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July 10, 1996

Mr. Michael Mason
New York State Department
of Environmental Conservation
50 Wolf Road
Albany, NY 12233-7010

Re: Operation and Maintenance Plan
Croton Point Landfill
Letter No. 374

Dear Mr. Mason:

We are pleased to submit herewith a revised copy of "Post Closure Care and Operation and Maintenance Manual" for the Croton Point Landfill. The document incorporates revisions based on review comments by the NYDEC and Environ Corporation.

If you have any questions, please do not hesitate to contact me.

Very truly yours,

SAVIN ENGINEERS, P.C.

James M. Gavin, P.E.
Vice President

JMG:amm

Attachments

cc: R. Matarazzo, Deputy Commissioner, WCDEF, w/attachments
M. Nielsen, Environ Corp., w/attachments

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Section 1

Introduction

Section 1
Introduction

1.1 Purpose of Manual

The purpose of this manual is to familiarize County operations and maintenance personnel with the basis of design of the landfill post closure system, to provide a description of the system and its components and to make recommendations for operation and maintenance procedures so that the system can operate safely, efficiently, and in conformance with applicable regulations.

1.2 Scope

This Operation and Maintenance (O&M) Manual is a primary reference manual for the Croton Point Sanitary Landfill's Post-Closure System. It is essential that those persons responsible for the operation and maintenance of the system be thoroughly familiar with its contents and format so that desired information can be found quickly. Although it is a primary reference document, it is by no means the only reference, nor is it totally self-contained or comprehensive. References are provided in the Manual, directing the user's attention to more detailed manufacturer's literature, technical reference, textbooks and other sources of information which may or may not be appended hereto.

A Table of Contents listing all chapters is presented in the beginning of this Manual to permit easy identification and location of the topics addressed herein. This section is intended to give some explanation of the Manual's organization, as outlined in the Table of Contents, and to discuss its use. The general background concerning the history and features of the Croton Sanitary Landfill and its Post-Closure System is also discussed.

Section 1 provides a brief description of the purpose of the O&M Manual, the site history, rational for closure and an overview of the closure process and design of closure components.

Section 2 contains information pertaining to the operation, design and configuration of the leachate collection and landfill gas system. It is meant to provide operation and maintenance personnel with a clear picture of the system as a whole and the interrelationship of it's components. Each major component of the system is described in detail and guidance is provided on operating and controlling these units.

Section 3 describes type, location, sampling and sample preservation methodology, and recordkeeping and reporting requirements for all environmental monitoring activities.

Section 4 outlines the required maintenance and inspection procedures for all components of the landfill post-closure system.

Section 5 contains information regarding personnel needs for the Croton Sanitary Landfill's Post Closure System. Minimum qualifications and training requirements are also covered in this section.

Section 6 covers the safety and health programs for the site personnel involved in hazardous waste operations. The program is designed to identify, evaluate, and control safety and health hazards and provide for emergency response for activities involving hazardous waste operation.

Section 7 provides contingency plans to address potential problems associated with spills, fire, explosion, personal injury and toxic exposures.

Section 8 summarizes record keeping and reporting requirements for the Croton Point Sanitary Landfill Post Closure Operation and Maintenance Program.

1.3 Site Description

The Croton Point Sanitary Landfill is located on Croton Point, a peninsula slightly over 500 acres extending approximately two miles into the Hudson River from the eastern shore. The landfill is located southwest of the Village of Croton-on-Hudson (Figure 1). The Croton Point Sanitary Landfill is classified as a Class II inactive waste disposal site under the New York State Department of Environmental Conservation (NYSDEC) regulations pertaining to inactive hazardous waste disposal sites, 6 NYCRR Part 375.

The Croton Point Sanitary Landfill is divided into two distinct disposal facilities (Figure 2). The largest of these facilities is the "Original Landfill", an unlined unit of approximately 96 acres used from 1927 until 1986. The other unit, known as the "Ballfield Landfill" (approximately 27 acres), is an immediately adjacent lined landfill operated from 1982 until 1987. The Ballfield Landfill utilizes a bottom liner and leachate collection system.

The Railroad 1 Landfill is a separate landfill located north of the main landfill adjacent to the Metro North Rail Yard (Figure 2). The Railroad 1 unit is an 18 acre lined landfill with a combination

synthetic top and clay-side liner and a leachate collection system. Operated from 1976 until 1982, the Railroad 1 Landfill received only municipal solid waste.

The Original Landfill has no man-made liner, however, it is underlain by a organic clay/peat deposit. This deposit inhibits vertical flow of groundwater and would be expected to promote a predominantly lateral flow of groundwater out of the landfill. Based on shallow well water elevations in and around the landfill, preferential groundwater flow in the water table (unconfined) system is from the landfill northwest toward Haverstraw Bay and southeast toward the tidal shallows off the Croton Marsh.

A deeper groundwater system exists under confined conditions beneath the organic clay/peat deposit. Although flow in this confined system is more complicated by tidal influence than flow in the unconfined system, deep well water levels reveal a general direction of flow from the mainland toward Croton Bay. The organic clay/peat layer impedes the flow of groundwater between the shallow unconfined system and the deeper confined system.

Apart from the landfill areas, much of the land use on Croton Point is recreational. There are camping areas to the north and south of the Original Landfill, a picnic area to the west, and a beach area along Haverstraw Bay to the northwest.

Croton Point adjoins the mainland along its boundary with the Harmon Railroad Yard, an area of approximately 100 acres where the Metro-North Commuter Railroad operates a maintenance and repair yard.

1.4 Site History

The Croton Point Sanitary Landfill served as the primary solid waste disposal facility for Westchester County, New York for nearly sixty years beginning in 1927. During that time, the facility was used for the disposal of municipal refuse and construction-demolition debris. There are also reports of disposal of industrial waste and other materials of a hazardous nature at the Croton Point Sanitary Landfill. Although landfill operations continued at Croton Point through 1986, from 1975 to 1987 landfilling was conducted under a Consent Judgement and later a Stipulation and Order between Westchester County and the United States District Court, Southern District of New York. In 1989, the RI/FS remedial program was implemented by Westchester County in compliance with the 1989 Consent Order between Westchester and the NYSDEC.

The Original Landfill was used from 1927 until it was phased out in 1986. The Railroad 1 and Ballfield units were constructed subsequent to the 1975 consent judgement to provide interim solid waste management capacity. In 1995, after completion of construction of the Croton Point Sanitary Landfill Closure System, the site was reopened for public access.

1.5 Site Geology

The Croton Landfill is located on Croton Point which is a peninsula extending about two miles into the Hudson River from the mainland. Croton Point is believed to be a remnant of a delta deposited into glacial Lake Hudson which occupied the Hudson River Valley until approximately 10,000 years ago (Geraghty & Miller, Inc. 1973). The generalized stratigraphy of the Point includes, from bottom to top, a bedrock basement, lacustrine (lake) silts and clays, deltaic silts and clays, and deltaic sands.

This sequence of fine-grained deposits grading upwards into coarser deposits is typical of a prograding delta. The delta deposits once extended across most of Croton Point, Croton Bay, and Haverstraw Bay but were eroded to their present configuration by downcutting of the ancient Croton River (Reynolds, 1988). The western shore of Croton Point consists of elongated mounds which are postulated to be an end or lateral glacial moraine (Kindle, 1949; Markl, 1971).

1.6 Overview of the Croton Landfill Closure

1.6.1 Purpose of the Landfill Closure

The Croton Landfill Closure is designed and constructed to protect the environment and the Public Health and Safety. The design remediates potential adverse impacts of waste material disposed of at the site during the landfills 60 years of operation. The closure design encompasses corrective measures for contaminated surface, groundwater, stormwater and leachate, sediments and soils, landfill gas and ambient air. In addition, the closure is designed so that the site can be opened for general public access. Future site use is subject to deed restrictions which limit site use, preclude invasive activities and restrict the utilization of groundwater beneath the site.

1.6.2 Landfill Closure Process

The Croton Landfill Closure implemented a phased approach. The first phase determined the adverse impacts of the landfill on the environment and public health and safety. The second phase identified and implemented the most cost effective means of correcting the adverse impacts and preventing future impact. The Croton closure process was sequenced as follows: Remedial Investigation, Feasibility Study, Closure Design and Closure Construction.

1.6.2.1 Remedial Investigation

During the Remedial Investigation, environmental monitoring and sampling was conducted on soils, sediments, groundwater, stormwater, surface water, leachate, landfill gas, and ambient air on and around the landfill. The sampling was completed to assess existing conditions and degree of contamination from the waste material. The results of sampling was used to asses the potential impacts on the environment and the public health and safety.

1.6.2.2 Feasibility Study

The Feasibility Study was implemented to determine the most effective means of correcting the conditions identified in the Remedial Investigation. The Feasibility Study identified and developed various remedial alternatives for cleaning up the site. The alternatives were compared on the basis of cost, constructability and long-term effectiveness.

On the Croton Landfill, three basic remedial strategies were considered. Alternatives included: no action (keep the landfill closed to the public but pursue no further action), removal (excavate all waste material and remove it from the site) and insitu remediation (cover the landfill, collect contaminated liquids and landfill gas and open site to the public).

The insitu remediation alternative was selected as the best option. Preliminary designs were completed for the systems that specifically addressed the adverse impacts identified by the Remedial Investigation. The selected alternative consisted of an impermeable cover system, a landfill gas

control system, a leachate collection system and the means for maintaining the site and its systems in the future.

1.6.2.3 Closure Design

Final design of the landfill closure systems was completed based on site specific conditions including soil types, access, and the intended ultimate use of the site. The closure design culminated with the completion of biddable plans and specifications and the issuing of the construction contract.

1.6.2.4 Closure Construction

During closure construction, the plans and specifications were used as a blueprint for constructing the closure systems. During the construction process, some design modifications were implemented to accommodate site specific conditions and modifications to the original design that improved performance and optimized value. As a result, the original plans and specifications may not exactly correlate to the closure systems actually constructed on site. The closure construction process culminates with the completion of the as-built plans. The as-built plans are the most accurate record of the constructed facility.

1.7 Overview of the Croton Landfill Closure Components

The Croton Landfill Closure System includes the following closure components:

- Landfill Cover System
- Groundwater Monitoring System
- Leachate and Landfill Gas Condensate Collection System

- Landfill Gas Control System
- Stormwater Control System
- Operation and Maintenance Program
- Environmental Monitoring and Sampling Program
- Health and Safety Program
- Emergency and Contingency Response Program

The limits of the Croton Landfill Cover System are shown in Figure 3.

A brief description of the closure components follows.

1.7.1 Landfill Cover System

The purpose of the landfill cover system is to prevent leachate generation, stop the uncontrolled release of landfill gas, isolate the waste mass from the environment and support an aesthetically pleasing vegetative cover. The landfill cover consists from top to bottom of a six inch top soil layer, 24 inch barrier protection and cushion layer of select fill, a plastic impermeable barrier layer, a geocomposite gas venting and condensate collection layer. (Figure 4).

The topsoil layer supports the vegetative cover. Vegetation enhances site aesthetics and increases evapotranspiration reducing the amount of rain water which can impinge on the impermeable cover layer.

The barrier protection and cushion layer protects the impermeable plastic layer from mechanical damage. In addition, the porous soils drain rainwater infiltration off the impermeable layer and into surface discharge structures.

The plastic impermeable layer seals the garbage from the environment. The seal prevents rainwater from soaking into the garbage and creating leachate to contaminate the groundwater. In addition, the plastic layer captures the landfill gas generated by the decomposing garbage.

The landfill gas and condensate drainage layer allows the landfill gas and condensate trapped under the impermeable plastic layer to flow to controlled discharge points. The landfill gas is drawn into the gas collection piping. The landfill gas condensate flows down slope through the layer into the condensate and seep collection system around the toe of the landfill.

1.7.2 Groundwater Monitoring System

Twenty-one (21) stainless steel groundwater monitoring wells were installed at the Croton Point Sanitary Landfill from October through December 1989, in order to characterize site geology and to collect groundwater samples for laboratory analysis (Figure 10). The well locations were selected based on discussions between NYSDEC, Westchester County and Velzy/Weston. The majority of the wells are located around the perimeter of the landfill to monitor the radial flow of groundwater from the landfill's center. Monitoring wells RFW-1S and RFW-1D were located to monitor groundwater conditions between the landfill and the Metro-North property. Monitoring well RFW-13 was installed to serve as a water level monitoring point within the landfill; however, proper

procedure was used during installation to allow its use as a water quality monitoring point. Of the 21 wells, 16 are arranged in couplets to enable groundwater monitoring at two different depths (shallow-"S" and deep-"D"). Monitoring wells RFW-3S, RFW-5S and RFW-13 were screened directly in the landfill mass. The water quality results for wells RFW-3S and RFW-5S are to be used to evaluate the quality of leachate in the landfill adjacent to the marsh.

1.7.3 Leachate and Landfill Gas Condensate Collection System

The purpose of the leachate and landfill gas collection system is to collect leachate and landfill gas condensate from various collection subsystems around the landfill and conduct the contaminated liquids into the sewer system for treatment at the Ossining Publicly Owned Treatment Works.

The system encompasses the following subsystems:

- Leachate sewer system including pumping stations and force mains.
- The lined Railroad 1 Landfill leachate collection system.
- The lined Ballfield Landfill leachate collection system.
- The leachate seep and landfill gas condensate collection system on the Ballfield and Main Landfills.
- The landfill gas condensate pumping station which collects landfill gas condensate from the landfill gas collection system as well as the landfill gas blower system.
- Sanitary sewerage from various sources within the park.

Figure 5 is a schematic of the entire leachate and landfill gas condensate collection system.

1.7.3.1 Leachate Sewer System

Completed in 1992 as part of the closure contract, the leachate sewer system provides the main conduit for the collection and discharge to POTW of leachate and landfill gas condensate from the Croton Landfill. (Figure 6).

Constructed of HDPE, the leachate sewer system starts at the Ballfield Pumping Station with a short force main, continues to a gravity sewer around the west side of the landfill to Pump Station No. 1 by the Park Office Trailer. Pump Station No. 1 lifts the flow to the gravity line which culminates in Pump Station No. 2.

Two branches of the leachate sewer system in the vicinity of Pump Station No. 2 drain the leachate collection sumps in the Railroad 1 Landfill. Pump Station No. 2 discharges to the force main which carries the flow across the Croton Point Bridge discharging into the County Sewer Interceptor.

1.7.3.2 Railroad 1 Landfill Leachate Collection System

The system was completed as part of the Railroad 1 Landfill construction in 1986. Modified as part of the Closure Contract in 1992 , the Railroad 1 leachate collection system drains leachate collected in the Railroad 1 Landfill liner to two leachate collection sumps on the north and south sides of the landfill. From the sumps, which were constructed as pump station wet wells, the leachate now flows into the leachate sewer system by gravity.

1.7.3.3 Ballfield Landfill Leachate Collection System

The system was completed as part of the Ballfield Landfill construction in 1981. It consists of collection piping which drains leachate from the lined landfill to a leachate pumping station. Modified as part of the Closure Contract in 1992, the Ballfield leachate pumping station now discharges to the leachate sewer system.

1.7.3.4 The Leachate Seep and Landfill Gas Condensate Collection System

Landfill gas condensate and leachate seeps, which discharge to the landfill gas condensate drainage layer portion of the landfill cover system, drain down slope into collection piping around the landfill toe of slope. The toe of slope collection piping around the Main and Ballfield Landfills discharges to the leachate sewer at three points. On the east side of the cover system, the collection piping drains to the Seeps and Condensate Pumping Station, which discharges to the leachate sewer by force main. On the south and west sides of the cover, the collection piping discharges to the leachate sewer system by gravity.

1.7.3.5 The Landfill Gas Condensate Pumping Station and Collection System

The system collects landfill gas condensate from the landfill gas collection system header pipes and the landfill gas blower system knockout pots. Condensate from these sources drains by gravity to the landfill gas condensate pumping station, adjacent to the landfill gas control system. The condensate pumping station discharges to the leachate sewer system by force main.

1.7.3.6 The Railroad 1 Interim Flare Landfill Gas Condensate Collection System

The system takes landfill gas condensate collected in the flare blower system and gas collection piping and discharges it by gravity to the southern leachate collection sump (Sump No. 1) of the Railroad 1 leachate collection system.

1.7.3.7 Additional Sanitary Sewerage Sources

The leachate sewer system also accepts sanitary sewerage from various Park sources including the Recreational Vehicle Park, the Park Office Trailer and the Maintenance Crew Office Trailer. Additional stub connections to selected manholes are provided for future hook-ups.

1.7.4 Landfill Gas Control System

The purpose of the landfill gas control system is to collect and dispose of landfill gas generated by the decomposition of garbage in the Main and Ballfield Landfills. The system consists of the following subsystems.

- The Landfill Gas Collection System
    - Landfill Gas Venting and Condensate Drainage Layer portion of the Landfill Cover System
    - Landfill Gas Extraction and Venting Layer Relief Wells
    - Header Pipe Network
- The Landfill Gas Handling System
- The Landfill Gas Flare

Figure 7 is a schematic drawing of the Landfill Gas Control System.

1.7.4.1 Landfill Gas Collection System

The collection system includes 107 landfill gas extraction wells drilled into the waste mass. In addition, six venting layer relief wells collect gas from the landfill gas venting and condensate drainage layer of the cover system. The extraction and relief wells are connected to a system of header pipes buried in the cushion and barrier protection layer of the cover system. The header system connects to the landfill gas handling system. Vacuum supplied by the landfill gas handling system draws gas out of the landfill and into the gas collection system. (Figure 8).

1.7.4.2 Landfill Gas Handling System

The gas handling system maintains a constant vacuum on the landfill gas collection system by means of electric blowers and automatic vacuum control. Gas is sucked out of the landfill and through the gas collection system by the blowers and is delivered to the flare under positive pressure.

1.7.4.3 Landfill Gas Flare

Landfill gas is fed to the landfill gas flare from the positive pressure side of the landfill gas handling system. Automatic controls maintain a constant combustion temperature in the flare to ensure consistent thermal destruction of landfill gas components.

1.7.5 Stormwater Control System

The purpose of the stormwater control system is to collect and control the runoff from the landfill cover system. The control system must drain the cover as quickly as possible to help prevent infiltration into the waste mass while controlling the flow to avoid erosion and damage to the cover system. In addition, the control system must discharge the flow without flooding the Park facilities. The stormwater control system consists of:

- Berms and drainage channels on the cover system of the Main and Ballfield Landfills
- Stormwater sewers on the Park Access Road
- The Hudson River Outfall
- The Croton Bay Sedimentation Basin and Outfall

Rip rap bermed channels conduct stormwater off the cover system either to the Hudson River Outfall or to the Croton Bay Sedimentation Basin and Outfall. Both outfalls also accept a portion of the flow collected in the storm sewers along the Park Access Road on the north and west side of the landfill. Hudson River discharge accounts for about 15% of the total flow off the landfill. The remaining flow discharges to the Sedimentation Basin on the east side of the landfill and thence to Croton Bay. (Figure 9).

1.7.6 Operation and Maintenance Program

The Croton Point Closure must comply with New York State Part 360 Regulations. These regulations require that the closure system, including the elements discussed under this section, be serviced and maintained during the specified 30 year post closure period. The Operation and

Maintenance Program outlined in this manual provides the standard tasks and responsibilities to comply with the post closure care requirements.

1.7.7 Environmental Monitoring and Sampling Program

Environmental monitoring and sampling on and in the vicinity of the closed Croton Landfill is required during the post closure period. The purpose of the monitoring and sampling program is to demonstrate that the closure system is working to eliminate the adverse environmental and public health and safety impacts identified during the Remedial Investigative and Feasibility Study process. Samples will be collected and analyzed for selected parameters. The results of the analysis will be used to assess the effectiveness of the closure system. Media to be sampled include:

- Leachate
- Groundwater
- Stormwater
- Landfill Gas Condensate
- Landfill Gas
- Marsh Sediments
- Perimeter Soil Gas

For each media to be sampled the monitoring and sampling program outlines:

- Representative Sampling Protocols
- Sampling Locations
- Sampling Schedule

- Laboratory Analysis Requirements

1.7.8 Health and Safety Program

The health and safety program portion of the Croton Landfill Closure System Operation and Maintenance Manual is to protect the health and safety of the individuals who will be conducting operation and maintenance functions on the facility. The program identifies the issues which must be addressed for regulatory compliance. The program identifies site and task specific health and safety issues associated with operations on hazardous waste sites and provides guidelines for safe operation. In addition, the program outlines OSHA training and medical monitoring requirements for workers involved in these operations.

1.7.9 Emergency and Contingency Response Program

This program outlines procedures to be followed anticipating response to situations beyond the normal scope of this document. Such situations may include fire, flood, major failure in any one of the closure components, or others.

1.8 Closure Sequencing

1.8.1 Rational of Sequenced Approach

Early in the Croton Landfill closure process, the County of Westchester and the NYSDEC recognized the utility of completing certain closure elements early. It was agreed that a phased approach would substantially facilitate the closure construction schedule. As a result, the Croton Landfill closure was completed as a series of design and construction contracts.

The Croton Point is the site of three separate landfill facilities. Each facility differs in elements of design, years of operation and classification based on wastes received. The Croton Closure Project was required to integrate design features and tie the three facilities together under a cohesive, comprehensive closure program. A short summary of the configuration of each landfill site prior to the closure program follows.

1.8.2 Original Design Elements of the Three Landfills on Croton Point

1.8.2.1 Croton Main Landfill

The Croton Main Landfill was officially operated by the County of Westchester as a waste disposal site from 1927 through 1986, when it was closed under the conditions of the 1975 consent order.

Acres - 98

Classification - Class II Inactive Hazardous Waste Site

Liner - unlined. Waste placed in and on organic layer and marsh deposits

Cap - 18 inches of granular fill

Landfill Gas System - none

Stormwater Control - berms and channels to lagoons. Contaminated stormwater collected and pumped to lagoon at the top of the landfill for infiltration and storage in the waste mass.

Leachate System - no subsurface collection

1.8.2.2 Railroad 1 Landfill

The Railroad 1 Landfill was designed and constructed as a interim waste disposal site pending closure of the Croton Main Landfill under the 1975 consent order. The facility operated from 1976 to 1982 accepting only municipal solid waste.

Acres - 18

Classification - none

Liner - plastic

Cap - clay side slope liner. Plastic cap on top.

Landfill Gas System - passive gas venting. Ten inch PVC risers and header pipe located on south side sand slope adjacent to park area. Stand pipe vents at east and west ends.

Stormwater Control - berms and channels on cap and runoff to Hudson River.

Leachate System - piping to collect leachate trapped by landfill liner. Discharge to two pumping stations on north and south sides of landfill. Removal and disposal to the County sewer system by tanker truck.

1.8.2.3 Ballfield Landfill

The Ballfield Landfill was designed and constructed as an interim waste disposal site pending closure of the Croton Main Landfill under the 1975 consent order. The facility operated from 1982 to 1987 accepting only municipal solid waste.

Acres - 27

Liner - plastic

Cap - 18 inches of granular fill

Landfill Gas System - passive gas venting. Ten inch PVC risers and header pipe located on south side sand slope adjacent to park area. Stand pipe vents at east and west ends.

Stormwater Control - berms and channels on cap and discharge to Croton Bay.

Leachate System - piping to collect leachate trapped by landfill liner. Discharge to pumping stations east sides of landfill. Removal and disposal to the County sewer system by tanker truck.

1.8.3 Interaction and Sequence of Croton Closure Related Contracts

In order to integrate the three landfills under a comprehensive closure system a series of design and construction contracts were completed. Each contract completed a subsequent phase of the closure construction. A brief summary of the configuration and rational for each design/construction contract follows.

1.8.3.1 Railroad 1 Temporary Flare

Contract No. - 4073

Date - May 15, 1991

Objective - emergency contract to remediate offsite migration of landfill gas into adjacent Park and camping area.

Design Concept - tie existing landfill gas collection system into blower and flare system for active gas collection and thermal destruction

Design Engineer - Savin Engineers, P.C.

Flare System Manufacturer - Perennial Energy

Contractor - TLS Construction Corp.

1.8.3.2 Railroad 1 Interim Flare

Contract No. - 4017

Date - May 29, 1991

Objective - provide additional removal and long-term capacity to prevent offsite migration of landfill gas into adjacent Park and camping area.

Design Concept - modify existing gas collection system to correct deficiencies. Manifold existing gas monitoring wells into header system for increased gas removal capacity. Install improved blower and flare system for long-term active gas collection and thermal destruction.

Design Engineer - Savin Engineers, P.C.

Flare System Manufacturer - Perennial Energy

Contractor - Moretrench Environmental

1.8.3.3 Croton Leachate Sewer System

Contract No. - 4083

Date - June 12, 1991

Objective - eliminate the need for trucking of leachate from Ballfield and Railroad leachate pumping stations. Provide capacity for disposal of contaminated stormwater from the Main Landfill during construction, disposal of Park sanitary waste to POTWs and long-term post closure disposal for leachate and landfill gas condensate from the Main Landfill and Ballfield closure.

Design Concept - rehabilitate Ballfield and modify Railroad 1 Landfill leachate pumping stations. Provide HDPE sewer system, pumping stations and force mains to collect leachate from the Ballfield and Railroad 1 landfills and sanitary flow from park sources. Provide capacity for future contributions from the Main Landfill. Discharge flow to County interceptor via force main across Croton Avenue Bridge.

Design Engineer - Savin Engineers, P.C.

Contractor - Sentrale

1.8.3.4 Croton Main and Ballfield Landfill Closure

Contract No. - 4105

Date - August 26, 1992

Objective - complete Croton Landfill closure in compliance with New York State Part 360 Regulations as provided for under the 1975 Federal Consent Order and the Consent Order Record of Decision. Open the closed landfill to public access as part of the Croton Point Park.

Design Concept - install impermeable cover system and provide an active landfill gas extraction and control system for the Main and Ballfield landfills. Collect landfill gas condensate and leachate seeps for discharge into the leachate sewer system.

Design Engineer - Gibbs and Hill

Contractor - Briarwood Contracting Group

1.8.3.5 Croton Point Park Primary Utilities Upgrade

Contract No. - 4271

Date - September 1, 1993

Objective - provide upgraded water and electric service to accommodate expanded Croton Park utilization

Design Concept - replace existing potable water mains and primary electrical service to Croton Park. Utilize buried power cables.

Design Engineer - Lynch Engineering

Contractor - Briar Electric

1.8.3.6 Croton Point Park Secondary Electrical Upgrade

Contract No. - 94-452

Date - November 2, 1994

Objective - upgrade the existing secondary electrical service to various Croton Park Facilities.

Design Concept - replace and provide secondary electrical branch feeders to various Croton Park Facilities.

Design Engineer - Lynch Engineering

Contractor - West-Fair Electric

Section 2

Post Closure Operation Program

Section 2
Post-Closure Operation Program

2.1 Introduction

This section of the O&M Manual discusses the operation of the leachate collection system and landfill gas collection and combustion system. Included in Appendix E is the original Leachate Collection System O&M Manual. Appendix K includes copies of the related permits for flare and leachate discharge. Appendix L provides shop drawings for the Condensate and Seeps/Condensate Pumping Station, also included are the control wiring diagrams for all five pumping stations.

2.2 Leachate Collection System

The purpose of the leachate collection system is to transport leachate and landfill gas condensate from the Main, Ballfield and Railroad 1 Landfills, as well as domestic sewage generated within the park, to the Westchester County Interceptor Sewer System, and thence to the Ossining Wastewater Treatment Facility for treatment. Operation of the leachate system is subject to conditions of a Westchester County Department of Environmental Facilities Wastewater Discharge Permit (see Appendix K).

2.2.1 Equipment Overview

The Croton Point Leachate Collection System utilizes five pumping stations and approximately 11,000 linear feet of Polyethylene (PE) Pipe to convey leachate, leachate seeps and landfill gas condensate to the County sewer system. A schematic of the system and its components is shown on Figure 5. Figure 6 shows the system layout.

The basic equipment for leachate collection consists of the following major components:

- One air/vacuum release valve.
- Wet wells.
- Manholes for discharge and collection of flow.
- Nine submersible pumps for pumping leachate, condensate and sewage.
- Five local pump control panels.

2.2.1.1 Main Landfill Seeps Condensate Collection System

Seeps and condensate collected in the closed landfill are conveyed by gravity to discharge points on the East, West and South side of the closed landfill. On the East side, the collection system discharges into the Seeps/Condensate Pumping Station wet well, on the West side into Manhole No. 11 and on the South side into Manhole No. 28. Seeps and condensate from Manhole Nos. 11 and 28 flow by gravity to Pumping Station No. 1 wet well.

2.2.1.2 Seeps/Condensate Pumping Station

The Seeps/Condensate Pumping Station utilizes two submersible pumps to discharge the seeps and condensate into Manhole No. 32. From Manhole No. 32, the seeps and condensate flow by gravity to Pumping Station No. 1 wet well.

The pumps are normally run in the AUTO mode. The HAND/OFF/AUTO controls are in the Seeps/Condensate Pump Control Panel located at the Seeps/Condensate Pumping Station.

Peripheral equipment includes check valve, gate valve and pressure gauges. Design data for the pump includes:

Pump Nos. 1 & 2

Manufacturer	Davis EMU
Type	Submersible
Capacity	110 gpm
TDH	68 ft
Operating Design Pressure	29 psig, +/- 3 psig
Motor Size	10 hp
Speed	1740 rpm

The pumps operate through a system of on/off automatic floats located at different levels in the wet well. The floats are positioned as follows:

- High Water Alarm EL. 2.55'
- Lag Pump On EL. 1.55'
- Lead Pump On EL. -0.45'
- All Pumps Off EL. -2.45'

2.2.1.3 Ballfield Leachate Pumping Station

Leachate collected in the Ballfield landfill is conveyed, by gravity, to the Ballfield Pumping Station wet well. This pumping station, which was originally constructed in 1983 and modified as part of the closure project, utilizes one submersible pump to discharge the seeps, condensate and leachate into Manhole No. 32. From Manhole No. 32, the seeps, condensate and leachate flows by gravity to Pumping Station No. 1.

The pump is normally run in the AUTO mode. The HAND/OFF/AUTO controls are in the Ballfield Pump Control Panel located at the Ballfield Pumping Station. Peripheral equipment includes check valve, gate valve and pressure gauges. Design data for the pump includes:

Manufacturer	Flygt Corporation
Type	Submersible
Capacity	170 gpm
TDH	50 ft
Operating Design Pressure	22 psig, +/- 3 psig
Motor Size	6.3 hp
Speed	3400 rpm

The pumps operate through a system of on/off automatic floats located at different levels in the wet well. The floats are positioned as follows:

- High Water Alarm EL. 17.22'
- Pump On EL. 16.72'
- Pump Off EL. 14.22'
- Low Water Alarm EL. 13.00'

2.2.1.4 Pumping Station No. 1

At Pumping Station No. 1, the leachate is discharged by two submersible pumps through approximately 200 L.F. of 8" dia. PE force main and 1900 LF of 15" dia. PE gravity sewer to Pumping Station No. 2.

