissions and ambient air quality monitoring are conducted to measure compliance with established ambient air quality guidelines. This monitoring, which parallels the groundwater monitoring program, has shown that, during the initial year of operation (April 1, 1992 to March 31, 1992), the system's air discharges, as measured at the property line, were

in compliance with the guidelines established by the Consent Decree (see Table 2).

#### Operation and Maintenance

An O&M Manual was prepared by Lockwood, Kessler & Bartlett, Inc., Consulting Engineers, for the Town of Oyster Bay. The material contained in the O&M Manual includes operating and maintenance instructions for the system of groundwater production wells, treatment equipment, pumping units, piping and valves, electrical, instrumentation and HVAC equipment related to the collection and treatment of the groundwater at the Oyster Bay Solid Waste Disposal Complex (OBSWDC).

The instructions and recommendations in the O&M Manual serve as a guide for maintenance personnel in the performance of their duties in the operation and maintenance of the systems and equipment described.

Reports are submitted for each quarter of the operating period containing the following information and data:

- Pumpage records
- Treatment system air and water discharge data
- Data analysis (trends, position of plume, etc.)
- Modifications to system, including method and dates of approval
- Groundwater quality monitoring data
- Water level data
- Potentiometric surface maps, as revised
- Record of all system downtime

## LANDFILL CAPPING

### Performance Standards and Construction Quality Control

Prior to development of the final Consent Decree, 29 acres of the total 72 acres of the landfill had been capped. The remaining portion, 43 acres, was capped under the provision of the Consent Decree. Testing was conducted as per standards established by the American Society for Testing Materials (ASTM).

The clay cap was constructed in six-inch thick lifts, after compaction, to a final thickness of 18 inches. As outlined in the Consent Decree, the clay material was to meet the following specifications.

- |                      |  |
|----------------------|--|
| a. Permeability:     | $1 \times 10^{-7}$ cm/sec or less                |
| b. Grain Size:       | P200 content of 50% by weight or greater         |
| c. Liquid Limit:     | 25% or greater                                   |
| d. Plasticity Index: | 10% or greater                                   |
| e. Compaction:       | 90% Modified Proctor density or greater          |
| f. Moisture Content: | Varying between optimum and 2% of wet of optimum |

To ensure attainment of the required permeability for the clay cap, the following documentation testing was to be performed:

- Analysis of grain size distribution using the Unified Soil Classification System (ASTM D2487) and analysis of Atterberg Limits on at least one sample for every 500 cubic yards of clay placed.
- Development of reference compaction, dry density, moisture content and permeability curves using at least three points per curve for each sample of material proposed to be used

for the cap and for at least one sample for every 500 cubic yards of clay placed.

- Measurements of insitu compaction using a nuclear densometer (ASTM D2922) at the intersection points of a 100-foot grid pattern. The grid shall be offset for each lift of in-place material.
- Measurement of laboratory saturated hydraulic conductivity on a minimum of one undisturbed sample per acre per lift of clay placed. The procedure for obtaining the undisturbed sample and performing the test must be approved by the State.

#### Construction Activities

Construction plans and specifications for three separate contracts were prepared by LKB. The first contract to be carried out by town forces continued the capping of the slopes in a five-acre area on the landfill western face, abutting the previous capping work. The second contract established the remaining toe and side slopes, and the third contract addressed the top or "plateau" area. Phasing of the construction in this manner provided a means to make adjustments for the unpredictable fluff and compaction factors of the municipal solid waste that had to be shaped.

The Town commenced the area "D" capping work in June 1988. The effort involved shaping of the slopes, placement of clean fill to control odors, placement of 18 inches of clay (in three six-inch lifts) as a barrier layer, and the placement of 12 inches of growing medium. The work was completed with the application of hydroseed in June 1990.