The pumps are normally run in the AUTO mode. The HAND/OFF/AUTO controls are in the Pump Station No. 1 Control Panel located at Pumping Station No. 1. Peripheral equipment includes check valve, gate valve and pressure gauges. Design data for the pump includes:

Pumps Nos. 1 & 2

Manufacturer	Flygt Corporation
Type	Submersible
Capacity,	
each	370 gpm
combined	620 gpm
TDH	22 ft

Operating Design Pressure	9.5 psig, +/- 2 psig
Motor Size	5 hp
Speed	1700 rpm

The pumps operate through a system of on/off automatic floats located at different levels in the wet well. The floats are positioned as follows:

- High Water Alarm EL. -0.75'
- Lag Pump On EL. -1.25'
- Lead Pump On EL. -2.75'
- All Pumps Off EL. -4.25'
- Low Water Alarm EL. -4.75'

2.2.1.5 Landfill Gas Condensate Pumping Station

Condensate collected in the Main Landfill flare and landfill gas collection system flows by gravity to the Condensate Pumping Station. The Condensate Pumping Station utilizes two submersible pumps to discharge the condensate into Manhole No. 2, from where it flows by gravity to Pumping Station No. 2 wet well.

The pumps are normally run in the AUTO mode. The HAND/OFF/AUTO controls are in the Landfill Gas Condensate Pump Station Pump Control Panel located at the Landfill Gas Condensate Pumping Station. Peripheral equipment includes check valve, gate valve and pressure gauges. Design data for the pumps includes:

Pumps Nos. 1 & 2

Manufacturer	Flygt Corporation
Type	Submersible
Capacity	52 gpm
TDH	10 ft
Operating Design Pressure	4 psig, +/- 1 psig
Motor Size	1.74 hp
Speed	1740 rpm

The pumps operate through a system of on/off automatic floats located at different levels in the wet well. The floats are positioned as follows:

- High Water Alarm EL. 7.00'
- Lag Pump On EL. 4.00'
- Lead Pump On EL. 3.00'
- All Pumps Off EL. 2.00'

2.2.1.6 Railroad 1 Leachate Collection System

Leachate collected at Railroad (RR) 1 Landfill is conveyed by gravity to RR No. 1 and 2 sumps. Leachate at RR No. 1 sump is combined with the landfill gas condensate from the RR1 Interim Flare. The flow from both sumps is controlled by an influent butterfly valve located at each sump. Approximately 200 LF of 12" diameter, and 1,500 LF of 12" diameter, PE gravity from RR No. 1 and 2 conveys the leachate and landfill gas condensate to Pumping Station No. 2.

2.2.1.7 Pumping Station No. 2

At Pumping Station No. 2, the combined flow is discharged utilizing two submersible pumps through approximately 3000 LF of 8" dia. PE force main over the bridge above the Croton-Harmon Railyard to the Westchester County Interceptor Sewer System on South Riverside Avenue.

The pumps are normally run in the AUTO mode. The HAND/OFF/AUTO controls are in the Pump Station No. 2 Control Panel located at Pumping Station No. 2. Peripheral equipment includes check valve, gate valve and pressure gauges. Design data for the pump includes:

<u>Pumps Nos. 1 & 2</u>

Manufacturer	Flygt Corporation
Type	Submersible
Capacity,	
each	650 gpm
combined	820 gpm
TDH	75 ft
Operating Design Pressure	37.5 psig, +/- 3 psig
Motor Size	20 hp
Speed	1750 rpm

The pumps operate through a system of on/off automatic floats located at different levels in the wet well. The floats are positioned as follows:

- High Water Alarm EL. 5.20'
- Lag Pump On EL. 4.70'
- Lead Pump On EL. 3.20'
- All Pumps Off EL. 1.70'
- Low Water Alarm EL. 1.20'

2.2.1.8 Sources of Domestic Sewage

In addition to contaminated liquids (leachate, leachate seeps, and landfill gas condensate), the leachate from the Main, Ballfield, and the Railroad 1 landfills, the design and construction of the leachate collection system allows for domestic sewage from other Park sources to be transported to the Westchester County Interceptor Sewer System. Current sources of domestic sewage include the RV site discharging into Manhole No. 26, and the Park Office Trailer discharging into Manhole No. 10. These sources are shown on Figure 6.

2.2.1.9 Pump Control Panels

All pumps are controlled and monitored from pump control panels located at each pumping station. Each control panel contains selector switches, alarms and indicator lights for the individual pumps.

All pump station alarms are connected both to visual indicator lights on the control panels and to a remote notification system. Failure in any of the pump stations sends an alarm signal to the North Yonkers Pumping Station which is manned 24 hours per day by the DEF. Response to the alarm call is immediate 24 hours a day. County workers are dispatched to the site to diagnose and repair the problem while minimizing any potential damage.

The system has been designed such that an alarm or failure in any of the system pump stations will shut down all system pump stations. This protocol has been adopted to minimize the potential for spills or overflows. With all pumping stations shut down, the system has the capacity to store the various contaminated liquids for several days, at a minimum.

In general, all the pump control panels contain the following:

- High water level alarm
- Low water level alarm
- Seal failure pump 1
- Seal failure pump 2
- Elapsed time meters
- Pump selector switch, reset switches, indicator lights and local Start/Stop pushbuttons.

2.2.2 Operating Guidelines and Responsibilities

In accordance with the discharge permit issued by the Westchester County Department of Environmental Facilities (WCDEF), the total quantity of leachate and wastewater to be discharged to the Westchester County Interceptor Sewer System shall not exceed 145,000 gallons per day (gpd).

This total quantity of leachate to be discharged will consist of leachate and sewage collected at several locations throughout the Croton Point Sanitary Landfill. A plan of the Croton Point Landfill, indicating the sources that will contribute leachate to the collection system, is shown in Fig. 6. The values listed below are average daily discharge quantities for leachate and sewage.

Source	Average Daily Discharge(gpd)
Leachate	120,000
Sewage	25,000
Total	**145,000 gpd**

These quantities may be varied, as long as the total volume discharged from the entire system, on a daily basis, does not exceed 145,000 gallons. Table 2-1 summarizes the operation of the leachate collection system. All five pumping stations will be operated automatically, however, daily monitoring in accordance with the following procedures is required.

- Observe the wet wells and valve vaults to ensure that they are in operating condition and that the discharge piping is free from leaks.
- When opening the wet wells, the floats should not be tangled with the wet well lid.
- If floats are caked with solids, they should be cleaned.

Table 2-1

Leachate Collection System
Summary of Operations

Operation Mode

System Component	Operation	
	Day	Night
Seeps Condensate Pumping Station	Automatic	Automatic
Condensate Pumping Station	Automatic	Automatic
Ballfield Pumping Station	Automatic	Automatic
Pumping Station No. 1	Automatic	Automatic
Pumping Station No. 2	Automatic	Automatic

- Vent piping should be clear.
- Record the elapsed operating time readings indicated on the pump control panel and calculate the discharge quantity for the previous 24 hr period utilizing the Discharge Logs provided in Appendix A of this Operation and Maintenance Manual.
- Valve vaults floor drain should be free of debris.

Since the Railroad Sumps No. 1 and No. 2 discharges leachate to the collection system through gravity sewer, manual operation is not required. However, the sumps do require observation on a daily basis in accordance with the following procedure:

- Inspect sumps to ensure that they are free from debris and that flow has not been restricted.
- The influent butterfly valves at each sump have been calibrated to allow for an outflow of 3.5 gpm.
- Once monthly, the butterfly valves should be opened fully to allow for any sediment accumulated in the leachate collection line to be flushed clear. The valve should be opened for approximately 15 minutes, and then returned to the calibrated opening.

2.2.2.1 Equipment Operation

The leachate collection system pumps are intended to operate automatically after the proper equipment has been put into service.

System Start-up

System start-up for all five pumping stations is similar and includes the following:

- Energize the pump control panel and pumps.
- Close the circuit breakers for the pumps.
- Verify that all necessary equipment are operating as intended.
- All gauges should be operating properly.
- At the local control station start the pumps by turning the selector switch to "AUTO".
- Verify the pump output by the flow rate indicator on the control panel.
- Check that the RUN indicator lights for the pump(s) is lit and that no alarms are activated.

After activation, the respective stations are operated automatically by the system of on/off floats located at different levels in the respective wet wells.

Routine Monitoring

Routine monitoring is required to ensure proper operation of the leachate pumping stations. Frequent observation aids in avoiding operating problems. Changes in operating characteristics may indicate that trouble is developing. If any operating parameters are not within proper ranges, refer to the Troubleshooting Section in manufacturer's O&M manual for operator response.

Routine monitoring includes:

- Verify that the pumps are running properly. All pumps are run normally in "AUTO". Check for unusual vibration, noise or high motor temperature.
- Make sure that the pump suction and discharge valves are in the proper position.
- Record time and elapsed time meter readings on the daily log sheets provided in Appendix A. The daily log sheets should also be summarized on the weekly and monthly log sheets.

2.2.3 System Operation Constraints

The Leachate and Landfill Gas Collection System was designed and constructed to gather leachate, landfill gas condensate and sewage from various existing and future sources throughout Croton Point Park. The system accepts intermittent flows from pumping stations and sewage hookups, and continuous flow from the Railroad 1 Landfill Leachate System, and the Main and Ballfield Seeps and Condensate Collection System. Flow enters the leachate sewer at various locations along its length and is conveyed through the two main pumping stations (Pumping Stations No. 1 and 2) to the County interceptor.

Because of the interdependent nature of the collection system, there are specific constraints to system operations. These constraints must be observed to avoid failure of interdependent system components and spills of contaminated liquid. For instance, if Pumping Station No. 2 fails or is shut down for service, Pumping Station No. 1 must be shut down to avoid flooding Pumping Station No.2. If Pumping Station No. 1 is shut down, additional upstream sources of flow must be managed.

The following describes operational constraints for various system components and provides recommendations for mitigating problems which may occur. Refer to Figure 5 and 6 which provide a schematic of the system as well as the system layout.

2.2.3.1 Seeps/Condensate Pumping Station

Operational characteristics: fed by gravity flow from the Seeps/Condensate Collection System around the eastern side of the Landfill Cover System.

Service or failure - Continuous gravity flow floods wet well and valve box. Possible spill. If prolonged outage is anticipated, start bypass pumping or trucking of flow to Ballfield Pumping Station wet well. The Seeps/Condensate Collection System has some inline storage capacity. Outage as longs as several days have occurred without spill. The Ballfield Leachate Collection Systems has large storage capacity which can be utilized by pumping into the Ballfield Pumping Station wet well.

Downstream system failures or service - Continued operations contributes to downstream flooding of Pumping Stations No. 1 or 2, leading to a possible spill. Shut down affected station. Shut down Ballfield Pumping Station. If prolonged outage is anticipated, start bypass pumping or trucking of flow. The downstream system has limited inline storage capacity. Provided the Ballfield Pumping Station is shut down, it may be possible to operate the Seeps Condensate Pumping Station with continuous observation of downstream conditions. The Ballfield Leachate Collection System can be used for inline storage by bypass pumping into the Ballfield Pumping Station wet well.

2.2.3.2 Ballfield Pumping Stations

Operational characteristics: fed by gravity flow from the Ballfield Landfill Leachate Collection System.

Service or failure - continuous gravity flow fills wet well to static head level. The Ballfield Leachate Collection System has large storage capacity. Pump outages as long as several days have occurred without spill. The Landfill Cover System prevents leachate recharge so that overflow of the system is unlikely.

Downstream system failure or service - continued operations contributes to downstream flooding of Pumping Stations No. 1 or 2. Possible spill. Shut down Ballfield Pumping Station. The Ballfield Leachate Collection System can be used for storage for extended periods.

2.2.3.3 Pumping Station No. 1

Operation characteristics: Pumping Station No. 1 is fed by a single gravity influent line. Contributing sources include the Seep/Condensate Pumping Station (MH #32), the Ballfield Pumping Station (MH #32), the Seep/Condensate Collection System (MHs #28 and 11), Park Sewerage Sources (RV Park MH #26, Park Office Trailer MH #10). In case of emergency, the contributing pumping stations can be shut down. The Seep/Condensate Collection System contribution at MH Nos. 28 and 11 is small but can not be controlled. Sewerage source can be controlled with difficulty.

Service or failure - continuous gravity flow floods upstream sewer, pumping station wet well and overflows spilling contaminate liquids. Shut down Seep/Condensate and Ballfield Pumping Stations. If prolonged outage is anticipated, initiate source controls for sewerage contributions. Initiate bypass pumping (from Pumping Station No. 1 wet well to MH #9) for remaining sewerage flow and uncontrolled flow from Seep/Condensate Collection System. With only sewerage and Seep/Condensate flow, the system can withstand short outages without overflowing.

Downstream system failure or service - continued operations contributes to downstream flooding of Pumping Station No. 2. Possible spill. Shut down Pumping Station No. 1. Proceed as for service or failure above.

2.2.3.4 Landfill Gas Condensate Pumping Station

Operational characteristics: the Landfill Gas Condensate Pumping Station receives condensate flow from the four Landfill Gas Collection System Header Pipes and from the on-line Landfill Gas Handling System Condensate Knockout Pots.

Condensate drains from the gas header pipes are buried, have no valves and cannot be controlled. Condensate drain lines from the knockout pots have valves. Proper operation of the Condensate Pumping Station adhering to float levels is critical to the operation of the Landfill Gas Control System. Levels too high or low can cause failure in the flare and blower system.

Condensate level too high - condensate level rises too high. Condensate backs up flooding the gas collection header pipes. Flooding blocks gas flow and causes the flare and blower system to shut down. Pump down Condensate Pumping Station wet well. **Cautions: pumping wet well too low with the blower system off will allow landfill gas to vent into pumping station wet well with associated dangers including fire and explosion. If gas vents into wet well, refill wet well with potable water.** Restart flare and blower system. Emergency flare shut down includes safety shut off of the gas collection system so no gas vents to the atmosphere. The Landfill Gas Control System has been previously shut off for several days without impact.

Condensate level too low - condensate level drops too low. With blowers on, air can be sucked into the gas system through the knockout pot and gas collection header pipe condensate drain lines. The landfill gas and air mix presents the potential of fire or explosion. Fill wet well with potable water.

Knockout pot drain line valves open too wide - with the blower system on, valves in drain lines of on-line knockout pots that are open too wide, may drain line and into the gas stream. Always keep knockout pot drain line valves partially closed.

Service or failure - continuous gravity flow of condensate floods landfill gas collection header pipes and causes flare shut down. Proceed as for "Condensate level too high: above. Condensate flow continues after flare shut down. Prolonged outage could cause overflow of pumping station wet well and spill of contaminated liquid. Initiate bypass pumping of gas condensate to leachate sewer.

Condensate flow is slow with several days of storage capacity in the Condensate Pumping Station wet well.

Downstream system failure or service - continued operations contributes to downstream flooding of Pumping Station No. 2. Possible spill. Shut down Landfill Gas Condensate Pumping Station. Monitor level in wet well against header line flooding and overflow. Pump and transport if needed.

2.2.3.5 Railroad 1 Leachate Sump No. 1

Operational characteristics: leachate from the Railroad 1 Leachate Collection System drains by gravity through a control valve and into Sump No. 1. In addition, a small volume of landfill gas condensate from the Railroad 1 flare drains into Sump No. 1. From Sump No. 1, the flow discharges to MH #1 by gravity.

Downstream system failure or service - continued discharge contributes to downstream flooding of Pumping Station No. 2. Possible spill. If prolonged outage is expected, shut influent valve to Sump No. 1. Flow from Sump No. 1 is approximately 3 gpm. This flow rate has not been considered problematic during previous outages of Pumping Station 2. The Railroad Leachate Collection System has large storage capacity. The influent line to Sump No. 1 can be shut off for days without impact. Note that because of the design of the Railroad Leachate Collection System, backed up flow will eventually start discharging through Sump No. 2.

2.2.3.6 Railroad 1 Leachate Sump No. 2

Operational characteristics: leachate from the Railroad 1 Leachate Collection System drains by gravity through a control valve and into Sump No. 2. From Sump No. 2, the flow discharges by gravity to Pumping Station No. 2 wet well. On the way to the pumping station wet well, the influent gravity line picks up sanitary flow from the Park Operation and Maintenance Office Trailer at MH #34.

Downstream system failure or service - continued discharge contributes to downstream flooding of Pumping Stations No. 2. Possible spill. If prolonged outage is expected, shut influent valve to Sump No. 2. Flow from Sump No. 2 is approximately 3 gpm. Additional flow from the Maintenance Office Trailer is similarly small. This flow rate has not been considered problematic during previous outages of Pumping Station 2. The Railroad Leachate Collection System has large storage capacity. The influent line to Sump No. 2 can be shut off for days without impact. Note that because of the design of the Railroad Leachate Collection System backed up flow can eventually discharge through Sump No. 1.

2.2.3.7 Pumping Station No. 2

Operational characteristics: Pumping Station No. 2 is fed by the main leachate sewer line and the gravity sewer line from Railroad Landfill Sump No. 2. Contributing sources include the Pumping Station No. 1 (MH #9), the Landfill Gas Condensate Pumping Station (MH #2), Railroad Sump No. 1 and Railroad Flare Gas Condensate System (MH #1), Railroad Sump No. 2 and Park Operation and Maintenance Office Trailer (Pumping Station No. 2 wet well). The contributing

pumping stations can be shut down. The contribution from the Railroad Sumps Nos. 1 and 2 is small and can be controlled. Sewerage source can be controlled with difficulty.

Service or failure - continuous gravity flow floods upstream sewer, pumping station wet well and overflows, spilling contaminate liquids. Shut down Gas Condensate and Pumping Station No. 1 (see Operation Constraints above). If prolonged outage is anticipated, initiate source controls for sewerage contribution. Shut down influent control valves on Railroad 1, Sumps Nos. 1 and 2. If needed, initiate trunking of flow and discharge to County interceptor. With upstream pumping stations shut down, previous experience has shown the short pumping station outages can be easily accommodated.

Downstream system failure or service - force main failure or service. Continued operations contributes to spill of contaminated liquids. Shut down Pumping Station No. 2. Proceed as for service or failure of Pumping Station No. 2 above.

2.2.4 Recording of Discharge Quantities

In order to provide documentation of compliance with the allowable discharge quantities of leachate, the daily operating durations of each pumping station must be recorded. Standard forms for each pumping station have been included in Appendix A of this manual. These forms are to be used by personnel on a daily basis to record the operating duration and discharge for quantity of each Pumping Station pump for the previous 24 hour period. These durations may be obtained from the elapsed time meters located on each pump station control panel. Weekly and monthly discharges

should be summarized on the appropriate discharge logs (Appendix A). Section 8 describes in detail the reporting and recording requirements.

2.2.5 Pump Station Alarm/Failure

In the event of a system failure (as with a pump stations alarm) storage of leachate on-site, while not anticipated, can be accommodated on a short-term basis. Failure of any one of the system pump stations automatically shuts down all pump stations. This protocol effectively initiates in system storage in the individual system components including:

- East Side Seeps/Condensate Collection System
- Ballfield Landfill Leachate System
- Landfill Gas Condensate Pumping Station

Remaining sources of flow to the leachate sewer system upstream of Pump Station 1 include:

- Sources of Croton Park sanitary sewerage MH Nos. 26 and 10.
- South and west connections to the Seep/Condensate collection system at MH Nos. 28 and 11.

Remaining sources of flow to the leachate sewer system upstream of Pump Station 2 include:

- Railroad 1 leachate sumps 1 and 2 (Backup of flow in Pump Station 2 will initiate in system storage of leachate within the Railroad 1 Landfill liner system).
- Park Operation and Maintenance Office Trailer, MH 34.

Sources of flow to the leachate sewer which remain after pump station shut down are small and variably dependent on time, season and weather. It is not possible to accurately quantify these flows to assess the in-line storage capacity of the system with a useful degree of accuracy. However, it has been noted that during construction and inadvertent system outages, shut downs of several days have not resulted in overflows.

2.3 Landfill Gas Control System

The Croton Landfill Gas Control System is designed and constructed to extract and safely dispose of landfill gas generated as a by-product of the decomposition of waste material from the closed Croton Landfill.

Typical of landfills, Croton Landfill gas consists of approximately 50% methane, 50% carbon dioxide and small to trace amounts of other components and contaminants. As such, the gas is explosive, acts as a simple asphyxiant, contains toxic elements and has an unpleasant odor. The uncontrolled release of the landfill gas poses threats of fire and explosion, adverse impacts on the environment and public health and safety and constitutes a source of nuisance odors which could detract from the enjoyment of park users.

The objective of the system is to eliminate uncontrolled release of gas, prevent the buildup of landfill gas beneath the cover, prevent off site gas migration, and dispose of the gas in a method consistent with the use of the site as a Park for passive recreation.

2.3.1 Future Landfill Gas Utilization

Until such time as landfill gas utilization is implemented, gas will be collected and disposed of by flaring. The landfill gas control system is designed and installed to allow conversion to a gas utilization system. The County is currently evaluating alternatives for gas utilization including:

- using the gas to run electrical generators. Excess electricity may be sold to the local utility company (Con Edison).
- Producing compressed natural gas (CNG), as an alternative fuel for automobiles.
- Cleaning up the landfill gas to medium BTU quality and selling it to industrial end users.

2.3.2 General Description

The Croton Landfill Gas Control System consists of the landfill gas collection system, the blower and vacuum control system and the landfill gas flare. Landfill gas is drawn out of landfill gas wells into a gas header system by vacuum generated by a blower system. The blower system sends the gas to the flare system which burns the gas at a controlled temperature to provide thermal destruction of landfill gas contaminants and components of concern.

2.4 Landfill Gas Collection System

The landfill gas collection system consists of the low permeability geomembrane, the geonet gas venting layer, 107 landfill gas extraction wells, six relief wells tied into the gas venting layer, lateral and header piping, valves and appurtenances.

Landfill gas formed by decomposition of the waste mass is trapped by the geomembrane layer. With no uncontrolled avenue of release, the landfill gas is forced to exit through gas extraction wells or to migrate through the geonet gas venting layer to the relief wells. In either case, vacuum draws gas into the piping system and hence to the Gas Combustion System.

The wells are tied into a network of four interconnected but independent landfill gas collection "circuits". The four circuits provide flexibility in routing gas to the blower system to provide contingency in case of damage, blockage or repairs to the header system. Two circuits encompass the perimeter landfill gas collection system and primarily maintain an intra-landfill pressure gradient to prevent offsite migration of landfill gas. Two circuits serve the gas wells in the center of the landfill.

Each gas extraction well has its own control valve to individually adjust applied vacuum based on well gas production and quality. Similarly, the four landfill gas circuit headers are equipped with manual control valves to independently adjust applied vacuum and so control the overall quality of the landfill gas for combustion.

A sump is provided in the bottom of each gas circuit prior to the blower station manifold to collect condensate from the gas collection piping. The condensate drains to the landfill gas condensate pumping station and is discharged to the leachate sewers.

Figure 7 is a generalized schematic of the entire Landfill Gas Control System. Figure 8 shows the site layout.

Complete details of well and header system design and construction are contained in the design documents included in Appendix B.

2.4.1 Operating Guidelines and Responsibilities

Operation of the landfill gas collection system consists of evaluating gas production volume and quality and tuning and balancing the collection system to optimize gas production on a monthly basis. The system must be attended to regularly both to maintain gas quality but also to ensure that the well field is not being "overdrawn". Over drawing occurs when high applied vacuum draws air into the system. Air dilutes the landfill gas directly. In addition, as air is drawn into the waste mass, it alters the decomposition process which hinders the production of methane.

Tuning and balancing the header circuits and wells to maximize gas production and methane content is a dynamic and interactive process. No adjustment will be permanent. The production characteristics of the entire landfill and each individual well will change with time, season, temperature, atmospheric pressure and other variables.

Each adjustment impacts other adjustments so that adjustment should be made gradually over time to avoid and minimize unwanted impacts.

2.4.1.1 Notes and Appendices

The following general information on gas collection system operation is more comprehensively addressed in Appendix C. Training for operation and maintenance of the gas collection system was provided as part of the O&M training program during the system startup period. The field training sessions were recorded on video and are included in Appendix D.

2.4.2 Landfill Gas Wells

Gas quality at each well head will be evaluated and recorded on log sheets on a monthly basis. Parameters to be measured and recorded at the well head will include:

- Vacuum
- % methane content
- % carbon dioxide
- % oxygen
- % nitrogen

Based on the measured parameters, the applied vacuum should be adjusted with the manual vacuum control valve in small increments over time to maximize methane and minimize oxygen and content.

In general, increasing oxygen and nitrogen content may indicate overdrawing the well. Overdrawing a well may result in air being drawn into the system and a transformation from anaerobic to aerobic decomposition in the waste mass with an associated decrease in methane production.

2.4.3 Header Circuits

The landfill gas header circuits each collect gas from approximately one quarter of the collection wells. Two circuits collect gas from perimeter wells. Landfill gas in each circuit will vary in the quality and quantity based on the nature of the wells served and on other independent variables. As a result, the balance of gas drawn from each circuit should be adjusted to optimize overall gas quality and quantity.

As with individual wells, landfill gas in each circuit will be quantified and the various parameters measured. Based on the measured parameters, the vacuum in each circuit will be adjusted with the manual vacuum control valves on the blower system manifold.

It is anticipated that the quality and quantity of gas collected in the perimeter collection circuits will be less than that collected in the circuits that serve the deeper wells in the center of the landfill. Perimeter circuits are likely to see higher oxygen content and varying gas composition. Vacuums in perimeter circuits should be adjusted accordingly.

2.4.4 Health and Safety Issues

Character of Landfill Gas - landfill gas is explosive, contains contaminants and acts as a simple asphyxiant. Procedures for conducting operations in the presence of landfill gas are covered in Section 6. While working in the vicinity of landfill gas, the following restrictions/procedures will be observed: (1) no smoking, (2) approach potential sources with the wind at your back, pull back if

odors are detected, (3) if gas is suspected work only in concert with real time air monitoring; and (4) work in pairs.

Character of Landfill Gas Condensate - landfill gas condensate is a contaminated liquid in which contaminants found in the landfill gas may be concentrated. Procedures for working in the presence of condensate are covered in Section 6. While working in the vicinity of landfill gas condensate, avoid skin contact, wear appropriate personal protective equipment, eye protection, practice appropriate personal hygiene.

2.4.5 Contingencies

Header Pipe Condensate Blocking - gas header pipes are installed sloping to the condensate drains at the blower system manifold. Because the landfill is settling, the header piping may eventually form a "belly" in which condensate may pool and block gas flow. While this condition may ultimately require excavation and repair, an interim solution is to redirect flow to adjacent gas header circuits through the header cross connections.

Crushed or Damaged Pipe - as with condensate blocking, if gas header piping is blocked or crushed, an interim repair may be made by redirecting the gas flow through adjacent circuits.

Condensate Flooding of Header Condensate Sumps - if the landfill gas condensate pumping station has been inoperative for a period of time, gas condensate can back up and flood the header lines

blocking gas flow to the combustion system. The unblock headers, drain condensate pumping station wet well.

2.5 Landfill Gas Blower and Flare System (Landfill Gas Combustion System)

For the purpose of this section, the landfill gas blower and flare system will be referred to as the landfill gas combustion system. The landfill gas combustion system consists of the blower and blower control system, the flare and flare control system, and the landfill gas condensate removal system and pumping station.

2.5.1 Blower System

The blower system removes gas from the landfill gas collection system and delivers it to the flare. The blower system consists of the landfill gas collection system circuit header, motor operated automatic vacuum control valve, electro pneumatic emergency shutoff solenoid valve, four redundant gas blower trains, including: air filter/condensate knockout pot and blower, the control system and valves and appurtenances for a complete system.

Landfill gas from the collection system is drawn into the blower system manifold from the four landfill gas collection system circuits. The combined flow passes through the vacuum control valve and the emergency shutoff valve and into one or more of the four gas blower trains. In the blower trains, the gas passes through an expansion chamber to knock out condensate and an air filter to remove particulates before entering the blower.

The four blower trains can be operated simultaneously, however, the flare is sized such that a maximum of two operate with the other trains as standby. The valve and piping system is such that each blower train can be removed entirely from the system without interrupting the operation of the others.

The blower control system monitors the operation of the blower system, controls the vacuum applied to the landfill gas collection system, selects the number of blowers operating at one time and monitors the flare operation to provide emergency shut down capabilities in the event that the flare is not operating properly.

After, the four blower trains, the gas streams combine and flows to the flare system.

2.5.2 Flare System

The flare system combusts the gas at a controlled temperature to ensure maximum thermal destruction of landfill gas components and contaminants.

The flare system consists of the flame arrestor, flare stack, gas burner unit, ignition system, cooling and combustion air supply system and the control system.

After passing through the blower system, the gas enters the burners through a flame arrestor. The ignition system ignites the gas at the burner tips utilizing a propane pilot light. The ignited gas rises into the flare stack creating a draft which draws combustion and cooling air into the flare stack

through two automatically and one manually operated air dampers located around the base of the flare stack for a specified residence time to ensure the effective thermal destruction. The flare control system monitors the flare temperature, the automatic ignition system, checks to ensure that the flare is burning, controls the adjustment of air intake and logs the flare operating temperature on a chart recorder. The control system monitors flare operation and provides safety shut down capacity as well as automatic restart for certain conditions.

2.5.3 Landfill Gas Condensate System and Pumping Station

Landfill gas condensate is collected from the landfill gas collection system circuit sumps and from the condensate knock-out pots in the gas blower trains. Condensate flows to the condensate pumping station wet well by gravity and is pumped automatically to the leachate collection system. Additional information on operating of the condensate pumping station is provided in Section 2.1.2.3.

2.5.4 Operating Guidelines and Responsibilities

The landfill gas flare system is designed for fully automatic, unattended operation. Under standard operating conditions, all that is required to start the enclosed flare is to turn the operation mode switch in the Flame-Trol II controller to "Auto". Detailed description of the controller logic sequence is provided in the manufacturer's O&M manual (Appendix E). Also, refer to O&M training videos (Appendix D) for a visual description of the automatic and manual operation of the flare.

2.5.4.1 Automatic Operation of the Flare Control System

The LFG Specialities' Flame-Trol II is a fully integrated, 100 percent automatic flare controller. The operator has full flexibility to set or change any temperature and/or time setting utilized in the automatic operation of the flare. The temperature and time setting controllers are described below.

Pilot Temperature Controller

This controller senses the pilot temperature and utilizes one event setting, determined by the operator, to begin operation of the landfill gas blower. This setting is referred to as the "blower on" temperature. Once the automatic pilot has been proven by obtaining the blower on temperature, the header valve will slowly open and the landfill gas blower will start.

Pilot Timer

This timer begins the instant the ignition cycle begins. It is set by the operator at the maximum time required for the pilot to achieve the blower on temperature and the gas supply to be ignited. This time will typically be 2 to 3 minutes. At the end of this time, the pilot gas supply valve will be closed and the pilot flame extinguished, if not already shut-off by the temperature controller.

Pilot Failure Indicator and Shut Down

The pilot timer also controls the "pilot failure" function. Upon initiation of the automatic ignition cycle, this timer begins timing down. Should the pilot not achieve the "blower on" temperature (set in the pilot temperature controller) in the time set in the pilot timer, the entire system will be shut down. The "pilot failure" indicator light will then come on. The system will not attempt to reignite

until the pilot problem has been remedied. If it is determined that the pilot gas supply has not been exhausted or another problem with the pilot system cannot be found the operator may attempt automatic reignition by pushing the "reset" button.

Ignition Time

The ignitor timer allows the operator to set the time the ignitor will spark during the ignition cycle. This allows for the adjustment of the spark duration to compensate for the distance of the pilot gas supply from the flare; thus extending the life of the ignitor plug, transformer and other pilot components.

Flare Chamber Temperature Controller

This temperature controller monitors the temperature in the flare chamber and utilizes two event settings, high and low temperature shutdown. High temperature safety shutdown setting simply shuts down the flare if the temperature should rise to a point of being unsafe or potentially damaging to the flare chamber. Low temperature shutdown setting establishes the minimum acceptable operating temperature for the flare. During operation, if the temperature should fall below this setting, the system will shutdown and not attempt to restart.

Air Louver Temperature Controller

This temperature controller monitors the temperature in the flare chamber and drives the automatic air louvers on the flare stack. The controller has an adjustable set point temperature that will be

maintained by automatically adjusting the air louvers and controlling the flow of combustion and quench air to the flare chamber.

The controller has a continuous digital readout of the actual temperature in the flare stack and the set control temperature. The unit will be operated by the thermocouples selected on the multi-point thermocouple selector switch in the Flame-Trol II control panel.

Main Gas Header Vacuum Controller

This controller monitors the vacuum in the main gas header through a vacuum sensor/transmitter installed in the main gas pipe, upstream from the gas blowers, and drives a throttling flow control.

Key Lock Switch

The controller utilizes a key lock switch as a primary safety, cutting the power supply to the panel in the locked position.

Emergency Shut-Down

An easily accessible emergency shut-down button is mounted on the face of the controller. Pushing the button will immediately shut-down the flare, stop the blower and shut the automatic header valve. The system will be locked out until the shut-down is manually reset.

Indicator Lights

The controller is equipped with indicator lights in the front panel to monitor all the operating functions. Through simple observation the operator can see what function is being performed at any given time without having to open the Flame-Trol II enclosure. Indicator lights are the push-to-test type and have reduced voltage 6V bulbs for longer life.

2.5.4.2 Manual Operation of the Flare Control System

The Flame-Troll II is equipped with a manual/auto switch which allows the operator to by-pass the automatic controls and operate the flare completely manually. All manual switches are isolated in an area together in the face of the controller, indicated by a different color background and labels. The selector switch must be turned to manual before any control switches in that section will operate. Manual switches include:

- Purge on/off
- Pilot on/off
- Ignitor button
- Header valve open/close

The Flame-Trol II monitors and displays the flare chamber temperature and also constantly records this temperature on a chart recorder. This allows the operator to maintain an accurate written record of all flare activity including; down time, day and time period the flare is burning, and operating temperature.

2.5.4.3 Blowers and Vacuum Control Logic

Blower control logic is programmed in the Flame-Trol II PLC controller. One ammeter is provided with each blower. Each ammeter is equipped with adjustable high and low amps settings. The high setting should be set to about 95% of the maximum blower capacity, and the low setting should be held at about 5% above the blower surge point.

On system start-up, the blower with the least amount of cumulative running hours will start first. The vacuum control modulating valve in the header system will try to control the vacuum in the field to a preset level by modulating the gas flow to the flare. If this first blower has high amps for more than 200 seconds, the next sequential blower will start. If the second blower hits high amps for more than 200 seconds, then the third sequential blower will start, and so on. If the landfill gas generation rate declines, the vacuum control valve will adjust the gas flow to the flare by closing partially. If any running blower hits low amps for more than 200 seconds, the blower that has low amps will drop out. If the last blower hits low amps, the system will shut down.

At all times, the vacuum control modulating valve will operate independently of the blowers in operation. It will continuously maintain a preset vacuum on the extraction system.

Note: A three setting Auto/Off/Hand switch is provided for each blower. When the system is in the automatic mode, the controller will keep track of the running hours on all blowers. The blower with the least amount of running hours will be automatically selected as the primary.

Section 3

Post Closure Monitoring and Sampling Program

Section 3
Post Closure Monitoring and Sampling Program

3.1 Introduction

The New York State Department of Environmental Conservation issued its Record of Decision (ROD) for the Croton Point Landfill site in March of 1993. The ROD states that "Groundwater, surface waters, leachate, landfill gases, stormwater discharges and marsh sediments will all be subjected to a periodic monitoring program designed to detect any changes in the effectiveness of the remedial program."

The Post Closure Monitoring and Sampling Program outlined below complies with the specific sampling requirements of the ROD. Where the ROD is not specific, sample locations and frequency are selected based on a thorough understanding of the purpose and configuration of the Croton Closure System to adhere to the intent of the ROD. A copy of the ROD is included in Appendix F. Unless otherwise specified, sampling will be conducted at the frequency and scope described in this section throughout the 30 year post closure monitoring period.

3.2 Section Objectives

It is not possible within the scope of this O&M manual to provide step by step directions for sampling each type of environmental media covered in the post closure monitoring and sampling program. Nor is it possible to cover the selection, use, care and maintenance of the various equipment required for proper sampling. It is assumed that personnel who will conduct sampling under this program are trained, experienced and competent to conduct sampling without the aid of this manual.

It is the purpose of the manual to provide an overview of environmental media to be sampled, frequency and schedule of sampling, number of samples required and laboratory analysis requirements based on the New York State DEC Record of Decision. Where possible, generally appropriate procedures and guidelines are outlined based on approved sampling methodology which has been previously conducted during the remedial investigation and feasibility study. Unless specifically stated otherwise, the procedures and guidelines provided are intended to be used as reference only and should not be considered requirements. All sampling and laboratory analysis procedures as well as the laboratories conducting the analysis must be approved by the NYSDEC.

The objective of this section is to provide the basis by which experienced personnel can plan and implement appropriate sampling episodes for the various environmental media to be sampled.

3.3 General

Environmental media to be sampled include surface water, stormwater, groundwater, leachate, marsh sediment and landfill gas. The samples will be collected and analyzed to obtain analytical data for these selected media at representative locations on and near the site. The data will be analyzed as part of the ongoing monitoring program implemented under the site closure plan. Results from the monitoring will be used to assess the long-term performance and effectiveness of the closure elements.

Prior to conducting sampling and monitoring as described below, specific sampling and analysis plans shall be prepared by the individuals responsible for conducting the sampling. The sampling and

analysis plans shall be submitted to the NYSDEC for comment and approval prior to conducting the work described herein.

Table 3-1 provides the frequency for sampling for the various media.

3.4 Surface Water Sampling

The Record of Decision specifies that surface water monitoring parameters will include 6 NYCRR Part 360 baseline parameters annually and routine parameters quarterly at a minimum for the first five years. Subsequent monitoring is subject to negotiation and may vary based on the results of the first five years.

3.4.1 Sampling Episode Logistics

Three sampling locations have been selected as representative of site conditions: Tellers Point the Public Beach and the Eastern Drainage Channel in Croton Marsh. Provided sampling is conducted on the incoming tide near half full, Tellers Point will serve as background conditions in the Hudson River and Croton Bay. The Public Beach and the Eastern Drainage Channel are selected as representative of the areas with the greatest potential to be impacted by surface water quality around the perimeter of the site.

Excluding trip and field blanks, two samples will be taken at each location. Samples should be taken within two hours before and after half tide with the tide rising. Sampling will begin at Tellers Point,

Table 3-1

Post Closure Monitoring and Sampling Program
Summary of Environmental Sampling Requirements

Sample Type	No. of Sampling Locations	Samples Per Location	Total Samples	Sampling Frequency	Analysis Parameters
Surface Water	3	2	6	Quarterly Annually	6NYCRR Part 360 Routine Parameters 6NYCRR Part 360 Baseline Parameters
Stormwater	2	2	4	Yearly	County of Westchester General Stormwater Discharge Permitted Parameters
Groundwater	18	1	18	Quarterly Annually	6NYCRR Part 360 Routine Parameters 6NYCRR Part 360 Baseline Parameters
Leachate	1	2	2	Monthly	Croton Point Landfill Wastewater Discharge Permitted Parameters
Landfill Gas	1	2	2	Yearly	NYSDEC Certificate to Operate a Process: Exhaust or Ventilation System Permitted Parameters in Addition to Combustible Gas Concentration
Marsh Sediments	3	1	3	Yearly	Arsenic, Cadmium, Copper, Lead, Mercury Silver as listed in the NYSDEC Record of Decision
Perimeter - Soil Gas	40	1	4	Yearly	Field instrument survey of combustible gas

* Sampling as listed above shall be conducted during the 30 year post closure monitoring period. Sampling is subject to modifications and reduction after the first five years of data collection based on review by the NYSDEC.

proceed to the Public Beach and finish with the Eastern Drainage Channel. Figure 10 shows the surface water sampling locations.

3.4.2 Surface Water Sampling Guidelines

Surface water sampling previously conducted during the remedial investigation included the following steps:

- Collect samples downstream to upstream (where applicable) to avoid taking samples from disturbed water.

- Label bottles prior to sample collection and store in coolers.

- Collect samples for volatile organic compound analysis first, followed by other samples for organic compound analysis, then metals and other parameters.

- Collect samples by filling the bottles directly or by using a decontaminated stainless steel scoop or beaker.

Record the following information in the field at each surface sampling location:

- Description of the location with a sketch containing the landmarks
- Sample identification number
- HNu/OVA readings above the water surface and above the samples

- Direction of surface water flow and description of the water
- Time
- Dissolved oxygen readings
- Description of the tidal status
- pH
- Approximate depth to bottom
- Temperature
- Conductivity reading
- Salinity

3.5 Stormwater Sampling

The ROD requires that sampling of stormwater discharges from the landfill cover system complies with the County of Westchester General Stormwater Discharge Permit. Those permit conditions have yet to be finalized. Once finalized, the sampling and analysis requirements will be appended to this manual.

3.5.1 Sampling Episode Logistics

Two sampling locations have been selected as representative of site conditions: the Hudson River Outfall and the Croton Bay Sedimentation Basin sampling locations are shown on Figure 10. These two outfalls discharge 100% of the stormwater from the landfill cover and adjacent access roads.

Excluding trip and field blanks, two samples will be taken at each location. Protocol and laboratory analysis and frequency will be as required under the County's finalized permit requirements.

3.5.2 Stormwater Sampling Guidelines

(Section to be completed on finalization of stormwater discharge permit requirements.)

3.6 Groundwater Sampling

Baseline groundwater quality was established as part of the Remedial Investigation and Feasibility Study effort. Ongoing groundwater sampling will ensure that the baseline quality is maintained and will demonstrate the effectiveness of the overall closure design.

Twenty-one (21) stainless steel groundwater monitoring wells were installed at the Croton Point Sanitary Landfill from October through December 1989, in order to characterize site geology and to collect groundwater samples for laboratory analysis (Figure 10). The well locations were selected based on discussions between NYSDEC, Westchester County and Velzy/Weston. The majority of the wells are located around the perimeter of the landfill to monitor the radial flow of groundwater from the landfill's center. Monitoring wells RFW-1S and RFW-1D were located to monitor groundwater conditions between the landfill and the Metro-North property. Monitoring well RFW-13 was installed to serve as a water level monitoring point within the landfill; however, proper procedure was used during installation to allow its use as a water quality monitoring point. Of the 21 wells, 16 are arranged in couplets to enable groundwater monitoring at two different depths (shallow-"S" and deep-"D"). Monitoring wells RFW-3S, RFW-5S and RFW-13 were screened directly

in the landfill mass. The water quality results for wells RFW-3S and RFW-5S are to be used to evaluate the quality of leachate in the landfill adjacent to the marsh.

The Record of Decision specifies that groundwater monitoring parameters will include 6 NYCRR Part 360 baseline parameters annually and routine parameters quarterly at a minimum for the first five years (see Table 3-2). Subsequent monitoring may vary based on the results of the first five years.

3.6.1 Sampling Episode Logistics

Excluding RFW-3S, 5S and 13 all other wells in the 21 well system including RFW-1S, 1D, 2S, 2D, 3D, 4, 5D, 6, 7S, 7D, 8, 9, 10S, 10D, 11S, 11D, 12S and 12D will be sampled. RFW-3S, 5S and 13 are leachate sampling points. The requirements for leachate sampling are addressed in Section 3.7.

Sampling of the remaining 18 groundwater monitoring wells will be conducted quarterly over a period not to exceed seven consecutive days. Excluding trip and field blanks and requirements for field duplicates, one sample shall be taken from each well.

3.6.2 Groundwater Sampling Guidelines

The following steps were followed during groundwater sampling conducted as part of the Remedial Investigation. The well should be checked for above-ground damage. Any damage should be noted. After uncapping the well, the well head space should be monitored with an OVA/HNu and the readings should be recorded. After monitoring, the wellhead should be allowed to vent until

readings normalize at background. If action levels are exceeded at the well head, additional precautions may be required (See Section 6). Well sampling procedure is as follows:

- Place visqueen or other plastic on the ground around the well. Decontaminate equipment entering the well and handle with sterile gloves.

- Measure the depth from top of casing to water surface using a water level indicator; record the data in field logbook.

- Measure and record the depth of the well to the top of the protective casing; note any deviations from the depth as installed; record the height of the protective casing; record the differential between the protective casing and the top of the interior well casing.

- Determine linear feet of water in the well by subtracting the depth to water from the measured depth of the well; record the data in field data sheet.

- Calculate the minimum number of gallons to be purged by multiplying in linear feet of water in the well by 1.95 for a 4-inch well (this represents three well volumes); record the data in field logbook.

- Purge at least three well volumes from each well and monitor the field parameters (pH, temperature, and specific conductivity) until stabilized. Measure the required volume of

Table 3-2

Parameters for Surface and Groundwater Analysis

6NYCRR Part 360

Baseline Parameters (Annual Analysis)

- Total Kjeldahl Nitrogen (TKN)
- Ammonia
- Nitrate
- Chemical Oxygen Demand (COD)
- Biochemical Oxygen Demand (BOD_5)
- Total Organic Carbon (TOC)
- Total Dissolved Solids (TDS)
- Sulfate
- Alkalinity
- Phenols
- Chloride
- Total hardness as $CaCO_3$
- Turbidity
- Color
- Boron
- Potassium
- Sodium
- Iron
- Manganese
- Magnesium
- Lead
- Cadmium
- Aluminum
- Calcium
- Toxic metals including antimony, arsenic, barium, beryllium, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium, silver, thallium and zinc
- Cyanide
- Volatile organics

Routine Parameters (Quarterly Analysis)

- Ammonia
- Nitrate
- Chemical Oxygen Demand (COD)
- Total Organic Carbon (TOC)
- Total Dissolved Solids (TDS)
- Sulfate
- Alkalinity
- Phenols
- Chloride
- Total hardness as $CaCO_3$
- Turbidity
- Potassium
- Sodium
- Iron
- Manganese
- Magnesium
- Lead
- Cadmium
- Calcium

water with the use of calibrated five gallon buckets. Collect purged water and discharge into leachate sewer.

- Collect one field screening sample from each well volume. Measure and record pH, temperature and conductivity. Take periodic readings with the HNu and OVA in the breathing zone and at the well head, and record these in logbook. If volatile organic compounds are detected, follow the procedures outlined in the Site Health and Safety Plan.

- Well water is assumed to be contaminated and cannot be discharged on the ground.

- For slowly recharging wells, proceed with sample collection within four hours of well purging, whether or not the water level has recovered to 75 percent of the original level. For slowly recharging wells, only one well volume may be removed prior to sample collection.

- Measure pH, specific conductivity, reduction potential, dissolved oxygen, temperature and headspace volatile organic compounds of each groundwater screening sample before collecting laboratory samples from the well. Determine the percent change in pH and conductivity between the screening samples. If the percent change for both the pH and conductivity is below ten (10) percent of the values for the previous sample, the well should be sampled. If not, purge the well again until consistent readings are obtained. Record screening results in field logbook.

- If the measured turbidity of the groundwater sample exceeds the NYSDEC goal of 50 Nephelometric Turbidity Units (NTUs), the metals sample collection should be postponed for up to 24 hours after well purging. All other samples may be collected within four hours of well purging.

- Samples for VOCs are to be collected first.

3.7 Leachate Sampling

Leachate sampling provides an indication of the performance of the landfill cover. Baseline quality has been established as part of the permit process allowing discharge of the leachate to POTW. Ongoing sampling will ensure that the baseline criteria are not exceeded and demonstrate overall performance of the closure design.

In accordance with the Westchester County Wastewater Discharge permit, the following items will be complied with during sampling, analysis and reporting:

All sampling, handling, preservation, and laboratory analysis of collected samples shall be performed in accordance with 40 CFR Part 136. If 40 CFR Part 136 does not contain an analytical technique for the pollutant in question, the analysis must be performed in accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater".

Laboratory analyses must be conducted by a wastewater laboratory certified by the New York State Department of Health. The results are to be submitted on the laboratory letterhead and certified by it.

The laboratory report must indicate the dates of sampling, times samples were taken, chain-of-custody procedures, sampling preservation procedures, analytical techniques used and units of measurement.

3.7.1 Sampling Episode Logistics

The wet well of Pumping Station No. 2 is selected for sampling as representative of leachate quality discharged into the POTW. Pumping Station No. 2 receives leachate and other contaminated liquids from all contributing sources. Sampling the wet well, therefore, is a composite of all sources. Figure 10 shows the location of the Pumping Station No. 2 wet well.

Leachate sampling will be conducted quarterly and analyzed for the parameters required under the Westchester County Wastewater Discharge Permit.

The parameters to be analyzed for are listed in Table 3-3.

3.7.2 Leachate Sampling Guidelines

Leachate sampling procedure will be as follows:

- Label bottles prior to sample collection and store in cooler.

- Open Pumping Station No. 2 wet well. Screen wet well head space with OVA and HNu. Allow wet well to vent until background readings are achieved.

- Recover sample from wet well with a disposable bailer.

- Lower bailer to the bottom of the wet well before sample recovery.

- Fill sample containers directly from bailer.

Record the following information:

- Sample identification number

- HNu/OVA readings

- Leachate level in wet well

- Condition of wet well and description of leachate

- Describe visible flow from incoming pipes

3.8 Landfill Gas Sampling

The ROD requires that landfill gas be sampled from the collection pipes and tested for volatile organics and combustible gas concentration. The Croton Landfill Gas Control System is subject to the requirements of the New York State DEC Certificate to Operate a Process, Exhaust or Ventilation System. In compliance with the ROD, the volatile organics listed in the Certificate to Operate in addition to combustible gas concentration will be sampled and analyzed yearly.

Table 3-4 lists the landfill gas parameters to be analyzed for.

3.8.1 Sampling Episode Logistics

Landfill gas is collected from the Main and Ballfield Landfills and is transported to the landfill gas flare for thermal destruction of methane and volatile organics. Sampling from the positive pressure side of the landfill gas handling system is selected as representative of a composite sample of all landfill gas sources.

Landfill gas will be collected from a sampling port on the positive pressure side of the landfill gas handling system and analyzed for the parameters listed in Table 3-4 yearly.

3.8.2 Landfill Gas Sampling Guidelines

The following outlines one procedure for collecting a landfill gas sample for appropriate laboratory analysis.

Table 3-3

Croton Point Landfill Wastewater Discharge Permit No. 7511
Leachate Analysis Parameters

- Biochemical oxygen demand
- Total suspended solids
- pH
- Total cyanide
- Phenols
- Copper
- Lead
- Mercury
- Nickel
- Zinc
- Arsenic
- Selenium
- Silver
- Total Chromium
- Hexavalent Chromium
- Oil and Grease
- Total toxic organics

Table 3-4

Landfill Gas Parameters for Laboratory Analysis (from the NYSDEC Certificate to Operate A Process, Exhaust or Ventilation System)

- Vinyl Chloride
- Methylene Chloride
- 1, 2 - Dichloroethane
- Carbon Tetrachloride
- Benzene
- Toluene
- Ethylbenzine
- Styrene
- Xylene
- Hydrogen Sulfide
- Carbon Monoxide
- * Combustible Gas Concentration

* As required by the ROD

In general, landfill gas is passed through a sampling train and a 50 cc gas sample is collected in a syringe. The sample is then slowly injected through a gas chromatograph coupled with mass spectroscopy (GCMS) and Tenax sampler. This same procedure is repeated a second time, collecting a 25 cc gas sample.

Landfill gas sampling may be divided into three categories:

- GCMS/Tenax sampler assembly
- Sample collection
- Tenax tube loading

GCMS/Tenax sampler assembly includes:

1. Attach the sampling train NPT male pipe fitting to the gas source sampling port.
2. Check all fittings and connectors for a proper (hand-tight) fit.
3. Open gas source sampling port and allow gas to gently purge through sampling train for several minutes.
4. Attach a glass tenax tube to the TFE luer fitting assembly. A ferrule which fits around the outside of the glass tenax tube is present inside the TFE luer fitting assembly. Hand-tighten the Swagelok nut on the end of the luer fitting assembly to obtain an air-tight, snug fit.
5. The tenax tube should be positioned with the silica gel end of the tube next to the TFE luer fitting assembly.

6. Place the assembled tenax sampler system in an area isolated from the gas source until needed.

Sample collection procedure:

1. Attach the glass syringe to the sampling train TFE luer fitting.
2. If gas is pressurized, regulate gas flow to decrease the pressure and prevent breakage of the glass syringe. A gentle gas flow through the TFE luer fitting and check valve outlet is sufficient. Hold syringe plunger firmly while sampling.
3. Open syringe control valve and purge sampling train several times by slowly filling and emptying the glass syringe. Do not disconnect the syringe during this purge cycle.
4. After purging the system, collect slightly more than 50cc of gas in the syringe.
5. Close syringe control valve and disconnect syringe from sampling train.
6. Open syringe control valve and adjust gas sample volume to exactly 50cc.
7. Close syringe control valve.

Tenax tube loading procedure:

1. Attach glass syringe to the GCMS/Tenax sampler tfeluer fitting.
2. Open syringe control valve and slowly inject 50cc gas sample through the tenax sampler assembly. Use gentle, consistent pressure on the syringe plunger while passing the gas sample through the tenax tube.
3. Remove the glass tenax tube from the sampling assembly.

4. Label the tenax tube, specifying sample size site I.D., date and time sampled. Immediately place the tenax tube in a long glass vial.
5. Repeat the complete sampling procedure, taking a 25cc gas sample from the same site.
6. Send all tenax tubes (2 tenax tubes per site) to laboratory for analysis. Include one blank tenax tube per sampling trip as a background contamination check.

3.9 Perimeter Soil Gas Survey

The objective of the perimeter soil gas survey is to assess the effectiveness of the Landfill Gas Collection System in preventing the off-site migration of landfill gas. The procedure consists of punching a hole through the soil outside the limits of the landfill cap. A probe is inserted into the hole and real time air monitoring instruments are used to measure the presence of landfill gas in the soil. Landfill gas beyond the limits of the cover suggest a malfunction in the collection system and can pose a threat to the public health and safety.

3.9.1 Sampling Episode Logistics

The Perimeter Soil Gas Survey will be performed annually, as a minimum for the first five years of the 30 year Post Closure Monitoring Period. The frequency of the soil gas survey will be subject to review and revision after the first five years of the 30 year Post Closure Monitoring Period. Survey locations will be stationed at 300 foot intervals around the perimeter of the landfill. All stations must be located outside of the boundaries of the landfill cover system. No stationing is included along the Croton Marsh because beyond the cover boundaries the soil is assumed to be saturated

eliminating any danger of off-site gas migration. It is anticipated that as many as 40 survey points will be sampled over a period of three consecutive days.

3.9.2 Perimeter Soil Gas Survey Guidelines

The following general procedure was utilized for the Perimeter Soil Gas Survey conducted during the Remedial Investigation.

Sampling protocol for perimeter soil gas survey includes:

- Using a slam hammer, drive a six foot soil gas probe, fitted with drive head and point, 3-feet into the soil at each sample location.

- Jack the probe out of the ground one foot, opening the point end to a subsurface air space 1 foot by 3/4 inch in diameter.

- Remove drive end of probe and insert sampling tube through the soil gas probe.

- Seal sampling tube against the outer soil gas probe to create an air-tight seal.

- Remove minimum of 3 volumes of air from the probe using a hand-operated squeeze-ball type vacuum pump.

- Sample soil gas by connecting the monitoring instrument to the sampling tube.

- OVA values should be recorded as the peak of observed readings. Record CGI values after observed readings have stabilized.

If there is no oxygen at the sample location, then there is no explosive hazard regardless of the amount of methane present. However, if oxygen is retained in the soil or the sample is taken just below the soil surface where oxygen is more likely to be present, then an explosive hazard may be present. This is further dependent on soil gas emission rates, porosity of the soil, moisture content and where the sample is taken.

3.10 Marsh Sediment Sampling

During the Remedial Investigation and Feasibility Study, a baseline characterization of Croton Marsh Sediments was completed. As required by the ROD, ongoing marsh sediment sampling will be conducted to demonstrate that the quality of marsh sediments is maintained. With the closure of the landfill and cap construction, it is anticipated the sediment quality will improve over time.

3.10.1 Sampling Episode Logistics

Three sampling stations in the Eastern Marsh Channel have been selected to be consistent with sediment sampling completed during the Remedial Investigations. Sediment sampling locations are shown in Figure 10. For ease of access, these points will be sampled while they are exposed at low tide. Sampling will be conducted yearly as a minimum for the first five years of the 30 year Post Closure Monitoring Period. The frequency of subsequent sampling will be subject to review and

revision by the NYSDEC. Table 3-5 outlines the parameters for laboratory analysis as required by the ROD.

3.10.2 Marsh Sediment Sampling Guidelines

Sediment sampling conducted as part of the remedial investigation included the following steps:

- Collect sediment samples immediately after and below the location of the surface water samples.
- Collect samples to a depth of approximately three inches.
- Use properly decontaminated stainless steel trowels and scoops to collect the sediment samples and fill the jars.
- Decant excess water from the sample container.
- Label glassware prior to sample collection and store in a cooler.

Record the following information at each sediment sampling location:

- Description and sketch of the location
- Sample identification number
- HNu/OVA readings of sample
- Depth to bottom
- Description of sample color, texture, odor, etc.

Table 3-5

Marsh Sediment Parameters for Laboratory Analysis (from the Rod)

- Arsenic
- Cadmium
- Copper
- Lead
- Mercury
- Silver

3.11 General Sampling Protocol

3.11.1 Generic Sampling Procedure

Environmental sampling and analysis is an extremely tolerance sensitive activity. The protocols used for sampling and analysis make it possible to assess the presence of some contaminants in quantities of one part in a billion. Conversely, improper implementation of the protocols or small amounts of contamination during sampling by foreign matter can have a large impact on results showing the presence of a contaminant not actually in the sample.

A typical sequence of events for a generic sampling event might consist of the following:

1. Sampling equipment includes:
    - sampling tools
    - instrumentation for recording physical parameters (temperature, location, air quality, etc.)
    - sample containers
    - sample shipping materials
    - paper work and chain of custody documentation
    - appropriate personal protective equipment

2. Sampling equipment is decontaminated including:
    - sample containers
    - sampling devices

3. Trip blanks (often bottles of water with known components supplied by the testing lab) are prepared to assess any cross contamination over the duration of the sample episode.

4. The sampling location is pre-screened to assess any Health and Safety consideration (air quality, high levels of contamination, etc.).

5. The physical conditions of the sample location is recorded (location, weather, soil, water depth, observed conditions, etc.).

6. A sample is collected with decontaminated tools and placed in the decontaminated sample container.

7. Field blanks (like Trip Blanks but prepared in the field) are prepared to assess any cross contamination resulting from the sampling procedure.

8. Chain of custody paperwork is completed to track the samples from origin through carriers to the laboratory.

9. Samples are packed and shipping containers are sealed.

10. Samples are shipped to a laboratory within a specified handling time (usually 24 to 48 hours depending on samples and analysis).

Proper completion of such a procedure allows the sample to reach a laboratory without degrading or spoiling on the way to be analyzed for specific contaminants. The trip and field blanks are tested by the laboratory using the same procedure as for the environmental samples. A comparison of analysis results for the sample, trip and field blanks will determine if the sample was contaminated during any part of the sampling episode.

The generic scenario outlined above changes significantly with respect to sampling and monitoring equipment and procedures in addition to office and field preparation for various media sampled, (landfill gas compared to leachate for instance).

3.11.2 Field Duplicates Purpose and Methodology

Field Duplicates are sets of samples collected at the same location and time under as nearly identical conditions as possible. Field duplicates are collected and analyzed to asses analytical reproductibility by comparing the laboratory results of identical samples.

Collect field duplicate samples for aqueous samples by alternately filling sample containers from the sample sampling device for each parameter. For instance, fill samples for VOC analysis from wells from the same bailer of sample water. VOC containers should be filled first.

Duplicates of a sediment matrix require homogenizations of the sample aliquot prior to filling the sample containers. Complete homogenization of duplicate samples in the field. Place sample aliquot into a decontaminated stainless steel bowl or tray and mix thoroughly with a decontaminated

stainless steel or teflon device until a consistent physical appearance is achieved. Split the sample in half and fill the sample containers by alternating spoonfulls from each sample half.

In general, one field duplicate should be taken for every twenty samples of each sample media. If less than twenty samples of a media are taken, then one duplicate should be taken for each media sampled.

3.11.3 Field Blanks Purpose and Methodology

Field Blanks are prepared and analyzed to assess the potential for the sampling procedure to introduce contaminants into the field samples. Field Blanks preparation starts with two sets of identical laboratory-prepared sample containers. One set of containers is empty. The other set is filled at the laboratory with analyze free water.

Field Blank preparation is completed in the field, preferably at the most contaminated sampling site. Liquid from the full containers is transferred into the empty containers by passing it through the same decontaminated sampling equipment and using the same procedures to be used in collecting the field samples. The Field Blanks are returned to the laboratory with the same bottles they accompanied into the field and are analyzed for the same parameters as the field samples they accompany.

In general, one Field Blank should be prepared each day for each sample media.

3.11.4 Trip Blanks Purpose and Methodology

Trip Blanks are prepared and analyzed to assess the potential for sample or container contamination through laboratory handling, field exposure or sample shipping. In general, Trip Blanks are necessary only when samples are being analyzed for VOCs.

Trip Blanks consist of laboratory prepared and sealed sets of sample containers, filled with analyze free water. The sealed Trip Blanks are prepared with each order of sampling containers. Trip Blanks accompany the sample containers through the field sampling and sample shipping procedures and are returned unopened with the samples to the laboratory for analysis.

In general, one Trip Blank should accompany each day's sample shipment.

3.12 Sample Document and Custody Procedures

3.12.1 Sample Nomenclature

To simplify future data management, the following sample nomenclature will be adopted:

General:

Duplicate samples will be denoted by capital letters A and B.

Surface Water Samples

Tellers Point = SRF-1, A and B

Public Beach = SRF-2, A and B

Eastern Channel of Croton Marsh = SRF-3, A and B

Stormwater Samples

Hudson Outfall = Strm-1, A and B

Croton Marsh Outfall = Storm-2, A and B

Groundwater Samples

Groundwater samples shall be labeled according to the monitoring wells from which they are recovered. For instance:

RFW-1D = RFW-1D

Leachate Samples

Pumping Station 2 = PS-2, A and B

Landfill Gas Samples

Croton Main Flare = LFG A and B

Marsh Sediments

Starting at the eastern most sampling location and counting westward

SED-1

SED-2

SED-3, A and B

Soil Gas Survey

No permanent markers will be used to denote the soil gas survey points. The general vicinity of the sampling points will be marked on a site map and numbered sequentially clockwise starting at the Marsh Condensate Seeps Pumping Station.