For the second contract, the general contractor, J.D. Posillico, Inc., commenced operations for the side slope contract on November 19, 1990. Responsibilities included implementation of a

Health and Safety Plan. The scope of work included: reshaping the proposed capping and closure area; placement of cover material, consisting of clean fill to control odors, fire hazards and blowing litter; placement of a six-inch layer of clean fill prior to capping; placement of clean fill, Type A, Type B, as necessary to complete the reshaping; placement of clay material cap placed in six-inch lifts (after compaction) to a depth of 18 inches; and to provide all field testing of same; placement of growing medium to a depth of 12 inches (the top four inches of the growing medium were scarified prior to hydroseeding; replacement of two leachate collection wells and piping.

At the onset of construction, the specifications concerning compaction and moisture content were challenged by the contractor's soil consultant. Data put forth by the consultant showed requisite permeabilities could be achieved at a wider range of water content and density than two percent of wet optimum and 90 percent of modified proctor. An illustrative graph (see Figure 1) was presented by the contractor's consultant, which depicted this expanded range. The matter was brought to the attention of the NYSDEC.

In further discussions with the NYSDEC, it was noted that there was little variation in the reference curves of the clay being utilized. Additionally, the time required to develop these reference curves was slowing contract progress. Since the curves are reference guides to the material's permeability, which is ultimately confirmed by the hydraulic conductivity tests, the following alternate testing procedures were requested and approved by the NYSDEC:

- Reference compaction and permeability curves for every 500 cubic yards (as per 6NYCRR Part 360).
- Undisturbed hydraulic conductivity tests at the rate of three per acre per lift of clay placed.

During the course of construction, it was determined that the overall consolidation and compaction of the municipal solid waste was higher than expected. Accordingly, the ultimate height of the plateau was lowered, thereby reducing the quantity of clay and growing medium necessary to complete the work. The adjustments are noted as follows:

	<u>Quantities</u>		
	<u>Estimated</u>	<u>Actual</u>	<u>Difference</u>
Reshaping MSW	130,000 cy	286,235 cy	+156,235 cy
Embankment in place (clay)	70,000 cy	53,674 cy	-16,325 cy
Embankment in place (clean fill)	235,000 cy	126,300 cy	-108,700 cy
Growing Medium	69,000 cy	46,403 cy	-22,596 cy
Hydroseeding	115,000 cy	92,807 cy	-22,193 cy

Difficulties were later encountered when the contractor began installing leachate collection well "C". Due to the nature of the municipal solid waste, the contractor was unable to excavate in a manner that would allow the precast concrete rings to slide into place. The various debris encountered could catch the rings and prevent them from maintaining proper alignment. After a number of unsuccessful attempts, the contractor opted to open cut the area. The rings were then stacked and the area backfilled in a sequential manner. Concerns for odor problems were addressed with the application of lime on open cuts.

In support of the above-described construction work, the Town received approval from NYSDOL and initiated filling operations for the 13-acre Phase II pit area in early 1990. The pit area was located at the toe of the existing fill area along the landfill's steep (slope of approximately 1 on 1) western face. The purpose of the fill operation was to: enhance area drainage to eliminate collection and retainage of runoff at the toe of the landfill; provide for a sound and stable foundation upon which the landfill slopes could be constructed; and provide for an

adequate construction lay down and work area for the contract. The fill operation began in mid 1990 and was monitored and directed by Town forces. The material approved by NYSDEC for acceptance as clean fill is shown in Table 3. As part of their oversight, the Town instituted an intense three-stage inspection program to ensure that only acceptable material is used in the fill operation. This operation includes: 1) an initial visual inspection of the fill material that is brought in for placement in the Phase 2 pit area. The trucks are inspected from the tower and then directed, in a controlled manner, to the fill area provided the tower watchman does not observe any unacceptable fill material; 2) the end-dumping of the fill material in an operation area, and the visual inspection of this material as it is emptied from the truck. This inspection is conducted on grade and also includes VOC detection, using a photoionization method (Tip Meter) in the air space immediately above the material. Any material that is found to be unacceptable is reloaded and shipped out of the area; 3) the spreading and inspection of the fill material in the Phase 2 pit area. As the bulldozer operator moves the refuse material, it will be visually inspected for a third time to insure that unacceptable material is not present. Any material deemed unsuitable during these last two phases is unloaded and removed from the site. Finally, groundwater monitoring wells, both upgradient and downgradient of the fill area, were installed and continue to be monitored on a quarterly basis.