3.12.2 Field Custody Procedures

Use chain-of-custody protocols consistent with USEPA sample custody protocols as described in "NEIC Policies and Procedures" EPA-330/9-78-001-R, revised February 1983. The custody procedure is in three parts: 1. Sample Collection, 2. Laboratory, and 3. Final Evidence Files. Field custody (sample collection) procedures are described herein.

These procedures provide documentation of the handling and tracking of a sample from time of collection through the time of analysis.

Chain-of-custody forms accompany sample bottles to the field. The field crew record whether the cooler is intact upon arrival in the field. The crew should contact the laboratory immediately if the seal is broken, bottles are damaged, or the proper number of bottles is not received. Maintain a record of sample collection, transfer, shipment, and receipt at the laboratory. Custody documentation should include: project, work order number, sampling date and time, sample site location, cross-referenced site and sample numbers, analyses required, sample description, container and preservative, number of bottles and special instructions for the laboratory. Each time a sample

is transferred to another custodian, signatures of the persons relinquishing and receiving the sample, time, and date of the transfer should be obtained and documented on the chain-of-custody.

Label sample containers with work order number, sample number, sample date, time, description, preservative and analyses required.

3.13 Sample Handling and Shipping

Samples obtained at the Croton Point Sanitary Landfill are classified as environmental or low level samples. Environmental samples are those which are collected off-site, around the perimeter of a waste site, or in areas where hazards are thought to be significantly reduced by normal processes.

In preparation for shipment to the analytical laboratories, all samples must be packaged in accordance with the following procedures:

- Each sample checked to make sure that it is properly preserved; the cap tightened securely; and liquid levels marked if bottles are partially full.

- Sample labels are securely attached to the sample container; each container is placed in a zip-loc or plastic bag, ensuring that labels are visible.

- Containers are placed in a cooler lined with two inches of vermiculite or equivalent absorbent material; sufficient ice or ice packs are added to the cooler so that the samples remain at a temperature of 4^0C during shipping.

- The chain-of-custody form is put in a waterproof plastic bag and taped under the inside of each cooler lid.

- Each cooler is closed and sealed with custody seals in such a manner that the seals would be broken if the cooler was opened.

- Clearly visible return address labels and "This End Up" labels are placed on the outside of each cooler.

- Samples are delivered to the laboratory 24 to 48 hours from the day of collection.

- The laboratory is notified immediately following all sample shipments with the following information: No. of samples, type of sample, and time samples were collected.

- Field and trip blanks are received in the field within one day of preparation in the laboratory.

3.14 Instrumentation Calibration Procedures, Frequency and Documentation

Monitoring and Sampling equipment should be calibrated and maintained according to manufacturer's recommendations to assure accuracy within specified limits. Standard procedures for field equipment maintenance, repair and calibration for all instruments and equipment must be followed.

It is the responsibility of the Field Team Leader to ensure that equipment is calibrated and maintained prior to use in the field, during field operations and after use according to manufacturers recommendations and as required for the operations being conducted.

Instrumentation used in conjunction with sampling and monitoring efforts should be calibrated and maintained in accordance with manufacturer's requirements as provided in the Manufacturer's O&M manuals. The maintenance and calibration of each piece of equipment should be documented in service logs that are routinely kept for each piece of equipment. The service logs should document that each piece of equipment is kept in good working order.

In addition, the calibration of equipment prior to sampling use, should be documented in the field logs kept for each type of sampling.

In general, this should result in (1) a record of instrument service and calibration maintained as part of the required professional instrument service and (2) a record of calibration conducted as part of the equipment operation requirements during sampling and monitoring.

The level of effort for maintenance and calibration will depend on equipment use and the duration of operation.

3.15 Generalized Use, Calibration and Service of Some Common Monitoring and Sampling Instruments

3.15.1 Field pH Measurements and Calibration Procedures

Discussion

This guideline details the steps required to measure the pH of an aqueous sample in the field using a pH meter and the proper calibration procedures for the pH meter. It is important to obtain a pH measurement immediately after taking a sample and thus avoid sample changes such as precipitation, temperature fluctuation, or oxidation which can affect the pH of the sample. To use the pH meter, the meter is standardized to a pH buffer of 7 and then immersed in the unknown sample to obtain a pH reading.

pH Measurement and Meter Calibration Protocol

The following procedure is used for measuring pH and calibrating a pH meter:

1. Turn meter on and allow to warm up for approximately 10-15 minutes.
2. Rinse the electrode with deionized water.
3. Immerse the electrode in pH 7.0 buffer solution.
4. Adjust the temperature compensator to the temperature of the buffer solution.
5. Adjust the pH meter to read 7.0. Standardize the meter with pH 4 and pH 10 buffers.
6. Remove the electrode from the buffer and rinse with deionized water.
7. Adjust the temperature compensator to the temperature of the sample.
8. Rinse the electrode with a portion of the sample to be tested. Place the tip of the electrode in the sample and stir the sample until the reading stabilizes.

9. Read and record the pH of the sample on the field data sheet.

10. Rinse the electrode with deionized water, dry and replace the cap, or keep the electrode tip in water when not in use.

11. Calibrate the meter before midway, and after each days use. Record calibration on field data sheet.

3.15.2 SPECIFIC CONDUCTIVITY MEASUREMENT AND CALIBRATION

Discussion

This details the steps required to measure the specific conductance of an aqueous sample in the field, and the proper meter calibration procedures. It is important to obtain a specific conductance measurement soon after taking a sample in that temperature changes, precipitation reactions, and adsorption of carbon dioxide from the air all affect the conductivity.

Conductivity is a numerical expression of the ability of a water sample to carry an electrical current. This value depends of the total concentration of the ionized substances dissolved in the water and the temperature at which the measurement is made. The mobility of each of the dissolved ions, their valences, and their actual and relative concentrations affect conductivity.

Specific Conductivity Measurement and Meter Calibration Protocol

The following procedure is used for measuring specific conductance and calibrating a conductivity meter:

1. Turn meter on and allow to warm up for approximately 15-30 minutes prior to use.

2. Turn the Mode Control to Redline and adjust the Redline control so that the meter needle lines up with the redline on the meter face.
3. Turn the Mode Control to Zero and check needle alignment with the zero on the meter face.
4. Rinse the probe with deionized water, and then one or more portions of the sample to be tested.
5. Adjust the temperature setting to the sample temperature.
6. Immerse the probe in the sample and allow time for the probe to reach equilibrium with the water.
7. Using the appropriate scale range on the Mode Control (X1, X10, X100), read the meter scale, multiply by the range, and record the conductivity on the field data sheet.
8. Rinse probe with deionized water, and keep probe immersed in water when not in use.
9. Check the meter performance against conductivity standards for three ranges once a week, and keep records of the calibration.

3.15.3 Temperature Measurement and Meter Calibration Procedures

Discussion

This guideline details the steps involved to measure the temperature of a sample. Field parameters, such as pH and conductivity are temperature dependent, thus it is important to obtain an accurate temperature measurement immediately after collecting a sample.

Temperature Measurement and Calibration Protocol

The following is used for measuring temperature and calibrating a thermometer and thermistor:

1. Rinse thermometer or thermistor with deionized water.
2. Immerse thermometer/thermistor into sample and allow reading to stabilize.
3. Rinse thermometer/thermistor with deionized water, dry and replace in appropriate casing.
4. Record temperature on the field data sheet.
5. Calibrate thermometer/thermistor against a NBS certified thermometer once every month over a full range of temperatures. Record calibration.

3.15.4 Dissolved Oxygen Measurement and Meter Calibration

Discussion

A dissolved oxygen meter is used to measure the amount of molecular oxygen available in natural water and wastewater. Dissolved oxygen (DO) is a key test in analyzing water pollution activities. DO levels in waters are dependent on physical, chemical and biochemical activities prevailing in the water body. This guideline details the steps required to measure the DO of an aqueous sample in the field using DO electrometric meter. The readings are based on the rate of diffusion of molecular oxygen across a membrane.

Dissolved Oxygen Measurement and Meter Calibration Protocol

1. Turn meter on and allow to warm up for approximately 15-30 minutes prior to use.
2. Check the probe membrane for bubbles and/or holes: Change the membrane and KCL solution if needed. Rinse the probe with distilled water.
3. Turn the Mode Control to DO and then to percent. Adjust the percent to 100. Record the temperature by turning the control to the temperature position. Turn the control to DO: at

100 percent, the DO should read close (within 10 percent) to the solubility of oxygen at the meter temperature (Refer to table on back of meter). If the DO does not match, recalibrate, check/change the probe membrane, and/or check the batteries.

4. Immerse the probe in the sample and allow time for the probe to reach equilibrium with the water.

5. Record all calibration and DO readings on the field data sheet.

6. Check the meter at lease once a week against the Winkler or HACH methods.

3.15.5 Organic Vapor Analyzer and Photoionization Detector Calibration and Monitoring

Discussion

An Organic Vapor Analyzer (OVA) and Photoionization Detector (HNu) are used to monitor volatile organic vapors in the field. OVA and HNu readings give an indication of presence or potential presence of chemical compounds and air contaminants on the site. The two instruments differ in their modes of operation and in the number and types of compounds they detect. The measurements obtained can be used to determine levels of personnel protection, establish site work zones, and subsequent monitoring or sampling areas.

Initially, background readings are made upwind of the site in areas where air contaminants are not expected. Readings above background may indicate the presence of combustible vapors or toxic chemical levels, thus it is important that measurements be made with one or more appropriate, calibrated instruments and proper procedures are followed.

3.15.5.1 Ova Procedures

OVA Calibration

The following procedure is used to calibrate an OVA:

1. Connect the probe to the meter by first attaching the flexible Teflon tube to the swagelok fitting and hand tighten. Insert the 5 ppm connector to the switchcraft socket until it clicks into place.

2. Move the pump switch to on and check battery condition by moving the instrument switch to the batt position. The needle on the probe meter should swing into the Battery OK region.

3. Move the instrument switch to on and allow five minutes for warm-up.

4. Set calibrate switch to 10X position and use calibrate adjust knob to adjust meter to zero. Set the gas select control set to 300.

5. Open the H_2 tank valve and observe the reading on the H_2 tank pressure indicator. (Approximately 150 psi of pressure is needed for each hour of operation). Refill self-contained tank if necessary.

6. Open the H_2 supply valve and observe the reading on the H_2 supply pressure indicator. Indication should be approximately 11 on the gauge.

7. Depress the red igniter button until the burner lights. Ignition is confirmed from a slightly audible pop at the FID exhaust port and by deflection of the probe meter needle to a higher baseline reading.

8. Introduce a methane sample of a known concentration and adjust trimpot R-32 on the circuit board so that the meter reads equivalent to the known sample. This sets the instrument gain for methane with the panel mounted gain adjustment (gas select) set at a reference number of 300.

9. Place the calibrate switch on X10 position and use calibrate adjust (zero) knob to adjust meter reading to 4 ppm.

10. Move calibrate switch to X1 and, using the trimpot R-31 on circuit board adjust meter reading to 40 ppm.

11. Move calibrate switch to X10 position again. Use the calibrate adjust knob to adjust meter to 40 ppm.

12. Move calibrate switch to X100 position and use trimpot R-33 on circuit board to adjust meter reading to 40 ppm.

13. Move calibrate switch to X10 position and calibrate adjust knob to adjust meter to zero.

14. To shut down the meter, close the H_2 supply valve and the H_2 tank valve, turn the instrument switch to off, and when the H_2 supply pressure indicator is reading zero, move the pump switch to off.

15. Record calibration on field data sheet.

OVA Monitoring Protocols

The following procedure is used when field monitoring air and soil samples:

1. Place the meter in the survey mode. Hold the probe in close proximity to the area being monitored to provide an accurate reading. Initially use the 1X scale and then change to higher scales if necessary to obtain a reading.

2. Monitor soil samples immediately after exposure to the surface during test pit or drilling operations.

3. Do not allow the probe intake to make direct contact with the soil or liquid materials as this may clog or contaminate the probe.

4. To obtain a sample of the headspace above the soil refer to Section 3.15.6.

5. Record all readings on the field data sheet.

3.15.5.2 HNu Calibration

The following procedure is used to calibrate a HNu:

1. Assemble the probe by screwing the handle to the probe body and inserting the probe extension into the probe body.

2. Connect the probe to the meter by matching the alignment keys on the 12 pin connector lock until a distinct snap is felt.

3. Turn the function switch to the battery check position. The needle should swing into or above the green arc on the scaleplate.

4. Turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. At this setting, the probe fan should turn on and the UV light source should be on. A distinct hum in the probe tube indicates the UV light source is operational.

5. Turn the function switch to the 0-20 ppm scale setting: The meter needle should read between 0.5-0.7 ppm.

6. Calibrate the instrument from a pressurized container of calibration gas (benzene, isobutylene).

7. Connect one side of the "T" to the calibration gas, another side of the "T" to a rotameter and the third side of the "T" directly to the 8" section of the photoionization probe.

8. Crack the valve of the calibration gas until a slight flow is indicated on the rotameter. The instrument draws in the volume of sample required for detection.

9. Adjust the pot span so that the instrument is reading the exact value of the calibration gas.

10. Instruments are laboratory calibrated on thirty day cycles. Calibration will be checked in the field daily using a factory supplied standard gas.

11. Record calibration on field data sheet.

HNu Field Monitoring

The following procedure is used when field monitoring air and soil samples:

1. Hold the probe in close proximity to the area being monitored to provide a accurate reading. Initially use the lowest possible scale range and then change to higher scales if necessary to obtain a reading. In environments where levels of organics are unknown, initially use the 0-2000 ppm scale and then change to lower scales, if appropriate.

2. Monitor soil samples immediately after exposure to the surface during test pit or drilling operations.

3. Do not allow the probe intake to make direct contact with the soil or liquid materials as this will disrupt the air flow to the UV light source and may contaminate the probe.

4. To obtain a sample of the headspace above the soil refer to Section 3.15.4.

5. Record all readings on the field data sheet.

3.15.6 HEAD SPACE VOLATILE ORGANIC MEASUREMENT

Discussion

The determination of volatile organics in the head space of the screening samples is a qualitative indication of the total volatile organics in the sample. This method is not precise and is included mainly for use in Health and Safety monitoring. The results that are obtained will assist the site safety coordinator in determining the proper level of safety protection that will be required.

Protocol

(1) Calibrate the OVA and HNU as per procedures in Section 3.15.5.1.

(2) Agitate the samples to volatilize organics into the head space by shaking the samples for about one minute.

(3) Carefully lift the lid of the screening jar and insert the instrument probe inside. Be careful not to allow any liquid to enter the sample probe.

(4) Observe and record the reading on the field data sheet. If the reading is above scale, switch to a higher scale and start over at step 1.

EQUIPMENT MAINTENANCE SCHEDULE

Equipment	Maintenance
HNu PI 101	Charge battery (14 hours) and calibrate daily
Specific Conductance	Calibrate and check battery daily
pH	Calibrate and check battery daily
Dissolved Oxygen	Calibrate and check battery daily
OVA	Charge battery, calibrate and check hydrogen gas cylinder daily

Section 4

Post Closure Site Maintenance and Inspection

Section 4
Post Closure Maintenance and Inspection Program

4.1 Introduction

Maintenance consists of taking care of equipment, structures, and grounds so that the post-closure system and all of its equipment function as intended. The ultimate purpose of a maintenance program is to ensure that systems and equipment installed to safeguard public health and safety and the environment continue to function in that capacity.

There are two broad categories of maintenance, (1) preventive maintenance, the objective of which is to ensure facilities continually perform as intended; and (2) corrective maintenance the purpose of which is to return facilities to service after a failure has occurred or after a possible failure has been prevented.

4.2 Maintenance and Inspection Program

Implementation of a complete maintenance and inspection program will ensure that the post-closure system continue to function as intended.

A complete maintenance and inspection program consists of the following:

- Assignment of responsibilities.
- Preventive maintenance and inspection to identify problems before they actually develop.
- Corrective Maintenance.

- A stock of tools and spare parts.
- A record keeping system to record when maintenance is performed, keep track of spare parts and tools, and perform other functions.

Inspection and Maintenance logs are provided in Appendix A.

4.3 Maintenance and Inspection Requirements

Maintenance and inspection of the elements of the post-closure system should be performed in accordance with guidelines and warranties provided by the manufacturers of the various components of these elements. To help facilitate the inspection and maintenance of the entire post-closure system, a brief description of the various components has been provided in the following sections. This discussion is intended to provide the user with an overview of the various components of the system, the maintenance and inspection responsibilities of those components, and the frequency required. Table 4-1 provides an outline of the post closure system components. For a more comprehensive description of the maintenance and inspection requirements of these components, consult the Manufactures Operation and Maintenance Manuals provided in Appendix E.

4.4 Landfill Cover System

The Landfill Cover System is designed to minimize the potential for adverse impact on the public health and safety and the environment by isolating the waste material from the environment. In addition, the landfill cap on the Croton Landfill is designed to enhance the aesthetic value of the site for public utilization and provide habitat for wildlife. The landfill cover is designed to:

Table 4-1
List of Major Closure Component Elements

Closure Component	Element	Manufacturer	Model Number	Service Representative
Ballfield Pumping Station	Submersible Pump	Flygt Corporation 129 Glover Ave Norwalk, CT 06856 203-846-2051	BS2084	G.A. Fleet 55 Calvert St. Harrison,NY 10528 914-835-4000
	Electrical Control Panel	Flygt Corporation	N/A	G.A. Fleet
Pumping Station No. 1 and No. 2	Submersible Pump	Flygt Corporation	CP-3102.090 (Station No.1) CP-3152.181 (Station No.2)	G.A. Fleet
	Electrical Control Panel	Flygt Corporation	N/A	G.A. Fleet
	Electrical Transformers and Meters	Consolidated Edison 511 Theodore Fremd Ave. Rye, NY 10580	N/A	Con Edison
Pumping Station No. 1 and No. 2 (cont'd)	15Kv Switch	RTE Corporation	Most Model No.5	
	6" dia. Gate and Check Valves	Mueller	A-2483-6 (Gate Valve) A-2600-6-01 (Check Valve)	N/A
	Pressure Gauges	Ashcroft Manufacturing		

Table 4-1 (Cont'd)
List of Major Closure Component Elements

Closure Component	Element	Manufacturer	Model Number	Service Representative
Seeps/Condensate Pumping Station	Submersible Pumps	Davis EMU P.O. Box 1419 Thomasville, GA 31799 (800) 841-1550	FA 104-223	Salleson Associates 3128 Fiddlehead Glen Syracuse, NY 13027 (315) 638-4734
	Electric Control Panel	Davis EMU P.O. Box 1419 Thomasville, GA 31799 (800) 841-1550	N/A	Salleson Associates 3128 Fiddlehead Glen Syracuse, NY 13027 (315) 638-4734
Force Main Bridge Crossing	Air/Vacuum Release Valve	Multiplex Manuf. Co. 600 Fowler Avenue Berwick, PA 18603 800-247-8258	Crispin-S20ASB	N/A
Landfill Gas Combustion System	Flare Stack	LFG Specialties, Inc. 7550 Lucerine Drive Suite 110 Cleveland, OH 44130 (219) 891-0305	EF1140I12	LFG Specialties, Inc. 7550 Lucerine Drive Suite 110 Cleveland, OH 44130 (219) 891-0305
	Control Panel	LFG Specialties, Inc.	N/A	LFG Specialties, Inc.
	Knockout Pot	LFG Specialties, Inc.	N/A	LFG Specialties, Inc.
	Blowers	Lamson Corporation P.O. Box 4857 Syracuse, NY 13221 (315) 433-5500	602-GB	Lamson Corporation P.O. Box 4857 Syracuse, NY 13221 (315) 433-5500

Table 4-1 (Cont'd)
List of Major Closure Component Elements

Closure Component	Element	Manufacturer	Model Number	Service Representative
Landfill Gas Combustion System (Cont'd)	Flame Arrestor	Rosemont Inc. Varec Div. 10800 Valley View Street Cypress, CA 90630 (714) 761-1300	Varec 5000	LFG Specialties

- Minimizing infiltration of surface water.
- Minimizing contamination of groundwater by leachate migration.
- Control the off-site migration and release of landfill gas generated as a product of the bio-degradation of waste material.
- Provide for runoff and storm water control.
- Prepare the site for post closure use.
- Support wildlife and improve site aesthetics.

This section does not cover the stormwater control system which is an integral part of the cover system. The procedures for maintenance and inspection of the stormwater control system are covered in Section 4.6.

4.4.1 Landfill Cap Components

To accomplish the above stated objectives the Croton Main and Ballfield Landfill final cover utilizes 4 distinct layers. See Figure 4. In order of top to bottom they are; a topsoil cover and vegetative support layer, a cushion and drainage layer, a low permeability water/gas barrier layer and a landfill gas venting layer. The general limits of the cover system are shown in Figure 3.

4.4.1.1 Vegetative Support and Topsoil Cover Layer

The vegetative support layer supports a final vegetative cover which stabilizes the cover soils against erosion and accelerates evapo-transpiration while improving the aesthetic quality of the closed

landfill. Accelerated evapo-transpiration reduces the volume of water impinging on the low permeability layer, thereby, reducing the potential for infiltration.

The vegetative support layer consists of a six inch topsoil layer seeded with a mixture of grass, wildflower and plants which provide food and cover for wildlife. Besides protecting against damage to the landfill cap by erosion and groundwater infiltration, the vegetative cover on the Croton Landfill is designed to support migratory birds and other wildlife and to provide site beautification.

The lower areas of the landfill, adjacent to the existing park road were planted with Iwon grass and clover. It is intended that only this area of the landfill will receive regular mowing.

The mid level of the landfill, consisting mostly of steep slopes was planted with Upland Game Bird Mix. It includes, among other things, peas, sunflowers, soy beans, wheat, millet, buckwheat, dwarf corn, beans, and rye.

The top of the landfill, about 15 acres of shallow sloped area, was planted with a Wildflower Butterfly Meadow Seed Mix, including some 15 varieties of wildflowers.

The upper most natural soil layer covering the landfill consists of six inches of topsoil. The topsoil layer provides the nutrient rich and moisture holding matrix necessary to support the vegetative layer.

4.4.1.2 Cushion and Drainage Layer

The cushion and drainage layer protects the low permeability layer against physical damage and insulates against freeze thaw cycling. The drainage layer provides a high permeability medium above the low permeability layer to facilitate horizontal migration and drainage of water downslope. The ease of drainage facilitates ultimate discharge rather than infiltration through the low permeability layer.

In addition, the cushion and drainage layer provides cover and protection for the piping of the landfill gas collection system. The gas collection headers are buried in the cushion and drainage layer above the low permeability layer.

The 24-inch cushion and drainage layer consists of the following: one foot of one inch crushed stone placed on geofabric directly over the Very Low Density Polyethylene (VLDPE) Liner; and one foot of select granular fill placed on top of the crushed stone.

4.4.1.3 Low Permeability Barrier Layer

The low permeability barrier layer effectively seals the landfill against the infiltration of surface and rainwater and prevents the uncontrolled release of landfill gas. Sealing the waste material from the infiltration of rainwater eliminates recharge and the production of leachate. Since leachate is one of the primary routes of contamination transport, reduction in leachate production is one of the main objectives of landfill capping.

In addition, the low permeability layer stops the uncontrolled release of landfill gas. Landfill gas can pose a threat to public health safety due to its flammable nature and toxic components. The impermeable cap forces the gas to be released into the landfill gas collection system for proper handling.

The low permeability barrier layer selected for the Croton Landfill is a 60 mil Very Low Density Polyethylene (VLDPE) liner. Textured VLDPE is used on landfill slope to increase stability of cover soils. Untextured VLDPE is used on low slope areas.

4.4.1.4 Landfill Gas Venting and Condensate Drainage Layer

The landfill gas venting and condensate drainage layer provides a high permeability medium below the low permeability layer which facilitates horizontal migration of landfill gas to designed collection points for controlled release, treatment or energy recovery. In addition, the venting layer provides a medium for the horizontal down slope drainage of condensate and moisture which forms on the bottom of the low permeability layer. Condensate is collected in the condensate and seeps drainage collection system around the toe of the landfill.

The gas venting and condensate drainage layer selected for the Croton Landfill is a geocomposite consisting of a High Density Polyethylene Geogrid bonded to and sandwiched between two layers of geotextile fabric.

4.4.2 Safety Practices and Emergency Procedures

Safety practices and emergency procedures are addressed in more detail in Section 6 of this manual. The Croton Landfill Cover System is designed to isolate the contaminated waste materials from the environment. The objective of the Cover maintenance program is to maintain the integrity of the Cover. Provided that the Cover integrity is maintained the personnel performing services outlined in this section are not subject to exposure to the waste materials or other contaminants. In general, routine safety practices and procedures as outlined in Section 6 should be followed for the completion of the tasks required under this section.

The following should be considered when performing operations on the landfill:

- The integrity of the Landfill Cap should be protected at all times.
- Promptly report and repair minor erosion, storm damage, settlement and ponding conditions on the cap.
- No invasive activities should be conducted on the landfill cover.
- All vehicular traffic should remain on access roads.
- Report the smell of landfill gas.
- Any task which can or has a significant likelihood of exposing workers to contaminated liquids, landfill gas, or contaminated soils or solid waste should only be conducted by OSHA Health and Safety Trained and Medically monitored personnel.

4.4.3 Personnel

Site activities related to maintenance of the vegetative cover will consist primarily of site inspection, maintenance of the vegetative cover, maintenance of access roads and pathways. These activities will be conducted by County Parks Department personnel and do not require participation in the hazardous waste training and medical monitoring programs.

Any activities which require or have the strong possibility of exposing workers to landfill gas, contaminated liquids, solid waste or contaminated soils on the closed landfill, should only be conducted by personnel who have completed hazardous waste training and are current in participation in the medical monitoring program.

4.4.4 Maintenance Responsibilities

O&M activities will be generally constrained to maintaining the integrity and aesthetic quality of the landfill cap, access roadways and paths. Cap integrity must be maintained to ensure that contact with the waste mass below is prevented. The cap's aesthetic quality must be maintained to ensure that the public may utilize and enjoy the park land to its fullest.

4.4.4.1 Planting and Seeding

Landscaping plantings around the landfill perimeter should be maintained according to the County Parks Department Planting Plan. Under no circumstances should any woody vegetation, shrubs or trees be planted or allowed to establish themselves anywhere on the landfill cover. Impingement of the roots of such vegetation can damage the cover.

The landfill cover has been seeded according to the seeding plan. Reseeding should only be required on areas damaged by erosion, foot traffic or other conditions which kills or destroys the normal vegetative cover. If reseeding is required, it should be conducted according to the seeding plan utilizing the specified seed mixes. A copy of the landfill cap planting and seeding plan is included in Appendix G.

Maintenance of the vegetative cover system may include the application of fertilizers. However, the application of herbicides and pesticides is specifically prohibited by the New York State Department of Environmental Conservation.

4.4.4.2 Mowing

Only the lower portion of the landfill cover along the park access road is expected to require mowing. Mowing shall be conducted as required to maintain public access and to retard the growth of unwanted woody vegetation on the landfill cover.

4.4.4.3 Pruning

Woody plantings around the landfill perimeter should be pruned to remove dead and diseased limbs and to maintain the aesthetic quality of the plantings and the park's appearance. Pruning should be conducted once a year. Limb and dead planting removal should be conducted as required.

4.4.4.4 Removal of Woody Vegetation

The landfill cover should be inspected at least once a year for the occurrence of woody vegetation, shrubs and trees. Any such vegetation should be removed to prevent root penetration from damaging the cover.

4.4.4.5 Snow Removal

Landfill access roads should be cleared of snow as needed to provide access to gas well heads, groundwater monitoring wells, pumping stations and other closure components for routine O&M during the winter months.

4.4.4.6 Litter, Waste and Rubbish Removal

Litter, waste and rubbish will be removed as required. Litter and garbage should be removed from the site weekly. Rubbish such as grass clippings and yard waste should be removed as required.

4.4.4.7 Access Roads and Pathways

Erosion and damage to access roads and pedestrian pathways should be repaired on identification. Damage may occur due to erosion, differential settlement of the waste mass, formation of ruts and washboard. Roads should be graded and rolled every 6 months or as needed. The addition or replacement of materials must be consistent with original materials of construction as specified in the design documents. See Appendix B.

4.4.4.8 Damage from Burrowing Animals

Holes in the landfill cover from burrowing animals pose a threat both to the integrity of the cover system and to the safety of park users. Holes and burrows should be backfilled immediately on identifications. Burrowing pests should be controlled as outlined below.

4.4.4.9 Vector and Wildlife Control

Vector and wildlife control problems outside the normal scope of site operations should be remanded to the services of a licensed professional. Such a professional shall be hired to initiate control programs as provided for in Section 7.5. Minor infestations, such as poisonous insects around pumping stations and manholes, can be taken care of with commonly available household products as required.

4.4.5 Inspection Responsibilities

County Parks personnel will be responsible for conducting routine inspection of the Landfill Cap condition and integrity and the condition of access roads and pedestrian pathways.

Inspection elements include:

- Vegetative cover
- Perimeter vegetation
- Grade condition
- Toe of slope details
- Access roads

- Pedestrian pathways

4.4.5.1 Vegetative Cover

The condition of the vegetative cover impacts the performance of the landfill closure system and the aesthetic quality of the parkland. The vegetative cover should be inspected every six months and after every one year return period storm (2.6 inches of rainfall in 24 hours). Evidence of erosion, bare spots, woody vegetation, stressed vegetation (an indication of leaking landfill gas) and damage from burrowing animals should be reported and scheduled for repair during routine maintenance tasks or in depth investigation.

4.4.5.2 Perimeter Vegetation

Abnormality in perimeter vegetation around the landfill cap may indicate problems in the performance of the landfill cover system. Dead, dying or stunted vegetation may be indicative of off-site migration of landfill gas. Unusual growth and greenery may suggest leachate seeps. Once every six months the perimeter of the landfill should be inspected and any abnormalities in the condition of the vegetation should be reported for further investigation.

4.4.5.3 Grade and Slope Condition

Maintenance of specified grades and slopes on the landfill cover and drainage system is essential to protect the integrity of the cap. Design slopes and grades were selected to ensure adequate drainage to prevent water from saturating the cover soils and impinging on the low permeability barrier. Comprehensive inspections should be conducted every six months and after every one year return

period storm to ensure that settlement or damage has not impacted the grades and slopes. Note and report evidence of erosion, ponding on the landfill surface or in drainage structures, cracks or apparent slippage in the cover soils.

4.4.5.4 Toe of Slope Details

While not visible from the surface, the design structures around the toe of slope or landfill perimeter include the condensate and seep collection system, anchor system for the various geosynthetic cover components and the off-site gas migration prevention skirt. The general area of the toe of slope anchor trench should be inspected once every six months and after every one year return period storm.

Note and report evidence of soil slippage and settlement, unusual conditions in vegetation (dead and dying may mean a landfill gas leak, unusual lush growth may indicate a leachate seep), seeps or the smell of landfill gas.

4.4.5.5 Access Roads

Access roads must remain open at all times for routine operation and maintenance activities as well as for emergency contingency. Besides keeping access roads clear of snow, roads should be inspected quarterly to identify erosion, or the formation of ruts and washboards. Any condition which would hinder normal use should be noted and reported.