The capping of the plateau area commenced on March 4, 1992 by general contractor, J.D. Posillico, Inc. Since the same contractor won the bid for this phase of the capping, the continuity of the overall program was not hampered. The contractor continued with the Health and Safety Program that was already in effect; other duties under this contract were the same as the side slope contract with regard to the placement of clay and growing medium and hydroseeding.

### Final Inspection

Preliminary post-construction inspections were conducted during the fall of 1992 and spring of 1993. The final inspection was held in September 1993.

During the preliminary inspections, the following punch list items were identified: slope erosion on the eastern slope of the landfill; the establishment of a monitoring program for potential settlement of the gabion wall; the elimination of weeds in gabion chutes and bench roads; the removal of trees on capped areas; monitoring a portion of the plateau for possible additional hydroseeding; and the development of an Operations and Maintenance (O&M) Manual.

The erosion of the slope was addressed during the winter of 1992 and to date is still a viable repair. The monitoring program for the gabion wall settlement was established and an initial survey was conducted. It was determined that additional hydroseeding was required for a small portion of the plateau. This will be addressed during the 1993 growing season during acceptable weather conditions. An O&M manual was submitted to address ongoing maintenance of the cap.

### Certification that Remedy is Operational and Functional

Certification that the capping program is operational and functional is validated by reviewing the geological test data. A total of 148 laboratory saturated hydraulic conductivity tests confirm the clay cap has a permeability of  $1 \times 10^{-7}$  cm/sec or less. This is further corroborated by over 200 insitu compaction tests that were performed over a 100-foot grid pattern for each six-inch lift of clay (a total of 619 tests). The density reading that was obtained when plotted on the reference compaction curves to permeabilities that meet or exceed the contract requirements (i.e.  $1 \times 10^{-7}$  or less). Integrity of the clay cap is provided by 18 inches of growing medium and its vegetative cover.

### Operation and Maintenance

The Town of Oyster Bay performs periodic inspections and monitoring of physical aspects of the site to assure the continued effectiveness of the cap. The matters of concern include:

- Erosion by wind
- Root penetration/deep rooting trees
- Burrowing animals
- Vegetation/grass
- Cracks caused by uneven settlements
- Ponding caused by settlements
- Leachate seep management
- Odor control
- Drainage system
- Access roads
- Gabion wall settlements

### LEACHATE COLLECTION AND TREATMENT ENHANCEMENT

#### Construction Activities

A leachate collection and treatment system has been operating at the landfill since September 1983. The system is designed to collect, store, treat and dispose of leachate generated by the landfill. Collection wells and an underdrain system have been installed over the 12-acre, lined portion of the landfill. This system also includes the two leachate wells installed in the capping and closure contract. These replaced existing wells that had become partially silted and clogged. Leachate flows from these collection points to a clay and polyethylene lined storage basin. The leachate is then treated by standard metals precipitation and solids separation techniques and pH adjustment. The treated effluent is discharged into the Nassau County sewage treatment system in accordance with the requirements of the State Pollution Discharge Elimination System (SPDES) and Nassau County ordinances. The sludge generated by the leachate collection

system is disposed of at an off-site location in compliance with all applicable federal, state and local laws and regulations.

The capacity of the leachate collection system is 50,000 gallons/day. The amount of leachate produced is approximately 150,000 gallons/week. The leachate is and will continue to be monitored monthly for metals, sulfites and total suspended solids, until such time as leachate production ceases at the landfill.

In progress at this time, Raydon Construction is engaged in a contract that includes furnishing and installing a storage facility adjacent to the existing plant, various modifications to the existing building, modifications within the existing plant, including replacement of two pumps, as well as replacement of liner in the existing storage and settling basins.

As part of the remedial plan, the Town is required to continue to operate and maintain its leachate collection, treatment and disposal system in compliance with 6NYCRR Part 360 and applicable Nassau County sewer ordinances.