4.4.5.6 Pedestrian Pathways

Pedestrian pathways should be inspected quarterly to ensure that pedestrians have safe and immediate access to the park. Paths should be inspected for erosion, obstructions and unwanted vegetation. Note and report any condition which hinders the normal use of pathways.

4.5 Landfill Gas System

The gas control system is based on using blowers to maintain a slight vacuum (3 to 6 inch water column below atmospheric pressure) at gas extraction wells installed in the landfill. Gas withdrawn through the extraction wells is collected in laterals and header piping and is directed to the blowers located north of the original landfill area. The gas is then burned in an enclosed flare for destruction of the methane and non-methane organic components of the gas.

The key elements of the basic gas control system include the geomembrane, geonet gas vent layer, gas extraction wells, gas lateral and header piping, gas blowers, and the gas flare.

4.5.1 Landfill Gas Collection System

The landfill gas collection system is comprised of the landfill gas venting and condensate drainage layer, venting layer relief wells, landfill gas extraction wells, valves and piping. The system is described in greater detail in Section 2.3. Also, Section 2.3 outlines the requirements for operating the gas collection system which includes monthly balancing of the gas wells and header system to maximize gas quality and quantity. In the event that the County chooses to incorporate landfill gas utilization into the O&M program, this section will be revised, expanded and updated accordingly.

4.5.1.1 Landfill Gas Venting and Condensate Drainage Layer

The venting and condensate drainage layer is installed beneath the VLDPE barrier layer. It cannot be inspected and has no requirements for routine maintenance.

4.5.1.2 Venting Layer Relief and Gas Extraction Wells

The venting layer relief wells are tied directly into the gas collection piping without valves. The gas extraction wells are tied into the gas collection piping through throttling valves. Inspection and maintenance tasks should be conducted concurrently with Gas Collection System Tuning and Balancing Procedures.

Maintenance and Inspection includes:

- Inspect the flexible connections and boot seals at the well head to ensure that there are no cuts or gas leaks. Note any unusual smells. If landfill gas smell is detected, see Section 6 for proper procedures for working in the presence of landfill gas.
- Inspect for settlement and displacement of wells, valves, piping, valve boxes.
- Inspect for damage and leaks caused by animals.
- Inspections should be conducted concurrently with well field tuning as described in Section 2.
- Minor leaks due to faulty mechanical connections may be repaired by tightening clamps as required. Damaged boot seals or failed welds require special expertise and equipment and are beyond the scope of this manual.

- Note settlement and report any resulting damage or constriction of appurtenances. Repair of settlement is beyond the scope of this manual.

4.5.1.3 Landfill Gas Collection Piping and Header System

The collection piping and header system is buried in the cushion and barrier protection layer of the cover system.

Maintenance and Inspection includes:

- Inspect the proper operation of the header pipe condensate drainage system.
- Note blockage of pipe indicated by loss of gas flow. Loss of flow from a single header may indicate damage or blockage of that circuit.
- Make sure that condensate pumping station is operating properly. High condensate levels will block gas flow in header pipes.
- Pipe repair requires expertise and equipment beyond the scope of this manual.

4.5.2 Landfill Gas Handling System

The following is a summary of the manufacturer's O&M Manual (Appendix E) inserted for convenience. Actual maintenance and inspection should be as directed in the manufacturer's manual. The landfill gas handling system is comprised of piping valves, knockout pots, blowers condensate pumping station and blowers and vacuum control systems. Maintenance of the condensate pumping station is described in Section 4.7.1.

The manufacturer's operation and maintenance manual does not identify any routine O&M tasks associated with the control system for the Landfill Gas Handling System.

4.5.2.1 Valves

Manual valves do not require any maintenance. However, minimum maintenance is required for electric valves and solenoid valves, as follows:

- Electric valve actuators oil level should be checked monthly.
- Solenoid valves should be cleaned periodically. The time between cleanings will vary depending on service conditions. In general, if the voltage to the coil is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. In the extreme case, faulty valve operation will occur and the valve may fail to open or close. Clean valve strainer or filter when cleaning the valves.

4.5.2.2 Knockout Pots

Knockout pots protect the blowers from particulates and reduce the moisture contained in the influent gas. Moisture removed in the knockout pots drains to the condensate pumping station and is pumped into the leachate sewer system. Minimum maintenance required for knockout pots include:

- Drain valves on the knockout pots should not be fully opened due to the possibility of air being sucked into the knockout pots through the piping to the condensate pumping station.
- Demister pads should be checked and cleaned semi-annually.

4.5.2.3 Blowers

Minimum maintenance of blowers include:

- Periodically inspect blower monitoring and concrete slab foundation and correct if deficiencies are found. Check for level condition and correct as necessary.
- Check condition of isolation pads and replace as necessary.
- Lubricate as specified by the manufacturer.
- Check monthly all valves in system.
- Belt drive alignment should be checked and corrected twice yearly.
- Monthly check pipe supports and adjust if necessary.
- Vibration readings and bearing temperature readings should be taken monthly to monitor the condition of the blower machine bearings.

Minimum maintenance of blower motors include:

- Monthly inspect motor for dirt or obstructions. Keep motor clean and vent openings clear.
- Lubricate motor as specified by manufacturers.

4.5.3 Landfill Flare System

For convenience, the following is a brief summary of the manufacturer's O&M Manual (Appendix E). Maintenance and inspection tasks should be as directed in the manufacturer's O&M Manual. Landfill flare system includes the enclosed flare, controller system and the flame arrestor.

The enclosed flare and controller system maintenance requirements includes:

- Maintain the finish on the flare stack by cleaning any scratches or chipping with a wire brush and repainting with touch-up paint.
- Inspect semi-annually all wiring and connections for any wear and replace as necessary.
- Inspect quarterly spark plug igniter for electrode wear and replace as necessary.
- Monthly check pilot nozzle for obstructions and clean as necessary.
- Check all piping connections for tightness and leaks, replace gaskets as necessary and retorque bolts.
- Check propane pilot fuel tanks, refill as required.

Maintenance requirements for the flame arrestor includes:

- Check and clean bank sheets. Clean bank sheets prevent a decrease in gas flow and loss of heat absorbing efficiency. Inspection should be done on a monthly basis unless excessive deposits or accumulation of foreign matter are found. If so, the frequency of inspection should be increased.

4.6 Stormwater Control System

The various components of the stormwater control system require routine inspection and maintenance for trouble free operation. The components include:

- Berms and channels
- Culverts, pipes and storm sewers

- Sedimentation basins
- Outfalls

The general configuration of the Stormwater Control System is shown on Figure 9.

4.6.1 Berms and Channels

Maintenance task include:

- Monthly inspect berms and channels for obstruction or damage.
- Channels must be kept free of excessive sediment buildup and woody plant growth.
- Remove excessive sedimentation with backhoe, if required. Do not disturb the as constructed channel bottom or riprap.
- Remove minor sedimentation as required with hand tools.
- Inspect upstream section of affected channel for source of sediment, repair as required.

4.6.2 Culverts, Pipes and Storm Sewers

Maintenance tasks include:

- Inspect storm sewers for obstructions or damage every six months, and after every one year storm. Clean or repair as required.
- Inspect culverts for obstructions or damage every six months, and after every one year storm. Clean or repair as required.
- Clean stormwater sewer catch basins once a year.

4.6.3 Sedimentation Basins

Maintenance tasks include:

- Inspect sedimentation basins for obstruction or damage every six months, and after every one year storm. Clean or repair as required.

4.6.4 Outfalls

Maintenance tasks include:

- Inspect outfalls for obstructions every six months. Clean as required.
- Periodic inspection of operation and greasing of flap gates on Hudson River Outfall. (see manufacturer's O&M manual in Appendix E)
- Inspect outfall area for excessive erosion.

4.7 Leachate Collection System

The purpose of the leachate collection system is to transport leachate and gas condensate from the Ballfield and Railroad I landfills, as well as domestic sewage generated within the park, to the Westchester County Interceptor Sewer System, and thence to the Ossining Wastewater Treatment Facility for treatment.

The Croton Point Leachate Collection System utilizes five pumping stations and approximately 11,000 linear feet of Polyethylene (PE) Pipe to convey leachate to the County sewer system.

Maintenance of the leachate collection system is broadly divided into two categories:

- Pumping stations which includes Ballfield Pumping Station, Pumping Station No. 1 Pumping Station No. 2, Seep/Condensate Pumping Station and Landfill Gas Condensate Pumping Station.
- Leachate sewer systems and forcemains.

4.7.1 Leachate Pumping Stations

Maintenance requirements for the Ballfield, No. 1 and No. 2 Pumping Stations include:

- Daily visual inspection of wet wells to check for debris and that the discharge piping is intact and free from leaks.
- Submersible pumps should be overhauled annually by manufacturer's representative.
- Daily inspection of the electrical control system to ensure that the starting equipment is operating properly.
- Daily visual inspection to ensure that floats are properly attached and at the appropriate levels.
- Weekly observation of float function during pumping to ensure they are operating properly.
- Daily inspection of valve vaults to ensure that valves are in open position and that the discharge piping is free from leaks.
- Daily inspection of Railroad 1, Sump No. 1 and No. 2 influent butterfly valves to ensure that the valve stem operators are not opened greater than specified inches.

Maintenance requirements for the Seep/Condensate and Landfill Gas Condensate Pumping Stations include:

- Daily listen for any substantial change in operating sound.
- Daily check for any substantial vibration.
- Observe elapsed time meters and log the findings daily. After a history is developed, compare the daily run times to the past recordings. A substantial change in run times may be an indication of problems.
- Observe and log the amp drains daily. The benefit of this record is the same as above.
- Check the control panel daily for motor overtemp, and seal failure.
- Weekly using a megger check the insulation resistance of the motor winding. Record this information.
- Check monthly for loose hardware and correct as necessary.
- Check monthly for any leaks on pumps and piping. Correct as required.
- Once a month exercise and lubricate if necessary all valves.
- Semi-annually lower the level in the wet-well so that a visual inspection can be made. Note particularly any evidence of a buildup of foreign material on the motor housing. If such a buildup occurs, it will inhibit the cooling process of the motor, subsequently causing premature motor failure. If required, lift the pump out and remove buildup.
- Check oil level in the sealing chamber after the first 6 months and once a year thereafter. If required, replenish oil.

4.7.2 Leachate Sewer Systems and Forcemains

Maintenance requirements include:

- Weekly inspection of air/vacuum release valves on forcemain bridge crossing during pumping operation to ensure that they are operating properly and free from leaks.
- Weekly inspection of forcemain bridge crossing to ensure that the system is free from leaks.
- During winter months, when freezing temperatures are encountered, inspect air/vacuum valves to ensure that freezing has not occurred.
- Inspect sewer system once a year for obstructions or damage. (Appendix H).

4.8 Groundwater Monitoring System

The network of groundwater monitoring wells will be inspected quarterly as part of the quarterly sampling program. Depth of wells, condition of well casing and protective casing will be inspected. Any problems will be documented as part of the sampling logs. The duties will be provided by the individuals conducting the sampling program.

4.9 Post Closure Operation and Maintenance Check List and Schedule

Table 4-2 provides a short-form check list for the frequency of inspection or maintenance of the various post closure system components.

Table 4-2

Post-Closure Maintenance/Inspection Responsibilities

Maintenance/Inspection Task	Frequency of Tasks									
	Daily	3-Days	Weekly	2-Weeks	Monthly	Quarterly	6-Months	Yearly	As Reqd.	1-Yr. Storm
1. Landfill Cap										
a. Maintain landscape plantings, per County										
Parks Department Planting Plan.									O	
b. Mow landfill cover as required.									O	
c. Prune woody plantings around landfill										
perimeter.								O		
d. Remove woody vegetation.								O		
e. Remove litter, waste and rubbish.			O							
f. Inspect grade for settlement, subsidence,										
erosion and ponding.							O			0
g. Inspect toe of slope for stability, seeps and										
vegetation.							O			0
h. Inspect vegetative cover for erosion or										
woody spots.							O			0
i. Inspect perimeter vegetation for abnormality.							O			
2. Landfill Gas Handling System										
a. Valves										
- Check vacuum control valve actuator oil										
level.					E					
- Clean emergency shut off valve. Interval										
between cleaning will vary depending										
upon service conditions.									E	
- If worn or damaged parts are noticed										
during cleaning of emergency shut-off										
valve they should be replaced.									E	
- Emergency shut-off valve should be										
operated to insure proper opening and										
closing.					O					
b. Knockout Pots										
- Check demister pads and clean.							M			
c. Blowers										
- Inspect blower mounting and foundation.										
Correct as required.							M			

Table 4-2
Post-Closure Maintenance/Inspection Responsibilities

Maintenance/Inspection Task	Frequency of Tasks									
	Daily	3-Days	Weekly	2-Weeks	Monthly	Quarterly	6-Months	Yearly	As Reqd.	1-Yr. Storm
- Check condition of isolation pads. Replace										
as required.							M			
- Lubricate blowers as specified.									M	
- Check all valves in system.					O					
- Check belt alignment and correct as										
required.							M			
- Check pipe supports and adjust as required.					M					
- Inspect blower motor for dirt or obstructions.										
Clean as required.					O					
- Lubricate motor as specified.									M	
d. Landfill Flare System										
- Maintain finish on flare stack.									M	
- Inspect all wiring and connections for any										
wear and replace as required.							E			
- Check pilot nozzle for obstructions and										
clean as required.					M					
- Inspect spark plug igniter for electrode										
wear and replace as necessary.						E				
- Check all piping connections for tightness										
and leaks, replace gaskets as necessary										
and retorque bolts.					M					
- Check propane fuel tanks, refill as required.	O									
e. Flame Arrestor										
- Check and clean bank sheets.					M					
f. Chart Recorder										
- Clean pen tip, using alcohol soaked Q-tip.				O						
- Keep door closed to prevent dust entry.									O	
- Check chart recorder for sufficient paper.										
Replace if required.		O								
3. Landfill Gas Collection System										
a. Venting Layer Relief and Gas Extraction Well										
- Inspect the flexible connections and boot										

Table 4-2
Post-Closure Maintenance/Inspection Responsibilities

Maintenance/Inspection Task	Frequency of Tasks									
	Daily	3-Days	Weekly	2-Weeks	Monthly	Quarterly	6-Months	Yearly	As Reqd.	1-Yr. Storm
seals at the well head to ensure that there										
are no cuts or gas leaks.					M					
- Inspect for settlement and displacement of										
wells,valves, piping and valve boxes.					M					
- Inspect for damage and leaks caused by										
animals.					M					
- Note settlement and report and resulting										
damage or constriction of appurtenances.					M					
b. Landfill Gas Collection Piping & Header										
- Inspect the proper operation of the header										
pipe condensate drainage system.					M					
- Note blockage of pipe indicated by loss of										
gas flow.					M					
- Make sure that the condensate pumping										
station is operating properly.					M					
4. Ballfield, Pumping Station No.1 and										
Pumping Station No. 2 (Pumps)										
a. Inspect screws, bolts and nuts. Tighten if										
required.			O							
b. Inspect pump casing and impeller. Replace if										
required.					M					
c. Check oil quantity.			M							
d. Inspect visible parts of pump. Replace or fix										
worn and damaged parts.			M							
e. Check condition of oil. Replace if required.					M					
f. Check for increased leakage.					M					
g. Check for liquid in the stator casing if step f										
indicates leakage.									M	
h. Check cable and replace if outer jacket is										
damaged.					E					
i. Check cable clamps for tightness.			M							
j. Check level sensors. clean, adjust, replace or										
repair damaged level sensing equipment.					M					
k. Check starter equipment.					E					

Table 4-2
Post-Closure Maintenance/Inspection Responsibilities

Maintenance/Inspection Task	Frequency of Tasks									
	Daily	3-Days	Weekly	2-Weeks	Monthly	Quarterly	6-Months	Yearly	As Reqd.	1-Yr. Storm
l. Inspect pipes, valves and other peripheral										
equipment.					M					
m. Check insulation resistance in the stator.						E				
5. Seep/Condensate and Condensate Pumping										
Station (Pumps)										
a. Check for substantial change in operating										
sound.	O									
b. Check for substantial vibration.	O									
c. Observe elapsed time meters and log the										
findings daily. A substantial change in run										
times may be an indication of problems.	O									
d. Observe and log the amps drain daily.	O									
e. Check the control panel daily for motor										
overtemp and seal failure.	O									
f. Using a megger check the insulation										
resistance of the winding.			E							
g. Check for loose hardware and correct as										
required.					M					
h. Check for leaks on pumps and piping.										
Correct as required.					M					
i. Exercise and lubricate if necessary all valves.					M					
j. Inspect motor housing for buildup.							M			
k. Check oil level in sealing chamber.								M		
6. Leachate Sewer System and Forcemain										
a. Inspect air/vacuum release valves for proper										
operation.			O							
b. Inspect forcemain bridge crossing for leaks.			O							
c. During winter months, inspect air/vacuum										
valves for freezing.									O	
d. Inspect leachate sewer system, manholes										
and appurtences.								M		

Table 4-2

Post-Closure Maintenance/Inspection Responsibilities

Maintenance/Inspection Task	Frequency of Tasks									
	Daily	3-Days	Weekly	2-Weeks	Monthly	Quarterly	6-Months	Yearly	As Reqd.	1-Yr. Storm
7. Railroad 1 Sump No.1 & 2										
a. Inspect sumps to ensure that they are free										
from debris and that flow has not been										
restricted.			O							
b. Inspect influent Butterfly valves at each sump										
to ensure that the valve stem operators are										
opened at the specified opening.	O									
c. Open butterfly valves fully to allow for any										
sediment accumulated in the leachate										
collection line to be flushed clear.					O					
8. Stormwater Control System										
a. Berm and Channels										
- Inspect for obstruction or damage. Repair										
as required.					O					O
- Keep channels free of excessive sediment										
buildup and woody plant growth.							O			
- Check for grade and ponding. Correct as										
required.							O			O
b. Culverts, Pipes and Storm Sewers										
- Inspect storm sewers for obstructions or										
damage. Clean or repair as required.							O			O
- Inspect culverts for obstruction or damage.										
Clean or repair as required.							O			O
- Clean stormwater sewer catch basins.							O			
c. Sedimentation Basins										
- Inspect for damage or obstructions. Clean										
or repair as required.							O			O
- Inspect for sedimentation. Remove as										
required.							O			
d. Outfalls										
- Inspect for obstructions.							O			O
- Grease flap gates as specified.									M	

Table 4-2
Post-Closure Maintenance/Inspection Responsibilities

Maintenance/Inspection Task	Frequency of Tasks									
	Daily	3-Days	Weekly	2-Weeks	Monthly	Quarterly	6-Months	Yearly	As Reqd.	1-Yr. Storm
9. Public and Maintenance Access Ways										
a. Inspect for plant growth. Clear as required.							O			
b. Inspect for surface erosion, settlement or										
damage. Correct as required.							O			
c. Remove debris as required.									O	
d. Remove snow during winter as required.									O	
e. Check grading and correct if required.							O			
f. Inspect for obstructions, ruts and washboard.										
Clear or repair as required.							O			
g. Grade and roll public and maintenance										
access ways.							O			

Note:

E - Electrical Engineer/Technician
M - Mechanical Engineer/Technician
O - Operator

Section 5

Personnel

Section 5
Personnel

5.1 General

This section consists of a description of the personnel requirements for the operation and maintenance, environmental monitoring and sampling of the Croton Point Sanitary Landfill's Post-Closure System.

The recommendations made herein should be considered flexible with adjustments made for changes in conditions and in the capabilities of the personnel available. Recommendations are based on the anticipation that outside skilled tradesmen, such as motor mechanics, instrumentation servicemen, and laboratory services will be engaged to perform specialized maintenance, repairs, testing and analysis when facility personnel and equipment are not adequate.

The full capabilities of the facility cannot be realized without qualified personnel in adequate numbers to operate and maintain the system. Up-to-date training for operators and maintenance personnel is stressed as being of critical importance in the proper functioning of the facility to protect equipment from damage or deterioration and to safeguard the public health and safety and the environment.

Routine O&M activities have the potential of exposing personnel to health and safety hazards as defined in 29 CFR Part 1910.120. It is therefore recommended that all O&M personnel involved in activities that have the strong likelihood of exposing them to health and safety hazards as defined in 29 CFR Part 1910.120 complete a certified 40 hour Hazardous Material Health and Safety course

in accordance with 29 CFR Part 1910.120 and participate in an OSHA approved medical monitoring program.

5.2 Operation and Maintenance

The Westchester County Department of Environmental Facilities is responsible for the operation and maintenance of all post-closure components of the Croton Sanitary Landfill. These components include:

- Landfill Cover System
- Landfill Gas Control System
- Stormwater Control System
- Leachate and Landfill Gas Condensate Collection System

Maintenance of the vegetative cover, public and maintenance access ways is the responsibility of Westchester County Department of Parks, Recreation and Conservation.

The following sections outline the responsibilities and qualifications of personnel for each of the above post-closure components. Table 5-1 summarizes the personnel requirements.

5.2.1 Landfill Cover System

5.2.1.1 Responsibilities

Inspect landfill cover for erosion or settlement. Inspect cover system and toe of slope details for evidence of leachate seep and landfill gas leaks. Complete minor repairs. Keep records and make

Table 5-1

Personnel Training Requirements for Operation and Maintenance Of Various Closure Components

Closure Components	Duties	Performed By	Qualifications	Personnel
Landfill Cover System	Operation	WCDEF	Specialized training	As required
	Inspection		OSHA 40 hour training	All
	Maintenance		OSHA 8 hour supervisor's training	Supervisors
			OSHA 8 hour yearly refresher training	All
			Medical monitoring	All
Landfill Gas Control System	Operation	WCDEF	Specialized training	As required
	Inspection		OSHA 40 hour training	All
	Maintenance		OSHA 8 hour supervisor's training	Supervisors
			OSHA 8 hour yearly refresher training	All
			Medical monitoring	All
			OSHA confined space	All
Stormwater Control System	Operation	WCDEF	Specialized training	As required
	Inspection		OSHA confined space	All
	Maintenance			
Leachate and Landfill Gas Condensate Collection System	Operation	WCDEF	Specialized training	As required
	Inspection		OSHA 40 hour training	All
	Maintenance		OSHA 8 hour supervisor's training	Supervisor
			OSHA 8 hour yearly refresher training	All
			Medical monitoring	All
			OSHA confined space	All

Table 5-1 (Cont'd)

Personnel Training Requirements for Operation and Maintenance Of Various Closure Components

Closure Components	Duties	Performed By	Qualifications	Personnel
Vegetative Cover and Public and Maintenance Access Ways	Operation Inspection Maintenance	WCDPRC	Specialized training Landscaping training	As required As required
Environmental Sampling and Monitoring	Air Monitoring Sampling	WCDEF	Specialized training OSHA 40 hour training OSHA 8 hour supervisor's training OSHA 8 hour yearly refresher training Medical monitoring OSHA confined space	As required All Supervisors All All All

reports.

5.2.1.2 Qualifications

Landfill cap personnel qualifications shall include but not be limited to:

- Specialized training as required.
- Health and safety training as described in Section 5.4.
- Medical monitoring training as described in Section 5.5.

5.2.2 Landfill Gas Control System

5.2.2.1 Responsibilities

Operate and maintain the landfill gas system including gas wells and well heads, gas handling and combustion system, and gas collection piping and headers. Keep records and make reports.

5.2.2.2 Qualifications

Landfill gas system personnel qualifications shall include but not be limited to:

- Specialized training as required.
- Health and safety training as described in Section 5.4.
- Medical monitoring training as described in Section 5.5.
- Confined Space Entry training as described in Appendix H

5.2.3 Stormwater Control System

5.2.3.1 Responsibilities

Maintain berms and channels free of obstructions and repair damages if any. Keep channels free of excessive sediment buildup. Maintain storm sewers, culverts, sedimentation basins and outfalls free of obstruction. Maintain outfall flap gates. Keep records and make reports.

5.2.3.2 Qualifications

Stormwater control system personnel qualifications shall include but not be limited to:

- Specialized training as required.
- Confined space entry training as described in Appendix H.

5.2.4 Leachate and Landfill Gas Condensate Collection System

5.2.4.1 Responsibilities

Responsible for the proper operation and maintenance of the leachate collection system and related facilities. Maintaining pumps and similar equipment. Monitor meters, gauges and controls. Keep records and make reports of facility operations, observe variations in operating conditions and make appropriate equipment adjustments.

5.2.4.2 Qualifications

Leachate and seep collection personnel qualifications shall include but not be limited to:

- Specialized training as required.
- Health and safety training as described in Section 5.4.

- Medical monitoring as described in Section 5.5.
- Confined space entry training as described in Appendix H.

5.2.5 Vegetative Cover, Public and Maintenance Access Ways

5.2.5.1 Responsibilities

Mow lawn and maintain landscaping. Remove snow from vehicle access ways. Carry out seeding, planting and pruning. Maintain hiking and biking trails. Road maintenance. Perform earthwork to repair settlement and erosion. Remove garbage from trails and road. Keep records and make reports. (To be performed by Westchester County Department of Parks, Recreation and Conservation personnel).

5.2.5.2 Qualifications

Public and maintenance access way personnel qualifications shall include but not be limited to:

- Specialized training as required.
- Landscaping training.

5.3 Environmental Sampling and Monitoring

The Westchester County Department of Environmental Facilities is responsible for all environmental monitoring and sampling conducted at the Croton Sanitary Landfill.

The Department intends to maintain a sampling team, with each team member capable of performing all the necessary sampling at the landfill. Environmental media to be sampled includes:

- Surface water
- Stormwater
- Groundwater
- Leachate
- Landfill gas
- Marsh sediment
- Perimeter soil gas

Responsibilities and qualifications of personnel for sampling the above media is summarized below.

5.3.1 Responsibilities

Ability to understand and follow oral or written directions. Familiarity with and ability to operate and interpret results of standard real time air monitoring equipment such as OVA, HNU, CGI and Oxygen Meters. Collect samples according to protocol as outlined in Section 3. Observe variations in operating conditions and interpret meter and gauge readings to determine processing requirements. Calibrate and use different field measuring instruments. Purge and develop monitoring wells. Prepare duplicate samples, field blanks and trip blanks. Make simple chemical and other tests. Skill in operating and making minor repairs to mechanical equipment including generators and pumps. Keep records and make reports.

5.3.2 Qualifications

Sampling personnel qualifications shall include but not be limited to:

- Specialized training as required.
- Health and safety training as described in Section 5.4.
- Medical monitoring as described in Section 5.5.
- Confined space entry training as described in Appendix H.

5.4 Health and Safety Training

A Health and Safety Training Program for hazardous/chemical waste operations should be implemented for all O&M personnel who will be routinely conducting activities that have the potential of exposure to health and safety hazards on site. The purpose of this program is to train employees to work safely in hazardous or contaminated areas and with hazardous materials. The objectives of this program are:

- To make workers aware of the potential hazards they may encounter.
- To provide the knowledge and skills necessary to perform work with minimal risk to worker health and safety.
- To make workers aware of the purpose and limitations of safety equipment.
- To ensure that workers can safely avoid or escape from emergencies.

5.4.1 40-hour Training

OSHA requires that all general site workers engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of instruction off-site, and a minimum of three days actual field experience under the direct supervision of a trained, experienced supervisor.

The Health and Safety Training Program Curriculum consists of the following subject matter:

- Hazard Types
- Basic Industrial Hygiene
- Basic Toxicology
- Worker Rights and Responsibilities under OSHA 29 CFR
- Environmental Monitoring Equipment
- Hazard Evaluation
- Site Safety Plans
- Personal Protective Equipment
- Decontamination
- Emergency Response (injuries and contaminant releases)
- Contingency Plans

In addition to Health and Safety Training, the employee shall also be trained and certified in Multi-Media First Aid and Cardio Pulmonary Resuscitation (CPR).

5.4.2 Foreman and Supervisor Training

On-site foreman and supervisor who are directly responsible for, or who supervise employees engaged in hazardous waste operations shall receive 40 or 24 hours of training (as described above) and the applicable amount of on-site training. These employees shall also receive at least 8 additional hours of specialized training at the time of job assignment on such topics as, but not limited to, the employee's safety and health program and the associated employee training program,

personal protective equipment program, spill containment program, and health hazard monitoring procedures and techniques.

5.4.3 8-hour Annual Refresher Seminar

Annually, all employees shall participate in an 8-hour seminar which concentrates on field aspects of health and safety. The course will also concentrate on proper field techniques and a review of selection, care and use of personal protective and monitoring equipment.

5.4.4 Site Safety Issues Training Video

As part of facilities start-up, a video recording was made during a site safety issues training session. The video covers many of the site specific concerns encountered by O&M personnel. While the video is not a substitute for training as required in Section 5.4.3, it should be viewed by all O&M personnel who were not present during the session. A copy of the video is included in Appendix D.

5.4.5 Certification

Original copies of Health and Safety Training certificates of completion for health & safety training will be provided to the employee with copies maintained by the Health and Safety Officer.

5.5 Medical Monitoring Program

A medical surveillance program should be implemented for all O&M personnel who will be routinely conducting activities that have the potential of exposing them to on-site health and safety hazards. The purpose of the program is to identify in advance any medical or physical factors that may

preclude or otherwise restrict an individual's participation in routine O&M activities, to help evaluate the effectiveness of the health and safety procedures implemented and to provide high quality medical consultation in the event of an emergency.

Each employee is required to undergo a complete medical examination prior to beginning O&M activities. No employee should be permitted to work unless he or she has been medically cleared to do so. The program is coordinated by the Health and Safety Officer.

The program should be developed from governing agency recommendations and consists of three parts; a complete occupational exposure and medical history questionnaire and preplacement examination; annual physical examinations and clinical studies; and any additional testing that may be required for work at a specific site. The questionnaire is intended to help identify any previous exposures (including smoking, drinking, etc.) or medical conditions that may effect either the outcome of any clinical tests or the individual's ability to perform O&M activities. As part of the program, all employees are tested to ensure that the use of respirators will not jeopardize their health or safety while in the field.

The Health and Safety Officer will confer with a medical consultant prior to an employee beginning site work to review the possible exposures and to determine if additional medical testing of employees is needed. Post-exposure examinations may also be required to profile properly any clinical manifestations of exposure to specific chemicals.

5.5.1 Baseline Examinations

Newly hired and current employees who are just starting site activities shall receive a baseline examination. The baseline examination will consist of the following:

- Medical and Occupational History
- Physical Examination (including height, weight, pulse, blood pressure)
- Vision Test (refraction, depth perception and color vision)
- Audiometric Test (performed at 500, 1000, 2000, 3000, 4000 and 6000 Hz)
- Pulmonary Function Test
- Routine Metabolic Urinalysis
- Urine Screen for Heavy Metals (mercury, arsenic, cadmium, thallium, chromium)
- Complete Blood Count
- Blood Chemistries (Fasting SMA 12 - includes total cholesterol, glucose, bilirubin, SGOT, LDH, phosphorous, calcium, BUN total protein, albumen, alkaline phosphates, uric acid)
- Blood Lead Level
- RBC Protoporphyrin (lead exposure)
- Blood PCB Level

To be added if indicated:

- Chest X-Ray (PA/Lateral)
- Electrocardiogram (EKG)
- RBC Cholinesterase (Pesticide Exposure)

Copies of Baseline Medical Examination forms are provided in Appendix I.

5.5.2 Annual Examination

A yearly follow up examination will be performed on each employee participating in the medical surveillance program. The purpose of this examination is to compare follow up results with the baseline results to determine potential chemical exposures and adequacy of personal protective equipment. The follow up examination will consist of the following unless more limited testing is approved by the physician:

- Interval medical and occupational history
- Physical Examination (including height, weight, pulse, blood pressure)
- Vision Test (refraction, depth perception and color vision)
- Audiometric Test (performed at 500, 1000, 2000, 3000, 4000 and 6000 Hz)
- Pulmonary Function Test
- Routine Metabolic Urinalysis
- Urine Screen for Heavy Metals (mercury, arsenic, cadmium, thallium, chromium)
- Complete Blood Count
- Blood Chemistries (Fasting SMA 12 - includes total cholesterol, glucose, bilirubin, SGOT, LDH, phosphorous, calcium, BUN total protein, albumen, alkaline phosphates, uric acid)
- Blood Lead Level
- RBC Protoporphyrin (lead exposure)
- Blood PCB Level

To be added if indicated:

- Chest X-Ray (PA/Lateral)
- Electrocardiogram (EKG)
- RBC Cholinesterase (Pesticide Exposure)
- Specific exposure testing

5.5.3 Post Exposure Examinations

Post exposure examinations will be performed if an exposure has or is suspected of having occurred. The nature of the exposure will determine which tests are to be ordered. Test results will serve to monitor for potential chemical exposures and to determine the effectiveness of personal hygiene and protective equipment.

5.5.4 Exit Examinations

Prior to termination of employment, the employee shall receive an exit examination. The exit examination will be identical to the baseline examination. Exit examination results will be maintained and used to help determine the adequacy of the Health and Safety Program as well as to determine the employees health prior to termination of employment.

5.5.5 Medical Records

All test results including any abnormalities are followed up unless the individual worker particularly requests follow-up with his/her private physician. The individual worker is notified of the test results and can receive copies of medical records upon request. For the preplacement an annual

examination the County receives a "Fitness-for-Work" form that indicates the person is or is not "fit for the job"; if "more testing is necessary"' or if "accommodations or job restrictions" are needed. Further medical information that is relevant to employees medical fitness for work is released to the County only with written authorization of the employee. Results of specific biological (exposure) monitoring are sent to the County to become part of the industrial hygiene surveillance records for specific job sites. A summary report describing results of all employees tested will be sent to the County following completion of all examinations. These records will also include a history of real or potential exposures.

Section 6

Site Health and Safety Considerations

Section 6
Site Health and Safety Considerations

6.1 Introduction

The Croton Point Landfill Post Closure Project includes Operation and Maintenance of the landfill cap, leachate and seep collection system, landfill gas control system, environmental monitoring and sampling. Once classified by the State of New York as a Class II, inactive hazardous waste site the site has been reclaimed as parkland for passive recreation. The landfill closure process effectively isolates the waste mass and sources of contaminants of concern from the public and the environment. These sources of contamination include the waste mass, landfill gas, leachate and contaminated groundwater. However, during routine O&M operations, workers will come into contact with contaminated medium and therefore must be prepared to institute appropriate safeguards and hazard minimization procedures.

This section addresses site and activity specific concerns and operating procedures which personnel will be required to be aware of and conform to while conducting operations which have the potential of exposing them to contamination or safety concerns. In general, activities of specific concern encompass environmental monitoring and sampling and activities which have the potential of exposing workers to leachate, gas condensate, and landfill gas.

Items addressed in this section include:

- Health risk/hazard analysis
- Training requirements
- Personal protective equipment

- Medical surveillance requirements
- Air and environmental monitoring
- Site control measures
- Decontamination and personal hygiene
- Emergency response
- Confined space entry

6.2 Objective

The overall approach of the Health and Safety Plan is one of hazard avoidance through education, planning and project understanding. Alternative means for ensuring worker safety will only be implemented when hazard avoidance is not an option and specific tasks must be conducted in a hazardous or potentially hazardous environment. In such instances, task specific measures will be implemented to ensure worker safety. In order of preference, the following outlines the strategies site personnel should follow to ensure site and personnel safety.

1. **Hazard recognition and avoidance**: Personnel should be trained in and instructed to implement hazard recognition and avoidance strategies as the first and best alternative for ensuring worker health and safety. Examples: maintain heightened awareness of heavy equipment operation and potentially dangerous working conditions; avoid obvious contamination made manifest by waste, stained earth, liquids, odors; seek training and instruction where needed.

2. **Follow standard safe work practices:** Personnel should be instructed to follow safe accepted standard work practices for all site activities. Examples: wear all components of the specified work uniform for a specific activity, follow all standing orders, use common sense and do not use unfamiliar equipment.

3. **Plan and implement operational protocols for hazard avoidance:** Certain site activities will be planned and/or conducted according to specific procedures developed to avoid or minimize potential anticipated hazards. Site personnel will follow all such protocols where implemented. However, site personnel will not undertake the specified procedures without understanding their rational and the potential hazard. Examples: implementing the "buddy" system; procedures for confined space entry; remote observation of exclusion zone activities.

4. **Implement engineering controls for hazard avoidance:** Specific engineering controls have been developed for certain activities which must be conducted in the face of a hazard or potential hazard. Site personnel should be trained in these procedures and instructed to implement them where specified. However, personnel should not implement a specific engineering control without experience, familiarity and an understanding of the potential hazard. Examples: use of blowers to ventilate confined space; work zone access and logistics control; remote TV inspection as in sewer inspection.

5. **Implement environmental monitoring for hazard identification and avoidance:** Environmental monitoring must be implemented when work is conducted in the face of

known or potentially contaminated materials to provide real time assessment of work zone environmental quality. Monitoring shall be used to implement action levels controlling the selection of work practices, engineering controls and personal protective equipment. Site personnel should be trained in the applicability and limitations of environmental monitoring and use and limitations of monitoring equipment. Environmental monitoring shall be used to identify hazardous conditions such as the presence of air born contaminants, radiation, explosive or oxygen depleted atmosphere and dust.

6. **Use of respirators in conjunction with personal protective equipment (PPE) and environmental monitoring for hazard minimization in known or suspected hazardous environments which cannot be avoided by any other means:** Respirators in conjunction with other personal protective equipment (PPE) and environmental monitoring must be implemented when work must be conducted in known or suspected hazardous environments which cannot be avoided by any other means. The selection of levels of protection should be based on site familiarity, professional judgement and the results of ongoing real time environmental monitoring. Specific action levels reflect the presence of contaminants of concern identified in previous site investigations. Personnel should be trained in the use and limitations of respirators and PPE and are required to comply with specific requirements for their use. Examples: air purifying respirators or air supply respirators in conjunction with protective coveralls, standard safety cloths and hard hat and real time air monitoring.

7. **Implement emergency contingencies for employee protection:** Emergency contingencies have

been developed for unforeseen circumstances and emergencies. These contingencies will be implemented at the discretion of site personnel based on their best professional judgement. All personnel will familiarize themselves with these contingency protocols and the intent and purpose of their implementation. Protocols include emergency communication, response and incident reporting. Emergencies may include: accident/injury; environmental release; life threatening conditions.

6.3 Safety and Health Hazards at Site

June 1, 1995, the site was reopened as a public park with unrestricted public access. From 1986 to its reopening, the site was under study then construction to remediate contamination. The site served as a municipal landfill for Westchester County from 1927 to 1986. Besides the hazardous components of municipal waste, the landfill is reported to have received RECRA hazardous and industrial wastes, munitions and radiologic wastes including radiation contaminated construction and demolition debris. A summary of wastes known to have been disposed of at the site is included in Appendix K.

During environmental monitoring and sampling and maintenance during the post closure period, certain activities have the potential of exposing workers to:

- Landfill gas (explosive/oxygen depletion/contaminants)
- Contaminated liquids (leachate/groundwater landfill gas condensate) (chemicals, toxins)
- Physical hazards (slip/trip, heat/cold stress)

- Biological hazards (ticks/animals)

Other hazards which could be encountered during invasive construction activities include:

- Solid Wastes

Table 6-1 provides the chemical and physical properties of hazardous substances and health hazards expected at the site.

6.4 On-site Hazards

On-site hazards which can be encountered during environmental monitoring, sampling and routine operation and maintenance activity can include:

- Landfill Gas
- Leachate and Contaminated Liquids
- Biologic Hazards
- Health Hazards and Medical Emergencies

Other hazards which could be encountered during invasive construction activities include:

- Solid Wastes

6.4.1 Landfill Gas

Landfill gas is a product of decomposition in the waste mass. The primary constituents include approximately 53% methane, 47% carbon dioxide and small concentrations of hydrogen sulfide and

Table 6-1

Hazardous Substances and Health Hazards Expected at the Site and Their Chemical and Physical Properties

Hazard	Description	Indicators	Dangers	Mitigation
Landfill gas	methane low % toxins Benzene Vinyl Chloride	Odor, rotten eggs	Odors Chemical exposure Explosive Suffocation/ Asphyxiation	Move from source Air monitoring/ respirator LEL/O_2Monitoring
Leachate/ groundwater landfill gas condensate	low % chemicals/ contaminants	Liquid/odorous Dark color	Splash Skin Eyes	Avoid liquid contact Protective clothing Wash/flush skin Eye protection/ flush
Solid waste	Hazardous components Sharps/Needles Potentially anything	Visual waste Odors Invasive activity Stained soils	Hazardous materials Radiation Explosives Sharps/Puncture Injection	Avoid exposed waste Protective clothing Monitor Awareness Boots/gloves Environmental monitoring
Biological	Ticks Rabid animals Medical waste Poison Ivy	Brush/grass Strange behavior Visual waste	Lyme disease Rabies Puncture Infectious Radiological	Tick repellent Check clothes/ body Symptoms of disease Avoid animals Call responder Avoid visual waste Protectiv clothing Avoid Poison Ivy
Construction hazards	Heavy equipment Trenching Excavation Drilling	Haste Preoccupation Fatigue Obscured vision High activity	Impact Slip/trip Accidents Collision	Avoid construction Awareness Good visibility Think before act Rest breaks Take time
Medical emergencies	Accident/ injury Heat/cold stress Chemical exposure	Collapse Physical/ Mental aberrations	Injury Death	First aid Communications First response Medical monitoring Buddy system

other contaminants. Under the landfill cap, the gas is both hot and under pressure and fills the voids in the buried waste mass. The Landfill gas collection and control system collects the landfill gas and conducts it to the landfill gas flare. Combustion provides thermal destruction of combustible gas and low level contaminants. If the landfill surface is breached by drilling or excavation or if the landfill collection system is ruptured or leaks, landfill gas will vent to the atmosphere. Landfill gas creates potentially dangerous situations including:

- Asphyxiation
- Contamination
- Explosion
- Odors

6.4.1.1 Asphyxiation

Landfill gas may initially rise from a bore hole, leaking gas line, or other source because it is under pressure and/or warmer than the ambient air. However, it may settle and lie in hollows, pump station wet wells, fill holes and flow along the ground. Landfill gas is a simple asphyxiant. Where landfill gas settles, it displaces air. Landfill gas will not support human respiration and a worker entering an area where landfill gas has settled can pass out and die.

6.4.1.2 Explosion

Landfill gas is flammable and explosive due to its 53% methane content. At concentrations of as little as 5% methane in air (lower explosive limit LEL) landfill gas will burn or explode if ignited by a cigarette, electric motor, sparking tool, internal combustion engine or other source of ignition. In

the ground, landfill gas usually does not have enough oxygen to burn or explode. However, once vented into the air, it can explode and may burn like a torch, if ignited.

6.4.1.3 Contamination

Typical landfill gas contains small concentrations of toxic contaminants like benzene and vinyl chloride. These contaminants are by products of waste decomposition or may be present as a waste material. Typical low level contaminant concentrations are detectable at a landfill gas source but dissipate rapidly into the air and are not detectable at short distances. Higher concentrations of contaminants may be incurred if invasive activities, like drilling or excavation, rupture a drum or otherwise disturb a buried contaminant source. Higher concentrations of contaminants, if incurred, are associated with site specific sources and are not necessarily present at all landfill gas sources.

6.4.1.4 Odors

Landfill gas is extremely odorous. Its odor is characteristic and easily detectable on initial exposure. The odor has been described as similar to rotten chicken, eggs, or garbage. It may often be smelled at a miles distance from the source, if conditions are favorable. However, during continuous exposure, workers will lose their sensitivity to the smell. Therefore, workers experiencing prolonged exposure must be aware that landfill gas may be present even if it cannot be smelled.

6.4.2 Leachate and Contaminated Liquids

Contaminated liquids may be encountered during operation, maintenance and environmental monitoring and sampling activities. Contaminated liquids including leachate, contaminated

groundwater and landfill gas condensate may be encountered in leachate sewers, pump stations and groundwater wells during operation, maintenance and environmental monitoring and sampling activities, and during invasive activities on site.

Leachate results from the infiltration and percolation of precipitation or groundwater through the waste mass. Initially, clean water will dissolve and leach contaminants from the waste mass. Contaminants will travel in the liquid wherever it flows contaminating whatever it contacts.

Contaminated groundwater is a result of leachate migrating into and mixing with groundwater.

Landfill gas condensate is a result of the precipitation of moisture out of the landfill gas as the landfill gas cools or experiences a change in pressure. Landfill gas condensate typically contains contaminants similar to those contained in the landfill gas but at higher concentrations.

The strength of contaminated groundwater, leachate and landfill gas condensate, and other contaminated liquids depends on the initial waste material, the contact time, dilution and distance from the site.

Leachate typically has a strong metallic odor (often associated with landfill gas odor), a dark color and foams easily. Other contaminated liquids will exhibit characteristics similar to leachate in varying degrees.

6.4.3 Solid Wastes

The waste mass of the Croton Landfill beneath the landfill cap contains a sampling of virtually anything discarded or disposed of in Westchester County between 1927 and 1986. There is documentation of hazardous waste disposal, including radiation contaminated demolition debris, and reports that undocumented wastes including munitions, medical wastes and lab packs may have been disposed of at the site. Besides these, the hazardous component of household wastes could include anything from battery acid to pesticides. Appendix J summarizes hazardous wastes disposed at the site from 1951.

The closure design isolates the waste mass from the public and the environment with over two and a half feet of cover soils in addition to the membrane liner. During routine activities, the waste mass and associated hazards of previously disposed of materials are not considered a hazard to workers. However, invasive activities on or around the landfill, such as drilling and excavation, may encounter waste material or materials contaminated by the presence of the waste mass. Invasive activities within the boundaries of the site should be avoided and only conducted by special design with restrictions and planned contingencies. The March 1993 NYSDEC Record of Decision limits site use with deed restrictions governing and restricting intrusive activities.

6.4.4 Biological Hazards

Biological hazards associated with this project may include contact with poisonous plants, animals and insects. Invasive activities on the landfill may encounter potentially infectious wastes including "lab packs" or medical wastes.

Poison ivy may be present on site. Poison ivy is a shiny three leaved vine. The edges of its leaves are smooth and often have a yellow or red color especially in late summer and fall. The plant produces clusters of berries and is typically found on sandy, dry, disturbed soil, climbing fences, telephone poles and guardrails.

One case of Lyme disease was reported during prior site activity. Lyme disease is carried by ticks and is spread by tick bites. Primarily associated with the smaller species, the deer tick, the disease is reported in three phases; a rash, usually around the tick bite; flu like symptoms; and chronic fatigue, painful joints and mental disorders. The deer tick is about the size of a pin head and usually resides in brush, woods and tall grass.

In recent years, Westchester County has experienced a rabies epidemic. Any interference with wildlife should be avoided. Specifically avoid and report animals that appear disoriented, aggressive, sluggish, tame or otherwise act outside their nature.

Yellow Jackets, Wasps and other stinging insects are common on the site. Exercise caution around sumps, wells, pits, manholes, pumping stations, valve chambers and other areas conducive to nesting or swarming.

6.4.5 Health Hazards and Medical Emergencies

Health hazards and medical emergencies, which could occur during routine site activities, include physical injury, heat and cold stress and chemical exposures.

Physical hazards, which can lead to injury, include uneven or slippery terrain (slip/trip), sharp or jagged objects (cuts and punctures), damaged, misused and overhead equipment (impacts) and over exertion (muscle sprains and pulls).

Heat and cold stress may result from over exposure to heat or cold working conditions amplified by poor physical condition, improper equipment and clothing, improper eating and drinking habits, a poor work rest schedule and inadequate breaks to warm up, cool down or eat and drink.

Chemical exposures related to site contaminants are only associated with those activities during which workers may be exposed to contaminated liquids, soils and landfill gas.

6.4.5.1 Cold Stress

Extended or severe exposure to cold may result in injury from frost bite or hypothermia. The potential for these injuries is increased by wind and dampness. Frost bite is the result of skin tissue freezing. It is characterized by whitening of the skin, loss of feeling and, in later stages, the effected area may freeze, becoming hard or firm to the touch. The onset of hypothermia is characterized by numbness or shivering. Lips or extremities may take on a bluish hue. In more advanced stages, a person may become slow, apathetic or sleepy. Such symptoms may progress into unconsciousness.

6.4.5.2 Heat Stress

Heat stress is caused by over exertion in excessive ambient temperatures, or in equipment with poor heat dissipation and ventilating properties. Heat stress is facilitated by dehydration and low body

salt due to sweating and inadequate liquid and salt intake. It occurs when the body's normal capacity for heat regulation is overcome by exterior conditions and abnormal interior conditions (salt and water depletion). Heat stress manifests itself in varying degrees as physical discomfort; muscle cramps, weakness and irregular breathing and pulse; skin rash or prickling sensation; profuse sweating, fatigue, headache/dizziness, erratic behavior, nausea, fainting; failure to sweat, hot, dry, red skin, convulsions and loss of consciousness.

6.4.5.3 Chemical Exposure

The waste mass has been isolated by the capping of the landfill, thereby greatly reducing the potential of chemical exposure. However, chemical exposure may potentially result from dermal contact, inhalation, or ingestion of contaminated materials which may be encountered on site. Sources of contaminated materials may include landfill gas, leachate and contaminated liquids. Chemical exposure may manifest itself as physical discomfort, fatigue, euphoria, erratic behavior or other deviations from normal incidence response or characteristics behavior.

6.4.5.4 Incidence Response

Accidents, exposure, injuries and medical emergencies occurring during routine site activities may be either random or task related. Resulting injuries may be minor, major or life threatening. Response may require modifying work routines, administering first aid, professional emergency response and or transport to hospital.

Minor injuries require superficial first aid like washing and bandaging a cut. While causing some

discomfort and inconvenience, they will not substantially impair ability or cause loss of work time. In general, response will require the appropriate first aid administered as soon after the injury as practicable.

Major injuries are ability impairing and may make it impossible for a person to continue work without treatment. They may cause a person to lose substantial efficiency or work time. They may result in long-term disability. Major injury may constitute a medical emergency. In general, response will entail immediate appropriate first aid and immediate securing of professional assistance, if required. On site supervisors should be notified as soon as possible and a full report prepared and filed.

Life threatening injuries require immediate treatment to protect the life and/or health of an individual. Response will include professional assistance, treatment or inspection. Life threatening injuries are medical emergencies. In general, response will entail immediate appropriate first aid and immediate securing of professional assistance. On site supervisors should be notified as soon as possible and a full report prepared and filed. Appropriate off-site personnel should be notified.

Random injuries result from unforseen and unpredictable circumstances. They may include physical injury unrelated to the requirements of a specific task like spraining an ankle falling on ice while conducting inspection. Random injuries may be minor, major or life threatening. They must be responded to on a case by case basis which may include first aid, professional care or professional emergency response as outlined above.

Task related injuries are typical, systematic and are related to specific activities, equipment or conditions. Examples can include heat and cold stress, and chemical exposure or injury due to faulty equipment or dangerous work conditions and practices. Task related injuries are predictable and avoidable. Specific procedures have been developed to avoid task related injuries. Site personnel will adhere to those procedures. In addition, site personnel will monitor for and report conditions, work practices and equipment which are a potential source of task related injuries. On-site supervisors should be notified and an incident report prepared and filed. Personnel should follow up to ensure that potential sources of task related injuries have been rectified.

Task related injuries may be minor, major or life threatening. They will be responded to either on a case by case basis or as specified. Response may include first aid, professional care or professional emergency response. However, in all cases work should be stopped until the condition, which precipitated the injury, is rectified. A full report will document the accident, the precipitating conditions and the manner in which the condition has been corrected.

6.5 Site Work Zones

The landfill site is opened to public access. However, within the site there are areas restricted to public access and open only to designated personnel conducting specific O&M tasks. These sites may be permanent or temporary and may be defined as restricted or exclusion zones depending on the activities taking place. In addition, access to any OSHA classifiable confined space is also restricted.

All personnel conducting operations and work practices conducted in restricted or exclusion zones or confined space shall be in compliance with applicable Federal, State and local regulations which shall include but not be limited to OSHA and Confined Space. In addition, the owner must prepare and monitor compliance with their own Health and Safety Program, Site Health and Safety and Emergency Response Plan. The following is not intended to replace such documents and is presented as a guide and illustrative example of operational procedures.

Table 6-2 presents illustrative examples of site work zone classifications for various conditions. The table serves to illustrate that the classification of work zone changes with activity. A good rule of thumb for all site activities which have the potential for exposing workers to contamination or health hazards is as follows:

On arriving at a site for a specific activity, treat the environment outside your vehicle as restricted zone and follow all appropriate recommendations in Section 6.8 - Standard Operating Procedures and Safe Work Practices accordingly.

Examples of areas restricted to public access include:

- The vicinity of landfill gas well heads (during O&M activities)
- The fenced-in area around the landfill gas handling and combustion system
- Leachate, seep and condensate system pumping stations
- The vicinity of and leachate sewers and appurtenances (during O&M activities)
- Groundwater monitoring wells (during sampling)

- The vicinity of any ongoing environmental monitoring and sampling operation
- Any OSHA classifiable confined space

6.5.1 Restricted Zones

A restricted zone is defined as an area within which potential health and safety hazards may exist. However, the potential hazards are well defined, controlled and are predictable. Under normal operating conditions, the hazards do not constitute a significant health and safety threat. Examples include the fenced enclosures around leachate pumping stations and the landfill gas combustion system during routine operation of these facilities.

Access to and operations conducted in restricted zones will be limited to regular site workers and authorized personnel who have completed the requisite OSHA health and safety training and who are medically monitored. In addition, specific individuals who have received prior approval by the authorized site supervisor to conduct limited, specific operations or inspections may be admitted. Such limited and specific operations shall be deemed not to place the individual at substantial risk of contact with contaminated materials. An example of such an activity is filling the propane tank within the landfill gas combustion system restricted zone while that facility is experiencing routine operation.

6.5.2 Exclusion Zone

An exclusion zone is defined as an area within which there is imminent danger of exposure to or release of contaminants or the presence of health hazards. Examples include groundwater

Table 6-2
Illustrative Site Work Zone Classification

Area	Restricted Zone	Exclusion Zone	OSHA Classified Confined Space
The vicinity of landfill gas well heads	-	During monitoring and sampling	-
Landfill gas handling and combustion system compound	During routine operation	During maintenance	-
Leachate, seeps condensate and condensate pumping station compounds	During routine operation	During maintenance	Wet wells and valve boxes
Leachate sewers and appurtenances	During routine operation	During maintenance	Sewer and manholes
The vicinity of groundwater monitoring wells	-	During monitoring and sampling	-
Environmental monitoring and sampling operations	-	During monitoring and sampling	Wet wells and valve boxes
Stormwater sewers	During routine operation	During monitoring and sampling	Sewers, manholes, catch basins and outfalls

monitoring wells and landfill gas wells during sampling and well field tuning; pumping stations or the landfill gas combustion system during maintenance activities.

Access to and operations in Exclusion Zones will be limited to regular site workers and authorized personnel who have completed the requisite OSHA health and safety training and who are medically monitored.

6.5.3 OSHA Permit-Required Confined Space

The definition of and requirements for confined space entry are presented in the Confined Space Entry Program included in Appendix H. For the purposes of this section a confined space can be defined as an area of limited and restricted access and or egress which has or has the potential of developing a hazardous or life threatening atmosphere. Examples include: leachate sewers, manholes and pumping station wet wells and storm sewers, manholes and outfalls.

Confined space entry will be restricted to personnel who have completed the OSHA confined space entry training program. In addition if the confined space is also a restricted or exclusion zone those personnel restriction will also apply. All confined space training and operation will be conducted according to the requirements defined in Westchester County's Permit-Required Confined Space Entry Program provided in Appendix H.

6.5.4 Work Zone Demarcation

Site work zones as outlined above should be clearly defined and marked to prevent unauthorized

access. In the case of fenced areas such as pumping stations and the landfill gas combustion system, no additional demarcation is required. For temporarily defined work zones with no existing demarcation, such as groundwater monitoring and landfill gas wells, leachate sewers and appurtenances, temporary demarcation should be used. Highway cones, stakes and warning tape should be used to cordon off the work area and clearly restrict access to authorized personnel.

Table 6-2 summary of work zone classifications is intended to be illustrative and should not be considered comprehensive. Additional work zones may require definition for work tasks not covered in this manual. Site or O&M conditions or requirements may alter the classifications presented.

6.6 Buddy System

When conducting activities within the Restricted or Exclusion Zones, personnel will implement the following;

- Work in pairs maintaining visual contact.
- Maintain communications with support personnel.
- Do not enter the restricted or exclusion zones without notifying support personnel of destination, intent and estimated return time.
- On arriving at destination, notify the Health and Safety personnel of your presence and intended activities.
- Specifically make contact with the Health and Safety personnel.
- Avoid entering the Restricted Zone after hours and do so only in pairs.
- Avoid entering Exclusion Zones and do so only with the express understanding of

and direct supervision of the Health and Safety personnel.

- If in doubt, bring instrumentation, a partner, and the means for emergency communication.

6.7 Site Communications

Personnel conducting activities within Restricted or Exclusion zones, will maintain communications with each other and support personnel by means of hand held am/fm transceivers. Emergency communications will be coordinated though the Health and Safety personnel.

6.8 Standard Operating Procedures and Safe Work Practices

- All persons entering and/or working in Restricted or Exclusion Zone shall read, sign and become familiar with the site safety plan.
- All PPE shall be maintained in clean and good working order according to manufacturer's recommendations.
- All persons entering and/or working in the Restricted or Exclusion Zones shall be in compliance with OSHA 29 CFR 1910.120 including training and medical monitoring.
- All persons entering or working in the Restricted or Exclusion Zones shall be wearing appropriate personal protective equipment (PPE) as determined by the Health and Safety Officer.
- No employee shall enter the Restricted or Exclusion Zones without notifying the Health and Safety Officer.

- No employee shall enter the restricted or exclusion zones alone.
- All unsafe conditions or work practices shall be brought to the attention of the site Health and Safety Officer.
- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated shall result in the evacuation of work area or site personnel followed by reevaluation of the hazard and appropriate procedures for ensuring worker health and safety.
- No eating, drinking, smoking, gum or tobacco chewing in the Restricted or Exclusion Zones.
- Hands and face shall be thoroughly cleaned as soon as possible after exiting the Restricted or Exclusion Zones and before eating, drinking, smoking, gum or tobacco chewing.
- All equipment used in site operations must be properly cleaned and maintained in good working order. Equipment must be inspected for signs of defect and/or contamination before and after each use.
- Personnel will remove potentially contaminated clothing and shower as quickly as possible after completing each days work.

6.9 Standard Procedures for Contamination Avoidance

Personnel should avoid unnecessary contamination. In addition, personnel should comply with the following:

- Stay upwind of operations that release or have the potential to release airborne

contaminants such as or landfill gas and dust.

- Avoid entering Exclusion Zones unnecessarily.
- Avoid areas of known or suspected contamination.
- Walk around puddles and muddy areas.
- Avoid prolonged operations in the presence of landfill gas odors and dust.
- Avoid kneeling or sitting on the ground.
- Avoid handling, leaning against, or coming into contact with potentially contaminated equipment, material or waste.
- Use disposable outer garments when potential contamination is likely.
- Avoid activities with potential for gross contamination by splash or spray.
- Potentially contaminated samples or material brought out of the Restricted or Exclusion Zones must be thoroughly inspected for and decontaminated prior to exiting the site.
- Eliminate all unnecessary equipment when working in the presence of known or suspected contamination.
- Wrap or cover necessary equipment to protect it from contamination or to make it easier to decontaminate.

6.10 Personal Protective Equipment

Use of Personal Protective Equipment (PPE) is intended to protect individuals from known or potential hazards encountered in the work place which can not be avoided by other means. Other means by which the use of PPE may be avoided can include modified operating procedures or work

practices and/or engineering controls.

PPE is generally considered to be elements of a work uniform which are specifically required by the unavoidable hazards of a given work task. Typical PPE requirements for this project may include protective head, eye, foot, and hand wear as well as overclothes and respiratory protection.

Typically the use of PPE tends to reduce the agility, awareness, and productivity of a worker and may increase exposure to some hazards while reducing others. Unnecessary PPE should be avoided. The selection of PPE therefore will reflect the specific hazards present during a given work task and may vary task to task and day to day.

6.10.1 Levels of Protection

Levels of protection (A, B, C, and D) refer to ensembles of PPE which provide varying degrees of protection against respiratory and dermal or contact related hazards.

In general requirements of levels of protection may be summarized as follows:

Level D: No respiratory hazard. Standard uniform includes appropriate work clothing and gloves. May include hard hat, steel toed boot, hearing and eye protection, impermeable rubber boots or overboots, disposable impermeable rubber, latex or nitrile over or under gloves, dedicated work clothing or disposable coveralls (tyvex).

Level C: Respiratory hazard present. Use of air purifying respirator (APR) appropriate. APR used in conjunction with Level D ensemble. Site specific requirements may dictate

higher order of Level D dermal protection and may require coated tyvex disposable coveralls.

Level B: Respiratory hazard present. Use of air supply respirator required. May be used in conjunction with Level D ensemble. Typically site specific requirements dictate higher order of dermal protection including coated tyvex coveralls or saranacs coveralls.

Level A: Respiratory hazard present. Use of air supply respirator required. Site contamination requires highest level of dermal and contact protection. Fully encapsulate chemical and abrasion resistant suit utilized to completely isolate worker from contaminated environment.

The procedures for training, use, and care of respirators is provided in Appendix H, Westchester County DEF Respiratory Protection Program for OSHA - 1910.134.

6.11 Ambient Air Monitoring

The purpose of this section is to outline standard procedures and protocols for on-site real time air monitoring. The purpose of realtime ambient air monitoring is to:

- Provide data to assist in selecting engineering controls, work practices, and PPE to minimize potential employee exposure.

- Identify and quantify airborne levels of contaminants and safety and health hazards to assist in determining the appropriate levels of employee protection.
- Provide real time data to assist in decision to up-grade or down-grade PPE and levels of protection.

6.11.1 Conditions in Which Monitoring Is Required

Continuous realtime ambient air monitoring will be required under the following conditions:

- At the discretion of Site Health and Safety Personnel.
- Whenever an exclusion zone is initiated.
- On initial entry to an area where there is a known or suspected hazard.

  Examples:

  - Landfill gas present or suspected
  - Original landfill surface disturbed
  - Leachate or contaminated media present or suspected
- Entry into an area not previously characterized by health and safety monitoring.
- When the nature or type of contaminant encountered changes or is suspected of having changed.
- When employees are working in an area of known or suspected contamination.
- When site logistics, hazard uncertainty, or other factors constitute a significant high risk condition for employees.