#### LANDFILL GAS COLLECTION AND TREATMENT ENHANCEMENT

Since 1979, the Town has implemented programs to prevent off-site migration of landfill gas at the OBSWDC. A perimeter landfill gas collection system has been installed under four separate construction contracts. The system consists of 23 gas recovery wells, 6,500 feet of collection header and three condensate collection wells. The mechanical portion of the system consists of two independently driven blower packages with a combined flow rate capacity of nearly 1800 cubic feet/minute; condensate separation equipment; safety devices and a high temperature thermal oxidizer. Collected condensate is adjusted for pH and disposed through the Nassau County Sanitary Sewer System.

The gas collection system installed at the landfill is monitored on a monthly basis. Annual reports have been prepared summarizing the results of the data collected since 1979. The reports demonstrate the effectiveness of the methane gas collection system for controlling gas migration beyond the boundary of the landfill.

A supplemental gas sampling program was undertaken in June 1987 to confirm that the system effectively prevented the escape of gases other than methane from the landfill. This consisted primarily of collection of ambient and subsurface gas samples at various locations and depths around the site. The samples were then analyzed for volatile organic compounds (VOC's). Minimal levels of VOC's were found in some of the gas samples. The data demonstrated that the collection system is effective for controlling VOC's as well as methane. However, the data also demonstrated the need for further monitoring for potential migration. In light of these results, a continuing VOC sampling program to supplement the current methane gas monitoring program was designed and set forth in the Remedial Action Plan.

This supplemental program consists of: the collection of subsurface gas samples from depths of 30 inches at 14 locations around the perimeter of the collection system; the collection of subsurface gas samples at depths of 10, 20, 30 and 40 feet from one deep cluster beyond the collection system; the collection of ambient air samples at three locations around the landfill; the collection of thermal oxidizer emission samples (stack testing in the incinerator stack); and the taking of pressure readings to ascertain whether a vacuum is created by the collection system. These samplings are being performed on a quarterly basis.

Based on the results of this quarterly sampling program and monitoring conducted jointly with Nassau County Department of Public Works on the Nassau County Fireman's Training Center (FTC) property, the Town initiated several enhancements to the

collection system. These enhancements included the installation of three new gas collection wells along the FTC/landfill property boundary to further protect against gas migration and the installation of a third blower package to provide for system redundancy. The plans were prepared in early 1992, and the contract for these enhancements was awarded to Centrum Construction Company in September 1992. Construction was completed in December 1992, and performance testing conducted in June 1993 demonstrated enhanced control (greater negative pressure readings) along the property boundary with the FTC.

Presently, as part of this remedial program, the Town will continue to operate and maintain this gas collection system in compliance with the requirements of 6NYCRR Part 360 and maintain a zero percent methane gas migration limitation at the landfill boundary.

### COST SUMMARY

The costs associated with design and construction of the remedial action components described above are summarized in Table 4. Construction costs total \$19,226,000. Remedial Study and Design costs total \$4,173,000. Total costs are \$23,399,000.

TABLE 4

OBSWDC REMEDIAL ACTION  
DESIGN AND CONSTRUCTION COST SUMMARY<sup>1</sup>  
Pursuant to Consent Decree Requirements

<u>PROGRAM</u>	<u>CONSTRUCTION COSTS</u>	<u>REMEDIAL DESIGN COSTS<sup>2</sup></u>	<u>TOTAL COSTS</u>
Landfill Capping	\$12,051,000	\$ 1,831,000	\$13,882,000
Groundwater Remediation	\$ 6,275,000	\$ 1,562,000	\$ 7,817,000
Landfill Gas Control Enhancement	\$ 200,000	\$ 600,000	\$ 900,000
Leachate Treatment Enhancement	<u>\$ 700,000</u>	<u>\$ 180,000</u>	<u>\$ 880,000</u>
Total Remediation Costs	\$19,226,000	\$ 4,173,000	\$23,399,000

1. Does not include ongoing performance monitoring and operation and maintenance costs.

2. Inclusive of field work and studies in support of design efforts.