Once initial continuous air monitoring has adequately characterized an area, monitoring frequency

may be appropriately decreased at the discretion of site health and safety personnel. Table 6-3 provides the limitations of the air monitoring equipment available at site. Table 6-4 provides the action levels for different contaminant levels. Section 3.16 provides directions for use and calibration of some common air monitoring instruments.

6.12 Operation and Maintenance Task Hazard/Risk Analysis

The landfill closure process effectively isolates the waste mass and sources of contaminants of concern from the public and the environment. These sources of contamination include the waste mass, landfill gas, and contaminated liquids. However, during routine O&M operations, workers will come into contact with contaminated medium and therefore, must be prepared to institute appropriate safeguards and hazard minimization procedures.

Specific activities covered in this O&M manual are anticipated to have the potential of exposing workers to contamination or activity specific safety hazards. The following section identifies the specific hazards, describes the risks involved, and outlines risk mitigation strategies. General contamination and hazard avoidance strategies are addressed in Sections 6.8 and 6.9. Non-task specific hazards and risks such as heat and cold stress are covered in Section 6.4.

The activities of concern include:

- Environmental monitoring and sampling
- Landfill gas system, gas collection system, gas handling system and flare O&M
- Pumping Station and Leachate Sewers O&M

Table 6-3

Air Monitoring Equipment Limitations

Instrument	Limitation
Combustible Gas Indicator (CGI) - MSA	Not accurate in oxygen depleted or enriched environments
Photo Ionization Device (PID) - HnU	Looses accuracy in the presence of methane. Accuracy significantly decreased at 10% LEL. Looses accuracy in mist, fog, and rain.
Flame Ionization Device (FID) - OVA	Extremely sensitive to the presence of flammable gasses. Meter will "peg out" and/or "flame out", disabling meter, in low concentrations of methane. Meter of limited use where methane or other flammable gasses are present.

Table 6-4
Action Levels

Equipment	Action level*	Response	Rational
Oxygen Meter	19.5%<O_2<25%	Stop work	O_2<19.5 = possible asphyxiation
		Engng Cntrl	O_2>25% = high flammability/explosive
		Evacuate	Required for accurate use of CGI
CGI	10% LEL	Stop work	Required for accurate HnU reading
		Engng Cntrl	
		Evacuate	
HnU	Bkgd<HnU<1ppm	Level D PPE	No respiratory protection required
	1ppm<HnU<5ppm	Stop work	Air purifying respirator required
		Engng Cntrl	
		Level C PPE	
		Evacuate	
	HNu>5ppm	Stop work	Air supply respirator required
		Engng Cntrl	
		Evacuate	
OVA**	Bkgd<OVA<1ppm	Level D PPE	No respiratory protection required
	1ppm<OVA<5ppm	Stop work	Air purifying respirator required
		Engng Cntrl	
		Level C PPE	
		Evacuate	
	OVA>5ppm	Stop work	Air supply respirator required
		Engng Cntrl	
		Evacuate	
H_2S Detector	Bkgd<H_2S<10ppm	Level DPPE	No respiratory protection required
	H_2S>10ppm	Stop Work	Air supply respirator required
		Engng Cntrl	Substance causes olfactory
		Level B PPE	fatigue
		Evacuate	

* Readings taken in the breathing zone (work zone)
** Non-methane (flammable gas) instrument readings

- Storm Sewer and Outfalls O&M

6.12.1 Environmental Monitoring and Sampling

Environmental monitoring and sampling is conducted to assess the long term trend in quality of contaminated media remediated by the landfill closure. Individuals conducting sampling procedures will be handling contaminated materials including:

- Leachate
- Landfill Gas
- Groundwater
- Marsh Sediments

In addition, sampling will include media not expected to be substantially contaminated including:

- Stormwater
- Surface water

6.12.1.1 Groundwater Monitoring

Site groundwater is subject to varying degrees of contamination associated with the wastes disposed of on the site. In addition, contaminated and possibly combustible gases collect in the well casings and vent to the atmosphere when the wells are opened.

Risks associated with groundwater include:

- Ingestion (drinking or eating) - splashing contaminated liquid into the mouth or eating or

drinking food contaminated through improper personnel hygiene.

- Injection - contaminated liquid enters the skin through a puncture wound or through an open wound or cut.
- Splash - skin or eye contact from splashed contaminated liquids.

Risks associated with well head gases include:

- Inhalation - breathing gases from the well head.
- Explosion - gases ignite on opening well head from spark or other source of ignition like cigarette.

Mitigation strategies include:

- Follow recommendations for decontamination and proper personnel hygiene.
- Wear appropriate personnel protective equipment. The appropriate PPE ensemble would include Level D with:

  eye and face protection (full face shield) or safety glasses with side shields

  water proof and chemical resistant gloves (Nitrile)

  splash resistant disposable outer garments (coated Tyvex)
- Conduct real time air monitor of well headspace on opening with CGI. If no reading, then follow with HNu (PID) or OVA (FID). Allow to vent until background readings are attained prior to initiating further procedures.
- Eliminate sources of ignition - electrical equipment, cigarettes, sparking tools.

6.12.1.2 Leachate Sampling

Leachate is contaminated due to direct contact with the waste mass. Specific hazards are similar to those outlined above for groundwater sampling including handling contaminated liquids and the presence of potentially contaminated and explosive gases. In addition, leachate sampling may require approach to or entry into confined spaces such pumping station wet wells.

Risks associated with handling leachate include:

- Ingestion (drinking or eating) - splashing contaminated liquid into the mouth or eating or drinking food contaminated through improper personnel hygiene.
- Injection - contaminated liquid enters the skin through a puncture wound or through an open wound or cut.
- Splash - skin or eye contact from splashed contaminated liquids.

Risks associated with wet well and valve box gases include:

- Inhalation - breathing gases from the well head.
- Asphyxiation - being overcome and passing out from breathing gases.
- Explosion - gases ignite on opening well head from spark or other source of ignition like cigarette.

Risks associated with Confined Space Entry include:

- restricted entry and exit
- explosive and toxic gases

- asphyxiation
- contaminated liquids
- physical injury and drowning

Mitigation strategies include:

- Follow recommendations for decontamination and proper personnel hygiene.
- Follow all the requirements of the permitted confined space entry program.
- Wear appropriate personnel protective equipment. The appropriate PPE ensemble would be dictated by the results of real time air monitoring and entry permit requirements but would include as a minimum Level D with:
    - hard hat
    - eye and face protection (full face shield)
    - splash resistant disposable outer garments (coated Tyvex)
- Conduct real time air monitor of wet well before entering and continuously while conducted operations. Initiate engineering control strategies such as venting and utilizing blowers as dictated by results of air monitoring.
- Eliminate sources of ignition - electrical equipment, cigarettes, sparking tools.
- Work in teams and have all required safety equipment on hand and in good working order.
- Follow all procedures for confined space entry as required by the permitted confined space entry program.
- Initiate procedures to mitigate the potential build-up of airborne contaminants and explosive gases in sewers, wet wells and pumping stations.

6.12.1.3 Marsh Sediments Sampling

Marsh sediments may be subject to low level contaminants of a generally non-volatile nature. Sediments from the marsh are likely to be wet and associated liquids may present a source of contamination. Sampling sites have been selected to allow access by foot. Use of water craft is not recommended because of related hazards such as drowning.

Risks associated with contaminated sediments include:

- Ingestion (drinking or eating) - splashing contaminated liquid or sediments into the mouth or eating or drinking food contaminated through improper personnel hygiene.
- Injection - contaminated liquid or sediment enters the skin through a puncture wound or through an open wound or cut.
- Splash - skin or eye contact from splashed contaminated liquids or sediments.

Mitigation strategies include:

- Follow recommendations for decontamination and proper personnel hygiene.
- Wear appropriate personnel protective equipment. The appropriate PPE ensemble would include as a minimum Level D with:
  - eye and face protection (full face shield)
  - waterproof and chemical resistant gloves (Nitrile)
  - splash resistant disposable outer garments (coated Tyvex)

6.12.1.4 Landfill Gas Sampling and Perimeter Soil Gas Survey

Landfill gas is explosive, acts as a simple asphyxiant and contains varying levels of contamination. Landfill gas has a distinctive smell and initially can be detected by smell at low concentrations. Over a day of exposure, sensitivity to the smell of landfill gas tends to decrease. Therefore, the gas may be present even if it can not be smelled. Sampling is to be conducted from a sampling port on the positive pressure side of the Landfill Gas Handling System. Only small amounts of gas are anticipated. Confined space issues are not expected to be a concern. Landfill gas condensate is not expected to be a concern.

Risks associated with landfill gas include:

- Exposure to contaminants through inhalation - breathing contaminated gases.
- Asphyxiation - being overcome and passing out from breathing gases.
- Explosion - gases ignite from spark or other source of ignition like cigarette.

Mitigation strategies include:

- Exercise extreme caution if the smell of landfill gas is detected because it indicates a leak in the system.
- Do not depend on being able to smell landfill gas to detect its presence.
- Monitor for the presence of landfill gas, oxygen deficiency, levels of contamination and explosive environment.
- Eliminate sources of ignition - electrical equipment, sparking tools, cigarettes or other sources of open flame.

6.12.1.5 Surface Water and Stormwater Sampling

Surface and stormwater is not anticipated to be substantially contaminated. The primary hazards are water related accidents the most obvious being drowning and cold stress related to falling in.

Sampling locations have been selected to allow access by foot. The use of water craft is not recommended. Typical risks associated with contaminated liquids are much less of an issue for these media because contamination levels are expected to be very low.

Mitigation strategies include:

- conduct sampling by foot
- exercise caution when working around water, particularly bulkheads and outfalls.

6.12.2 Landfill Gas System

Conducting routine operation and maintenance activities can expose personnel to landfill gas condensate and landfill gas in addition to other tasks specific hazards and risks.

6.12.2.1 Landfill Gas Collection System Tuning and Balancing

Landfill gas - landfill gas is explosive acts as a simple asphyxiant and contains varying levels of contamination. Landfill gas has a distinctive smell and initially can be detected by smell at low concentrations. Over a day of exposure, sensitivity to the smell of landfill gas tends to decrease. Therefore, the gas may be present even if it can not be smelled.

Confined space - tuning and balancing the gas collection system will require working around and in well head valve boxes where landfill gas can collect at explosive levels and displace oxygen with the associated risk of asphyxiation.

Risks associated with landfill gas include:

- Exposure to contaminants through inhalation - breathing contaminated gases.
- Asphyxiation - being overcome and passing out from breathing gases.
- Explosion - gases ignite from spark or other source of ignition like cigarette.

Risks associated with confined space entry include:

- restricted entry and exit
- Explosive and contaminated gases
- Asphyxiation by landfill gas

Risks associated with moving mechanical equipment such as motorized valves, blowers and motors and mechanical linkage include:

- Injury cuts and lacerations from moving parts.
- Body parts being caught and dragged into moving parts.
- Clothing being caught and dragged into moving parts.

Mitigation strategies include:

- Balancing and tuning the collection system under normal circumstances should require

release of only very small quantities of landfill gas through sampling ports.

- Exercise extreme caution if the smell of landfill gas is detected because it indicates a leak in the system.
- Do not depend on being able to smell landfill gas to detect its presence.
- Monitor for the presence of landfill gas, oxygen deficiency, levels of contamination and explosive environment.
- Eliminate sources of ignition - electrical equipment, sparking tools, cigarettes or other sources of open flame.
- Comply with the requirements for confined space entry for work around or in valve boxes.

6.12.2.2 Landfill Gas Combustion System O&M

Landfill gas - landfill gas is explosive and acts as a simple asphyxiant and contains varying levels of contamination. Landfill gas has a distinctive smell and initially can be detected by smell at low concentrations. Over a day of exposure, sensitivity to the smell of landfill gas tends to decrease. Therefore, the gas may be present even if it can not be smelled.

Landfill gas condensate - landfill gas condensate is a contaminated liquid which may contains contaminants found in landfill gas in higher concentrations.

Confined space - O&M activities may require entering the flare stack.

Mechanical injury - may result from activities around blowers and other moving equipment.

Risks associated with landfill gas include:

- Exposure to contaminants through inhalation - breathing contaminated gases.
- Asphyxiation - being overcome and passing out from breathing gases.
- Explosion - gases ignite from spark or other source of ignition like cigarette.

Risks associated with handling landfill gas condensate include:

- Ingestion (drinking or eating) - splashing contaminated liquid into the mouth or eating or drinking food contaminated through improper personnel hygiene.
- Injection - contaminated liquid enters the skin through a puncture wound or through an open wound or cut.
- Splash - skin or eye contact from splashed contaminated liquids.

Mitigation strategies include:

- Follow recommendations for decontamination and proper personnel hygiene.
- When conducting tasks with the potential of exposure to landfill gas condensate, wear appropriate personnel protective equipment. The appropriate PPE ensemble would include Level D with:
  - eye and face protection (full face shield)
  - waterproof and chemical resistant gloves (Nitrile)
  - splash resistant disposable outer garments (coated Tyvex)
- O&M activities on the gas combustion system under normal circumstances should not require release of landfill gas.

- Exercise extreme caution if the smell of landfill gas is detected because it indicates a leak in the system.
- Do not depend on being able to smell landfill gas to detect its presence.
- Monitor for the presence of landfill gas, oxygen deficiency, levels of contamination and explosive environment.
- Eliminate sources of ignition - electrical equipment, sparking tools, cigarettes or other sources of open flame.
- Comply with the requirements for confined space entry.
- Be aware of and stay clear of moving mechanical equipment.
- Secure or do not wear loose flowing clothing and scarves.
- Secure long hair.

6.12.3 Pumping Station and Leachate Sewers O&M

These activities have associated personnel safety issues including:

- confined space entry
- leachate and contaminated liquid chemical exposure
- landfill gas and sewer gas exposure with associated chemical exposure, oxygen deficiency, explosive environment, asphyxiation considerations.

Landfill gas - landfill gas is explosive and acts as a simple asphyxiant and contains varying levels of contamination. Landfill gas has a distinctive smell and initially can be detected by smell at low concentrations. Over a day of exposure, sensitivity to the smell of landfill gas tends to decrease.

Therefore, the gas may be present even if it can not be smelled.

Leachate - leachate is contaminated due to direct contact with the waste mass.

Contaminated liquids - liquids from the leachate sewers will be a mixture of leachate, landfill gas condensate and park facilities sewerage.

Confined space - O&M activities will require work in pumping station wet wells, valve boxes and sewers and manholes.

Physical injury - from slip/trip and falling objects

Risks associated with landfill gas include:

- Exposure to contaminants through inhalation - breathing contaminated gases.
- Asphyxiation - being overcome and passing out from breathing gases.
- Explosion - gases ignite from spark or other source of ignition like cigarette.

Risks associated with handling contaminated liquids include:

- Ingestion (drinking or eating) - splashing contaminated liquid into the mouth or eating or drinking food contaminated through improper personnel hygiene.
- Injection - contaminated liquid enters the skin through a puncture wound or through an open wound or cut.

- Splash - skin or eye contact from splashed contaminated liquids.

Risks associated with confined space entry include:

- restricted entry and exit
- explosive and contaminated gases
- asphyxiation by landfill gas

Risks associated with physical injury include:

- physical injury from slips or falls
- injury from equipment dropped from above

Mitigation strategies include:

- Follow recommendations for decontamination and proper personnel hygiene.
- When conducting tasks with the potential of exposure to contaminated liquids, wear appropriate personnel protective equipment. The appropriate PPE ensemble would include Level D with:
    - eye and face protection (full face shield)
    - waterproof and chemical resistant gloves (Nitrile)
    - splash resistant disposable outer garments (coated Tyvex)
- Exercise extreme caution if the smell of landfill gas is detected.
- Do not depend on being able to smell landfill gas to detect its presence.
- Monitor for the presence of landfill or sewer gas, oxygen deficiency, levels of contamination

and explosive environment.

- Eliminate sources of ignition - electrical equipment, sparking tools, cigarettes or other sources of open flame.
- Comply with the requirements for confined space entry.
- While working in sewers, manhole, wet wells, valve boxes or in the presence of overhead equipment, wear a hard hat.

6.12.4 Storm Sewers and Outfalls O&M

Stormwater is not expected to be contaminated. However, these activities have associated personnel safety issues including:

- confined space entry
- water related hazards
- physical injury

Confined space - O&M activities will require inspecting sewers, manholes and outfalls. Landfill and sewer gas may form or collect in sewers, catch basins, manholes and outfalls.

Water related hazards - falling into sewers or outfall pipes or being dragged into the sewers, outfalls or channels by high flow.

Physical injury - from slip/trip and falling objects.

Risks associated with confined space entry include:

- restricted entry and exit
- explosive and contaminated gases
- asphyxiation by sewer gas

Water related risks:

- drowning
- cold stress

Risks associated with physical injury include:

- physical injury from slips or falls
- injury from equipment dropped from above

Mitigation strategies include:

- Exercise extreme caution if the smell of landfill or sewer gas is detected.
- Do not depend on being able to smell gas to detect its presence.
- Monitor for the presence of landfill or sewer gas, oxygen deficiency, levels of contamination and explosive environment.
- Eliminate sources of ignition - electrical equipment, sparking tools, cigarettes or other sources of open flame.
- Comply with the requirements for confined space entry.
- While working with sewers, manhole or in the presence of overhead equipment, wear a hard

hat.

- Avoid O&M activities during storms or in the presence of high flow conditions.
- Follow procedures for avoiding cold stress in the event of soaking.

6.13 Operation and Maintenance Task Personal Protective Equipment

PPE Ensemble

The following section recommends appropriate PPE ensemble for O&M tasks which have the likelihood of exposing personnel to contaminated media, confined space or other related health and safety concerns.

The task specific PPE ensembles recommended herein should be considered guidelines. Actual PPE worn should be based on task and condition specific consideration and the results of real time air monitoring.

Tasks not addressed herein may be completed in Level D (i.e. appropriate work clothing modified as required by the specific hazards of the task).

The general categories of PPE and respiratory protection including Level D, C, B and A are defined in Section 6.10.

The procedures for use, care, and training for use of respirators is provided in Appendix H, Westchester County DEF Respiratory Protection Program for OSHA 1910.134.

The activities in which PPE ensemble will be of specific concern include:

- Environmental monitoring and sampling
- Landfill gas collection system tuning, gas handling system and flare O&M
- Pumping station and leachate sewers O&M
- Storm sewer O&M

6.13.1 Environmental Monitoring and Sampling

Individuals conducting environmental monitoring and sampling procedures will be handling contaminated materials.

6.13.1.1 Leachate Sampling PPE Ensemble

Level D modified as follows unless respiratory protection is required as demonstrated by real time air monitoring.

- splash resistant coated Tyvex coveralls
- waterproof chemical resistant gloves (nitrile)
- face and eye splash protection (plastic full face shield)
- waterproof and chemical resistant boots or boot covers

6.13.1.2 Landfill Gas Sampling and Perimeter Soil Gas Survey PPE Ensemble

Level D modified as follows, unless upgraded, respiratory protection is required as demonstrated by real time air monitoring.

- safety glasses

- steel toed boots

6.13.1.3 Groundwater Sampling PPE Ensemble

Level D modified as follows unless upgraded respiratory protection is required as demonstrated by real time air monitoring:

- splash resistant coated Tyvex coveralls
- waterproof chemical resistant gloves (nitrile)
- face and eye splash protection (plastic full face shield)
- waterproof and chemical resistant boots or boot covers

6.13.1.4 Marsh Sediments Sampling PPE Ensemble

Level D modified as follows, unless upgraded, respiratory protection is required as demonstrated by real time air monitoring:

- Tyvex coveralls
- waterproof gloves
- face and eye splash protection (plastic full face shield)
- waterproof boots or boot covers

6.13.1.5 Surface Water and Stormwater Sampling PPE Ensemble

Level D modified as follows unless upgraded respiratory protection is required as demonstrated by real time air monitoring:

- waterproof gloves

- waterproof boots or boot covers

6.13.2 Landfill Gas System

Personnel conducting O&M activities on the landfill gas system are most likely to be exposed to landfill gas and hazards associated with mechanical equipment.

6.13.2.1 Landfill Gas Collection System Tuning and Balancing

PPE ensemble - Level D modified as follows, unless upgraded, respiratory protection is required as demonstrated by real time air monitoring:

- Steel toed boots

6.13.2.2 Landfill Gas Combustion System O&M

PPE ensemble - Level D modified as follows, unless upgraded, respiratory protection is required as demonstrated by real time air monitoring.

- hard hat
- steel toed boots
- safety glasses

6.13.3 Pumping Station and Leachate Sewers O&M

Personnel conducting O&M activities on pumping stations and leachate sewers are most likely to be exposed to contaminated liquids, landfill and sewer gas and hazards associated with confined space and mechanical equipment.

PPE ensemble - Level D modified as follows, unless upgraded, respiratory protection is required as demonstrated by real time air monitoring:

- hard hat
- steel toed boots
- splash resistant coated Tyvex coveralls
- waterproof chemical resistant gloves (nitrile)
- face and eye splash protection (plastic full face shield)
- waterproof boots or boot covers

6.13.4 Storm Sewers and Outfalls O&M

Personnel conducting O&M activities on storm sewers and outfalls are unlikely to be exposed to contaminated materials. The most likely hazards are associated with confined space and mechanical equipment.

Level D modified as follows unless upgraded respiratory protection is required as demonstrated by real time air monitoring.

- hard hat
- steel toed boots
- waterproof gloves
- waterproof boots or boot covers

6.14 Decontamination Protocols, Procedures and Locations

Sampling and analysis conducted as part of the Remedial Investigation demonstrated that contamination of various media on the Croton Site is relatively low level. Because of the low level nature of site contamination effective decontamination procedures are routine and simple corresponding to common practical personal hygiene.

6.14.1 Protocols

- Decontamination will be conducted as soon after a task as possible and before leaving the site.
- Five gallons of potable water, soap and disposable towels will be carried on maintenance vehicles for the purpose of personnel decontamination.
- Spent disposable cloths and equipment will be collected and disposed along with municipal garbage.
- Soiled non-disposable work clothing will be washed regularly and immediately on sustaining major contamination.

6.14.2 Procedures

- Waterproof non-disposable outer garments such as hardhats, gloves, boots and rain gear will be rinsed off in the field.
- Other non-disposable outer garments such as work gloves and coveralls will be removed in the field and temporarily stored in plastic bags or other suitable containers for washing.
- Hands and face will be washed with soap and water along with any skin suspected of having

been in contact with contaminated media.

- Dirty disposable garments will be removed in the field and stored in plastic bags for later disposal.
- Dirty equipment will be washed with soap and water and/or rinsed as needed in the field.
- If field decontamination is not practical, the procedures outlined above will be followed at the closest possible appropriate location.

6.14.3 Locations for Decontamination

The O&M Crew Office Trailer will be provided with hot and cold running water, sanitary facilities and a shower. These facilities will be available to crew members 24 hours a day, 365 days a week.

The following facilities are open on a seasonal basis:

Outdoor Water - outdoor faucets for field decontamination and replenishing supplies of on-board vehicle decontamination water are at the following location:

- 2 water faucets in meadow adjacent to Park Refreshment Stand
- 1 water faucet adjacent to gazebo
- 1 water faucet adjacent to restrooms in west meadow
- 1 water faucet adjacent to tent campground

Bathroom Facilities - Bathrooms suitable for washing and routine decontamination are located at:

- Trailer Park

- Cabin Campsite on Tellers Point
- In meadow adjacent to Park Refreshment Stand
- West Meadow adjacent to electrical pad
- Tent Campground

Shower Facilities - shower facilities are located:

- Trailer Park
- Cabin Campsite on Tellers Point
- Tent Campground

The following sanitary facilities are accessible year round:

- Park Office Trailer
- Locker room adjacent to Maintenance Building

Figure 12 shows the facilities and locations for decontamination.

Section 7

Emergency Contingency Plan

Section 7
Emergency Contingency Plan

7.1 General

The operation of a closed landfill system can be a dangerous occupation, if proper safety procedures are not followed. Physical injuries and body infections are potential threats. Explosions and asphyxiation from gases or oxygen deficiency are also common hazards.

Safety measures for operation and maintenance of the various systems are effective if hazards are known, and if proper safety precautions are followed. Personnel should be aware of hazards, preventive measures and emergency procedures. Any accidents or injuries which occur should be immediately investigated and recorded. Safety meetings, formal or informal, should be held on a regular basis, and safety equipment must be maintained and tested routinely. It is desirable that all employees become safety-conscious and develop a personal concern in preventing accidents.

The telephone numbers of several physicians, the nearest hospital, the police and fire stations, and one or more ambulance service should be prominently posted at the Office Trailer phone (914-271-9042).

The following contingency plans have been developed to address the potential problems associated with fires, vectors, dust, explosive conditions, severe weather, accidents and illegal dumping, during post closure. It is anticipated that the potential for these problems will be minimal due to proper closure procedures and limited use of the site. The intent is to allow the County to be prepared for the worst-case scenario and to provide the appropriate course of action, depending on events which

occur, Table 7-1, lists the emergency telephone numbers, which should be posted in a conspicuous place near each telephone at the site.

7.2 Emergency Response Procedures

There is a logical sequence of steps in responding to emergencies which should be followed. This sequence includes identifying the emergency, investigating the extent of the emergency, deciding on the proper initial course of action, taking corrective action to rectify the situation, and following up with a post-emergency investigation.

7.2.1 Emergency Notification

In the event of a emergency, the following agencies should be contacted in the order shown:

1. Town of Croton-on-Hudson Fire/Police Department - (914) 271-5177

2. DEF Personnel (See Table 7-1)

3. Westchester County Hazardous Waste Response Team - (914) 593-5900

4. New York Department of Environmental Conservation (800) 457-7362. During working hours (8:30 - 4:30), the NYDEC Regional Solid Waste Engineer should also be called at (914) 256-3155.

Table 7-1

Emergency Telephone Numbers

The following individuals and departments are to be notified in case of an emergency.

	Person/Agency	Work No.	Pager No.	Home No.
1.	DEF Personnel:			
	Clay, W.	528-1630		592-5782
	Kelecseny, E.	528-1630	547-1208	779-3974
	LaBella, J.	965-5233	951-7048	698-1383
	Matarazzo, R.	637-3041	641-7062	203-746-3065
	Posimato, J.	965-5233		718-824-0893
	Simonetti, P.	965-5233	792-8806	528-6174
	Sorrentiono, R.	528-1630	952-5926	739-3286
	Tramelli, A.	637-3063	694-7229	245-4659
	Wilson, J.	528-1630	546-6507	633-1493
2.	Westchester County Police	747-3200		
3.	Westchester County Hazardous Waste Response Team	593-5900		
4.	Sal Desantis Westchester County Parks Department Croton-on-Hudson	285-2620		
5.	Croton-on-Hudson Police Department	271-5177		
6.	Croton-on-Hudson Fire Department	271-5177		
7.	New York Department of Environmental Conservation (NYDEC)	800-457-7362		
8.	NYDEC Regional Solid Waste Engineer - Al Kauss	256-3155		
9.	Grasslands Medical Center Emergency	285-7307		

* These numbers are valid as of September 1995.

5. Westchester County Parks Department, Croton-on-Hudson - Sal Desantis (914) 285-2620

6. Savin Engineers, P.C. - James Gavin (914) 332-4830

7. If required, Grasslands Medical Center Emergency (914) 285-7307

7.2.2 Identify Emergency

This step is obvious in most cases and is essentially that of becoming aware that an emergency exists. Equipment breakdowns, power failures, injuries and natural disasters are usually rather dramatic and will capture attention immediately upon occurrence. In other cases, the worker may have prior warning of an impending emergency through weather reports in the case of natural disasters, and trends in equipment performance in the case of breakdown, etc.

Some emergency situations exist long before the worker is aware that an emergency exists. These cases usually produce larger disasters which then become immediate and obvious. Unattended equipment may have minor breakdowns which go unnoticed; further operations may then lead to complete destruction of the equipment with possible injury to the unwary bystander.

7.2.3 Initial Investigation

Once the worker is aware that an emergency situation exists or that a disaster is impending, an immediate initial investigation should be made. This step is undertaken to assess the severity of the situation and collect enough information to make an initial action decision.

Assessment of the emergency should include identifying obvious injured persons (if any), damage to property and equipment, noting possible impending damage which could occur if corrective action is not taken immediately, and itemizing resources immediately required to correct the situation.

7.2.4 Initial Action

Once the extent of emergency is known, the worker should make an immediate decision as to what initial steps should be taken to correct the emergency situation. This first action, in the case of large scale emergencies, usually consists of notifying responsible authorities and/or calling for the necessary assistance in order of priority.

After the necessary calls have been made, the worker should begin action on his own to remedy matters, but within limitations. The worker should not unduly endanger himself or others by attempting tasks for which the proper equipment is not available or with which he is unfamiliar. Injury cases are the best example. If the worker is not familiar with first aid techniques, he should do little more for an injured person than to keep him out of further danger. Moving a patient unnecessarily or attempting first aid when not absolutely needed may cause further, lasting injury to the patient.

In all cases, if in doubt, wait until qualified help arrives before taking action.

7.2.5 Corrective Action

When help arrives, the worker should immediately inform those called of the pertinent details of the

situation. If the type of emergency is beyond his own capabilities, the worker should also immediately appoint the proper person to supervise corrective action. While work is underway, the worker should find time to notify persons not called initially, but who have interests at stake in the emergency.

Corrective action should be continued until the situation is either under control or completely rectified. If correction will take considerable time, the worker should consult with the required parties to outline a long-term effort to complete the task.

7.2.6 Follow-Through

After the situation is corrected, the worker should make every effort to determine why the emergency occurred, review the corrective action taken, and then take preventive action to minimize the chance of recurrence.

In the case of equipment failure, if negligence was not a factor, then revising maintenance procedures would be the most likely first preventive step. For natural disasters which cannot be prevented from recurring, the procedures followed in dealing with them can be reviewed to develop more effective action plans.

> NOTE: IN ALL EMERGENCIES, THE STATE REGULATORY AGENCY AND THE FEDERAL ENVIRONMENTAL PROTECTION AGENCY REGIONAL OFFICIALS SHOULD BE NOTIFIED AND A FOLLOW-UP REPORT MADE DETAILING WHAT HAPPENED AND HOW THE SITUATION WAS CORRECTED. ALSO THE OPERATORS SHOULD ASK FOR AND EXPECT ASSISTANCE FROM THESE AGENCIES WHEN THE SITUATION WARRANTS.

7.3 Site Access

The public may access Croton Point across the Croton Point Avenue Bridge from routes 9 or 9A. The bridge is single lane, and traffic direction is controlled at either end by traffic light alternating at approximately 6 minute intervals. The bridge crosses the Metro North Croton/Harmon Railroad Yard.

Private access to Croton Point includes a service road through the Half-Moon condominium complex to the north, and a railroad grade crossing from the south end of the Croton-On-Hudson commuter parking lot into the Metro North Rail Yard.

Other potential accesses to the site includes shallow draft vessels and helicopter. The site is adjacent to both sandy beaches and a shallow sheet pile bulkhead. The Park provides several open and flat surfaces, including fields and parking lots, suitable for Helicopter landing.

Vehicular access to the site is from the Croton Point Park access road. The Park access road is the extension of Croton Point Avenue on the west side of Croton Point Bridge. The paved access road follows the perimeter of the site around 60% of its circumference on the North and west side. Unpaved vehicle access and maintenance roads enter the site from the North and South ends. The remaining east side 40% of the site perimeter is inaccessible except through the site.

7.4 Spill Contingency Plan

The following addresses emergency procedures for responding to contaminated liquid spills

associated with rupture of force mains or failure of leachate and contaminated liquid handling facilities.

Three general conditions which might allow the uncontrolled release of contaminated liquid are as follows:

- Pumping station failure
- Sewer line blockage
- Force main failure

Appropriate responses are as follows:

- Identify and shut down all upstream contributing sources. Follow guidance provided in Section 2.2.3 System Operational Constraints.
- Implement the Emergency Notification Procedures outlined in Section 7.2.1.
- Contact impacted abutting land owners including Metro North. See emergency phone numbers in Section 7, Table 7-1.
- Secure the impacted area to access only by emergency responders, fire and police personnel.
- Initiate spill control and cleanup procedures.
- Use earth moving equipment to construct dikes and berms of soil to restrain the spread of the spill.
- Block or dike off storm sewer manholes and catch basins to prevent spill release through the storm sewer system.
- Use sandy soil or other suitable absorbent material to absorb spilled material.

- Use plastic sheeting laid inside berms to construct temporary retaining or holding structures.
- Identify and repair the initial cause of the spill.

7.5 Vector and Wildlife Control Contingency Plan

Vector control problems are expected to be minimal after proper closure of the landfill. The landfill cap will provide adequate cover which should preclude vectors burrowing into waste for food.

As part of site inspection activities, evidence of vectors should be recorded and reported. In the event a problem does arise with vectors, particularly with rodents, an extermination program can be initiated. This task should be performed by licensed professionals.

If wildlife control problems are identified on site, for instance, cover damage due to burrowing animals, a survey of the extent and severity of the problem will be undertaken. On completion of the survey, a determination of appropriate action shall be made. Such action could include extermination programs undertaken by a licensed professional or a trapping program conducted by a DEC licensed wildlife trapper.

7.6 Dust Control Contingency Plan

The closure of the landfill includes vegetation of the final cover. Vegetation should eliminate problems of blowing dust. During excessive dry periods, there may be potential for dust problems to develop during high winds. If this should precipitate complaints or present potential for erosion

7.7 Explosive Gas Contingency Plan

Normal air contains about 21 percent oxygen by volume. Any atmosphere containing less than 19.5 percent oxygen is dangerous to human beings and is termed oxygen deficient. Such a situation may occur in any confined space such as sumps and wet wells if another gas displaces the oxygen.

Noxious and toxic gases or vapors may also exist in enclosed areas. The following are some of the more common hazardous situations.

1. Gas emitted by gas well heads, groundwater monitoring wells, leachate or wastewater is explosive when mixed with certain proportions of air. It can be asphyxiating, and is sometimes toxic. Methane is the main constituent of such gas mixtures and accounts for 60 to 70 percent of their volume. It is odorless and colorless and cannot be detected without testing equipment. Manholes, wet wells, well heads, monitoring wells and other enclosed or poorly ventilated spaces should not be entered for inspection or repairs until their atmosphere has been tested for flammable gas mixtures, for oxygen deficiency and for hydrogen sulfide. If any doubt exists about the quality of air in a confined space, positive ventilation or self-contained breathing apparatus should be used. A second person should always be present in case of unforseen problems.

2. Hydrogen sulfide has an odor similar to rotten eggs and can be easily detected by smell in small concentrations. In strong concentrations, it causes impairment or temporary loss of the sense of smell and may cause suffocation before one realizes

what is happening. Manholes, wet wells, well heads, monitoring wells and other poorly ventilated spaces should not be entered if a hydrogen-sulfide reading obtained by a detector is in excess of 50 ppm. Table 7-2 shows typical effects of hydrogen sulfide in various concentrations.

3. Gasoline and other flammable and volatile substances may find their way into the system from time to time. Such materials pose a serious fire and/or explosion hazard in wet wells, or wherever there is an open surface of wastewater. Smoking or open flames should be absolutely prohibited in such areas, and only explosion-proof lights or flashlights should be permitted. Tools should be of the non-sparking type.

4. Materials releasing toxic gases may also enter the system occasionally and could cause personnel hazards in the previously mentioned areas. Personnel should be alert to such danger and be sure that an area is purged of all foreign gases before entering. If irritation of the eyes, nose or throat is experienced, personnel should leave immediately.

5. The first workman to enter a confined area should wear a safety belt and be witnessed by a least another person to assist him to safety if necessary. A good rule to observe is never to go alone into a hazardous location. There should be a minimum of three persons present. Someone should be present who can observe the worker's condition and who is equipped to give all necessary assistance in case of

Table 7-2
Physiological Response to Various Concentrations of Hydrogen Sulfide[1]

Response	Concentration/ppm
• Maximum allowable concentration for prolonged exposure	10
• Ceiling limit, 8 hours	50
• Slight symptoms after several hours	70-150
• Maximum concentrations for one hour; serious consequences possible	170-300
• Death Possible	400-700
• Immediate Death	5000

Note 1: Most landfills do not have H_2S in concentrations greater than 10 PPM. However, concentrations up to 250 PPM have been measured.

Note 2: In many cases, laboratories do not know how to properly analyze for H_2S. Draeger tube check analyses are generally more accurate than most laboratories, if other interferants are not present.

[1]Source: "Compilation of Landfill Gas Laboratory and Field Practices and Procedures", GRCDA Landfill Gas Committee, October 1985

emergency.

6. Fires may start spontaneously from exposed and/or decomposing solid waste.

7. Smoking is prohibited near hazardous areas.

8. Responsible personnel should be familiar with the care and use of the self-contained breathing apparatus. This equipment should be stored in a readily available location, but one which is appropriately remote from potential sources of toxic gases.

9. Painting in confined areas should be undertaken only with proper ventilation.

7.8 Flood and Storm Damage

The closure of the landfill has been designed for adequate drainage and control of normal rain conditions. During severe weather conditions (heavy rainstorm) and flood conditions, the integrity of the constructed cap and surrounding terrain may deteriorate in localized areas due to erosion. After the occurrence of a severe storm or flood, an inspection of the landfill area must be conducted to check for erosion of the cover, or adjacent areas that could eventually affect the cover. In the event that areas of excessive erosion are found, actions must be taken to repair and return the damaged area to its proper state. Special attention should be given to the drainage ditches and steep slopes.

Catastrophic erosion, such as that which exposes the synthetic cover materials, should be repaired in compliance with the design specifications included in Appendix B. Some of the issues that must be considered are:

- Use of appropriate replacement materials both natural soils and geosynthetics.
- Protection of the VLDPE cover, gas wells and headers, during construction.
- Removal of eroded material from drainage system.
- Reseeding and planting with appropriate materials.

7.9 Power Loss

The post-closure landfill system has been designed so that in the event of a power loss all operating systems on the landfill will shutdown. Pumping stations and landfill gas flare stations local indicator alarm beacons light up to indicate power loss. All facilities will have to be restarted manually. Power loss on the landfill is also indicated at the Main Control Panel of the Yonkers Joint Wastewater Treatment Plant (YJWTP). The control room of the YJWTP is manned 24 hours a day,

7 days a week. Upon indication of power loss, personnel at the Croton Landfill are contacted during weekdays and the Westchester County Department of Environmental Facilities during weekends by the operating staff at YJWTP.

7.10 Accident Procedures

If an accident does occur, the following procedure should be followed:

1. **Injury When Victim is Not Incapacitated.** Authorized personnel who receive injuries that

do not incapacitate them, such as minor burns, punctures, and sprains, should be given first aid at the site only when necessary. The victim should then be taken to the hospital emergency room for examination and treatment.

2. **Serious Injury.** First aid should be rendered only by individuals who have had first aid training. Give only that first aid which is necessary to prevent further harm to the accident victim. Seriously injured victims should not be moved unless they are in danger because of their location.

Be certain to obtain personal information about the accident victims in order to complete accident forms. If person is not authorized to be on the site, inform the police.

3. **Procedures After an Accident.** County representatives should make a complete investigation of the accident, including occurrences which may have led up to the accident. The investigation should be started as soon as possible. All witnesses to the accident and persons involved in the accident should be interviewed.

After the facts about the accident have been compiled, a determination of probable cause(s) of the accident should be made and a report filed with the County and, if appropriate, with their insurance carrier.

After a thorough investigation and determination of the causes, corrective steps should be

taken if applicable so that the same type of accident will not reoccur. Corrective steps may include, but are not limited to, instruction to authorized personnel, safety precautions, and the elimination or repair of unsafe conditions.

7.11 Vandalism

In the case that vandalism is observed to be taking place or has already taken place, the following procedures should be followed:

1. Whoever observes or comes across vandalism shall report the incident to the foreman of the Croton Sanitary Landfill. The observer shall note the following:

   a. Observe where the vandalism occurred; by whom if possible (make of vehicle if present, and individuals identifying characteristics); what was vandalized; extent of damage and any obvious emergency precautions to be taken. Such observations should only be made with extreme caution, and with utmost regard for safety.

   b. If responsible person(s) is still present, the observer should not try to detain the person(s) alone, but should immediately inform the police and the Region 6 NYSDEC. If the responsible person(s) attempts to leave the site, the observer should make note of any identifying information.

2. The foreman should:

   a. Make arrangements for temporary repairs if warranted of the damaged site. Evaluate health and safety considerations.

b. Maintain records of all pertinent facts regarding the damaged site including, but not limited to, any available information on responsible party, badge number and name of police officers responding to call, copy of police report, health and safety measures taken.

c. Notify NYSDEC Regional Solid Waste Engineer. Damage to the landfill gas main flare or the pumping station should be considered potentially hazardous and the New York State Department of Health should be notified.

d. Maintain careful records of personal service and other costs incurred as a result of the vandalism, including, security costs in isolating the area, cost of repairs, and any other pertinent costs.

e. All damages should be repaired to original condition.

7.12 Illegal Dumping

No wastes are allowed to be disposed of at the landfill. There is potential for illegal dumping of wastes at the landfill which may even include hazardous wastes. In the case that illegal dumping is observed to be taking place or has already taken place, the following procedures should be followed:

1. Whoever observes such dumping shall report the incident to the foreman of the Croton Sanitary Landfill. The observer should take all possible care to:

a. Avoid exposure to the material dumped.

b. Observe where the material was dumped; by whom (make of vehicle and individuals identifying characteristics); how much was dumped; whether containers were dumped and if they appear sound or leaking; what the material looks like and if any smells were noticed. Such observation should only be made with extreme caution, and with the utmost regard for safety.

c. If possible, ask the hauler where the material was picked up.

d. The observer should not try to detain the vehicle alone, but should immediately inform the Region 6 NYSDEC and, if possible, ask the driver of the vehicle to remain at the dumping point to ensure adequate vehicle identification. If the driver attempts to leave the dumping point, the observer should make note of any identifying information.

2. The foreman should:

a. Record all pertinent facts regarding the vehicle including, but not limited to: name of hauler, license plate number, County landfill permit number, where the load was picked up if known, any visible evidence of the identity of waste substance, quantity and state of substance (solid or liquid), and if contained or loose.

b. Maintain careful records of personnel service and other costs incurred as a result of the dumping incident including, but not limited to, security costs in isolating the area, costs of removal (by contract or otherwise) of the suspect material, costs of intermediate or ultimate treatment and/or disposal, and any other pertinent costs.

c. Notify NYSDEC Regional Solid Waste Engineer.

d. Where radioactive or hazardous waste is suspected, notify the New York State Department of Health.

e. The Westchester County Department of Environmental Facilities will be responsible for determining whether or not material is hazardous based on criteria of 6 NYCRR Part 371. If it is not hazardous, the material will be removed to a permitted waste disposal facility. If material is positively identified as hazardous, arrange for disposition according to NYSDEC procedures and in strict conformance with the requirements of 6 NYCRR Part 371. If known, the responsible party for dumping the waste should be notified and made responsible for cleanup.

7.13 Safety Equipment

Workers engaged in the operation and maintenance of post-closure facilities should wear the

following protective safety equipment as appropriate for various O&M tasks:

1. Respiratory protection as appropriate for level of hazard;
2. Hard hats, if near moving or mechanical equipment or if working in confined spaces;
3. Steel-toed shoes, rain boots, or both;
4. Safety glasses or face shields;
5. Protective gloves (rubber or plastic if working with wet solid waste, or where exposure to leachate/condensate is expected.)
6. Hearing protection, depending on noise level of work environment.

Other protective equipment may include:

1. Chemically protected overalls (Saranex/tyvex);
2. Steel-toe, steel-shank neoprene boots;
3. Chemically protective gloves (i.e., viton, neoprene, nitrile).

The following safety equipment should be available at the site in quantities sufficient to cover all personnel:

1. Clean water, soap, paper towels.
2. First aid kit, eye wash station, stretcher, and blanket.
3. Fire extinguishers (2) - 20-A80B:C.
4. "No Smoking" signs.
5. Acid gas/organic vapor respirator.
6. Self-contained breathing apparatus.

7. Parachute-type harnesses (2) and safety lines (for use in excavation, manholes, etc.)
8. Explosimeter/oxygen indicator.
9. Hydrogen sulfide indicator (direct reading instrument or Draeger Tubes).
10. Additional monitoring equipment for toxic vapors and aerosols.
11. Barricades.
12. Covers for excavations that will remain open at end of working day.
13. Air-moving equipment that can provide ventilation if working in sub-standard air environment (trenches, condensate drain pits, wet wells, etc.).
14. Fire blanket.

7.14 Settlement and Ponding

These two conditions suggest subsurface shift or compaction of the buried waste mass. Settlement may change slopes and hinder or slow runoff while ponding is an indication that a no slope condition exists. In either case soil saturation may occur leading to impingement of water on the low permeability layer, accelerated infiltration with associated leachate generation.

Small localized areas of settlement or ponding may be repaired by the addition of cover soils with reseeding to facilitate runoff and eliminate the ponding conditions.

Larger areas of ponding and settlement may require major construction including the addition of soil coupled with placement of a new cover system. Any major repair of this nature must be designed in accordance with the original design specification and in concert with the existing cover

components. Besides regulatory issues, cover replacement will need to address the following issues in addition to many location specific design issues:

- Interface between existing cover and new including questions of removing old cover system.
- Welding and joining to maintain continuity of cover components.
- Access to landfill gas wells.
- Drainage system modifications.

7.15 Cap Damage or Replacement

Every effort should be made to avoid cap damage. No invasive activities should be undertaken on the landfill cover. All traffic should remain on access roads. If cap repair or replacement is required, it must comply with the requirements of the original design documents, regulatory issues and with all pertinent requirements of OSHA regulation governing health and safety issues.

Some of the problems that might justify major cap repair include:

- Identification of leachate or landfill gas leaks above the cover.
- Some repairs to landfill gas wells or header pipes.
- Major settling or ponding on the landfill.
- Slope failure.
- Failure in the perimeter leachate and condensate collection system.

Any problem of this magnitude will require a substantial design effort, addressing the following issues:

- QAQC issues
- Exposure to hazardous waste and health and safety hazards.
- Hazardous waste training and medical monitoring of workers.
- Protection of existing closure components.
- Maintaining operation of closure components.
- Protection of public health and safety and the environment.

The above issues must not be undertaken without notifying authorities and conducting the proper designs.

7.16 Abnormal Vegetation

Identification of abnormal vegetation on the landfill cover or around its perimeter may suggest failure in the landfill closure components. However, similar conditions may be due to a variety of other conditions.

For apparent stressed, dead or dying vegetation on or around the landfill cover, possible causes may include:

- Normal decay
- Seasonal cycle
- Road salt
- Too little water
- Landfill gas

- Chemical spills or illegal dumping

For apparent unusual greenery or lush growth on or around the landfill cover, possible causes may include:

- Normal growth in well suited flora
- Normal variation between differing species
- Favorable drainage
- Leachate seeps

Abnormal conditions in vegetation should be noted and reported. Any condition the cause of which cannot be determined should be identified for immediate investigation.

Any abnormal condition in vegetation which can be attributed to landfill gas, chemical spills, illegal dumping or leachate seeps, will require response beyond the scope of this manual. Any such response should be designed, coordinated and planned in concert with appropriate State and County officials and in accordance with the original design documents and appropriate OSHA regulations.

7.17 Emergency Disposal of Leachate

Prior to the installation of the Croton Landfill Leachate Collection System, the County of Westchester provided offsite disposal of leachate collected from the Ballfield and Railroad 1 landfills. The offsite disposal was accomplished removing leachate from landfill sumps and pumping stations via tanker trucks and discharging it into the Hawthorne Local Septage Receiving Station. The

current leachate collection and disposal system was implemented to replace the tanker truck system by providing automatic collection and disposal of leachate.

In the event of extended shutdown of the Croton Landfill Leachate Collections System, the County may return to the system of pumping and trucking leachate to the Hawthorne Local Septage Receiving Station.

7.18 Invasive Activities

Pursuant to the requirements of the March 1993 NYSDEC Record of Decision for the Croton Point Landfill, deed restrictions limit future site uses to specific non-intrusive activities that will not interfere with the effectiveness of the site remedial actions. This should be interpreted as precluding any activity impacting remedial components, not related to the operation and maintenance of the remedial components, as described herein, which would tend to interfere with or compromise the integrity of the remedial components or their normal function. Examples of some activities that would be precluded include:

- Disturbance of the landfill cover
- Blocking or diversion of drainage structures
- Non O&M related motor vehicle travel on the cover system
- Introduction of unauthorized materials into the leachate sewer system
- Erection of structures on the cover system

During the course of O&M activities for the landfill closure components, intrusive activities may be

required. Examples of some intrusive activities that could be required include:

- Excavation of the cover system to repair landfill gas collection system elements
- Repair of erosion damage
- Rehabilitation of groundwater monitoring wells or gas collection wells
- Rehabilitation of leachate collection system elements

Intrusive activities beyond the routine scope of O&M activities outlined herein shall be conducted according to the following:

- The NYSDEC shall be notified as soon as practicable and shall be a party to and provide approval for any design or premeditated intrusive activity.
- Intrusive activities shall be planned and implemented according to the letter and intent of the Project Design and Contract Documents using the same materials and procedures as required by the Contract Documents.
- Intrusive activities shall be planned and conducted in accordance with all applicable Health, Safety and Emergency response requirements contingencies and as specified herein and in the project Contract Documents.

7.19 Fire

All fires should be immediately reported to the Town of Croton-on-Hudson Fire/Police Department at (914) 271-5177.

Operation and maintenance vehicles, park facilities and offices should be equipped with fire

extinguishers. After notifying the fire department, an attempt should be made to extinguish small fires, such as trash can fires.

Under no circumstances should unqualified or untrained personnel attempt to fight large fires or fires with the potential of releasing toxic fumes. In such cases, personnel should evacuate the area, contact the fire department and remain clear of the area until instructed to return.

Section 8

Post Closure Program Record Keeping and Reporting Requirements

Section 8
Post Closure Program Record Keeping and Reporting Requirements

8.1 Post Closure Care Record Keeping Requirements

As part of the Post Closure Care program for the Croton Point Sanitary Landfill, operation and maintenance personnel are required to complete a variety of record keeping tasks. Record keeping will be completed as part of the O&M tasks for Post Closure Operations, Maintenance and Inspection and Environmental Monitoring and Sampling Programs.

Record keeping is conducted as part of the Post Closure Care Program to:

- Track proper completion of operation and maintenance tasks.
- Track trends in the results of environmental sampling and monitoring.
- Demonstrate compliance with the requirements of the NYCRR Part 360 Regulations and the DEC Record of Decision.
- Provide the basis for preparing annual and quarterly reports to the State.

8.2 Post Closure Operation Program

8.2.1 Leachate, Seep and Landfill Gas Condensate Collection System

Record keeping will primarily consist of completing the individual Daily Discharge Logs for the system's five pumping stations, the summary Weekly Discharge Log and the summary Monthly Discharge Log. In addition, the nature and location of any operational problems will be recorded on the log sheets as appropriate. Copies of the discharge logs are included in Appendix A. The following procedure will be followed:

Daily Discharge Logs (Individual pumping stations)

- Visit each pumping station daily.
- Record month, year, start and end date, and operator name.
- Record date, time of visit and the reading of the Elapsed Time Meter.
- Calculate and record hours of operation by subtracting the last recorded reading from the present reading.
- Calculate and record discharge quantity by multiplying hours of operation by pump capacity (varies with station).

Weekly Discharge Log (System weekly total)

- Complete weekly.
- Record month, year, start and end date, and operator name.
- Enter results from individual pumping station logs.
- Calculate and record sewage and seeps contribution by summing contributions from the Ballfield and Seeps Pumping Stations and subtracting it from the flow recorded for Pumping Station 1.
- Calculate and record the RR-1 leachate and sewage contribution by summing contributions from Pumping Station 1 and the Landfill Gas Condensate Pumping Stations and subtracting it from the flow recorded for Pumping Station 2.

Monthly Discharge Log (System monthly total)

- Complete monthly.

- Record month, year, and operator name.
- Record week start and end dates for all the weeks in the current month.
- Enter results from the weekly discharge logs.
- Record weekly discharge totals from Ballfield, Seeps/Condensate, Gas Condensate, Pump Station No. 1 and 2 pumping stations. Also, record the weekly RR1 discharge.
- Record the weekly total sewage and seeps contribution.

8.2.2 Landfill Gas Control System

Landfill Gas Collection System

Record keeping for the landfill gas collection system will consist of recording the results of monthly system tuning and balancing tasks for individual gas wells, the four header circuits and the combined flow. Sample recording log sheets are included in Appendix A.

The following will be recorded at each location during every Balancing/Tuning episode:

- Date, time, location, temperature, weather conditions
- Operator name
- Condition of sampling location
- Landfill gas composition (methane, carbon dioxide, nitrogen, oxygen)
- Vacuum
- Flow rate (if applicable)
- Action taken and justification (open/close valve)

- New vacuum/flow readings

Landfill Gas Handling System and Flare

Record keeping for the landfill gas handling and flare system will consist of manually recording operational parameters. In addition, hard copy from the System Data Logger and the Flare Chart Recorder will be recovered and documented weekly. Sample recording log sheets are included in Appendix A.

The following will be manually recorded daily:

- Date, time, location, temperature, weather conditions
- Operator name
- Flare operational status
- If down, reason for failure and steps taken for restart
- Operating temperature (actual and set point)
- Header line vacuum (actual and set point)
- Gas flow rate
- Blower status, amps and hour meter readings
- Action taken/adjustments made

8.3 Post Closure Monitoring and Sampling Program

Record keeping tasks for the post closure monitoring and sampling program consists of documenting

that sampling and analysis procedures are in compliance with approved methods and recording field procedures and results of laboratory analysis.

Specific recording requirements will vary with media to be sampled and should be as required by approved sampling protocols. In general, the following documentation will be completed:

- QA/QC procedure (including chain of custody)
- Sampling procedures
- Field notes including any deviations from procedures
- Laboratory procedures
- Laboratory results

8.4 Post Closure Maintenance and Inspection Program

Record keeping requirements for the post closure maintenance and inspection program consist of recording the results of routine tasks outlined in Section 4 for the following closure components:

- Landfill Cover System
- Landfill Gas Control System
- Stormwater Control System
- Leachate, Seep and Landfill Gas Condensate Collection System

To facilitate the recording procedure summary, recording forms have been prepared and are included in Appendix A. The summary forms delineate maintenance and inspection tasks into daily,

bi-weekly, weekly, bi-monthly, monthly, quarterly and year periods.

Each form should be completed for each tasks during the appropriate maintenance/inspection period with the following information:

- Period start and end date
- O&M personnel
- Date work performed
- Condition of component and work performed
- Recommendations or requirements for additional work
- Additional comments

8.5 Post Closure Program Reporting Requirements

As part of the post closure care requirements for the Croton Point Sanitary Landfill, the 6NYCRR Part 360 Regulations require that annual summary reports must be submitted to the Department. In addition, quarterly reports describing environmental sampling and monitoring activities will be submitted to the Department. The following section outlines report requirements.

8.5.1 Purpose

8.5.1.1 Annual Report

The annual summary report will:

- Provide the means for the Department to determine that the post closure system is being

maintained and operated to requirements laid out in the Part 360 regulations and in the Department's Record of Decision.

- Summarize the results of ongoing environmental sampling and monitoring to demonstrate that the landfill remedial action is continuing to safeguard the environment and the public health and safety as intended.

- Provide the basis to review and modify future environmental monitoring and sampling requirements.

8.5.1.2 Quarterly Report

Quarterly reports will provide a detailed description of ongoing environmental monitoring and sampling activities described in Section 3.

8.5.2 Reporting Requirements

8.5.2.1 Annual Report

The annual summary report will summarize routine operation and maintenance activities described in Sections 2 and 4 and describe in detail non-routine activities completed on the:

- Landfill Gas Control System
- Leachate, Seep and Landfill Gas Condensate Collection System
- Landfill Cover System

- Stormwater Control System

The annual report will summarize the results of all environmental monitoring and sampling activities described in Section 3 including:

- Surface water
- Stormwater
- Groundwater
- Leachate
- Landfill Gas
- Marsh Sediments
- Perimeter Soil Gas Survey

8.5.2.2 Quarterly Report

Quarterly reports will provide a detailed description of the sampling activities for the media listed above. The reports will include:

- QA/QC procedures
- Description of field activities
- Sampling and sample preservation procedures
- Laboratory procedures
- Laboratory analysis and results

List of Tables

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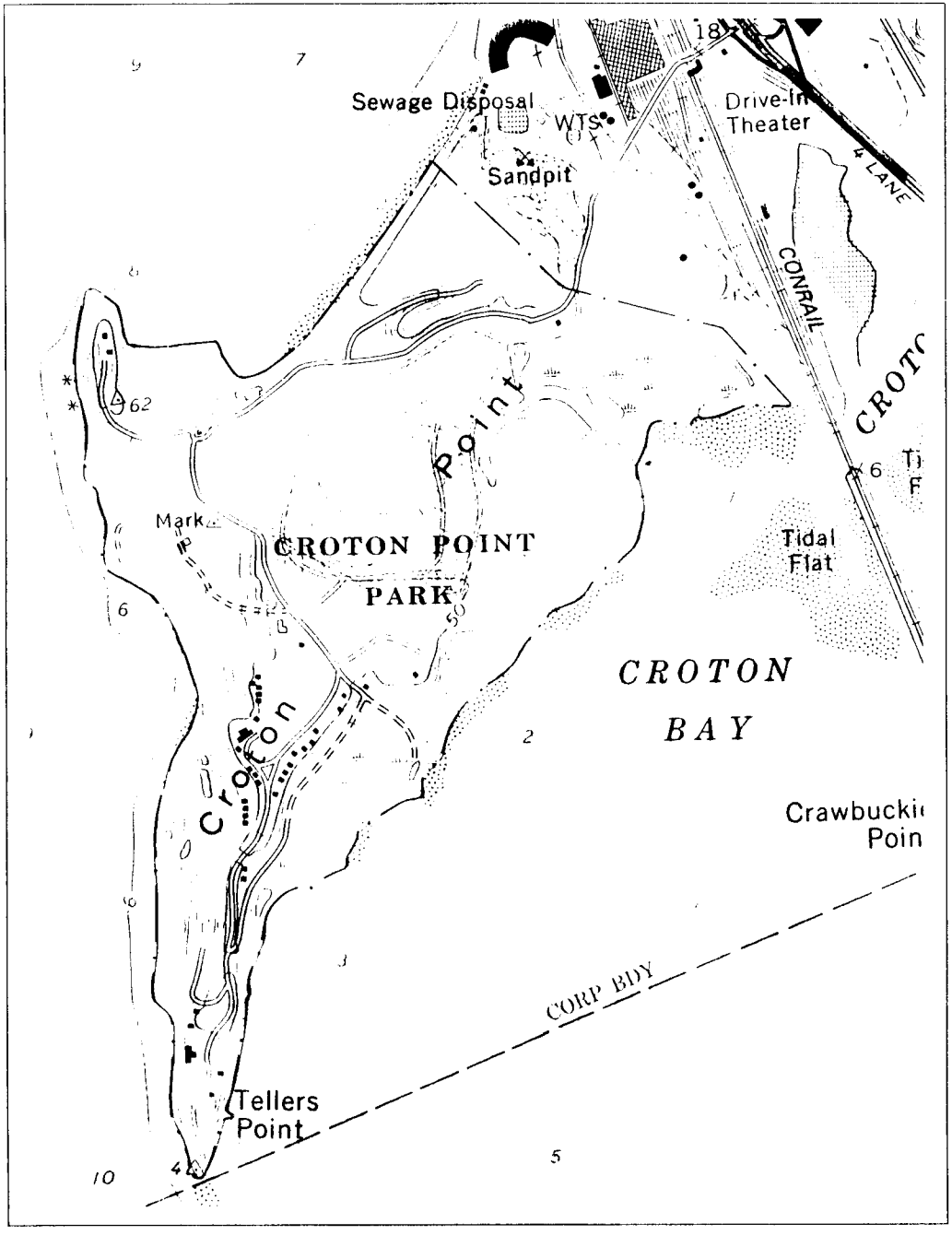
Figures

Figure 1

Croton Point Sanitary Landfill Site Location Map



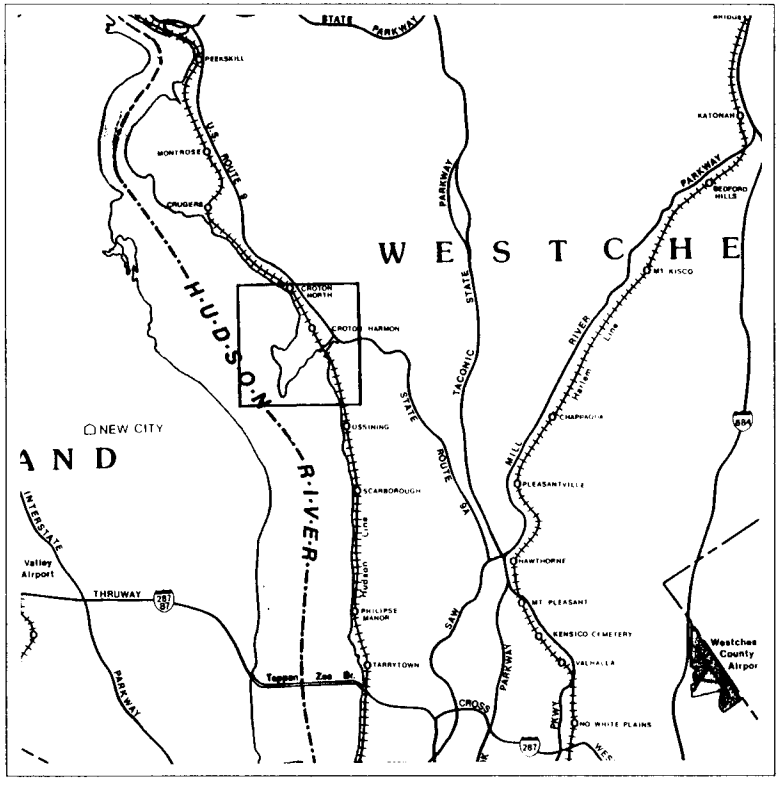


FIGURE 1
LOCATION PLAN

Figure 2

Croton Main Ballfield and Railroad 1 Landfills Location Map

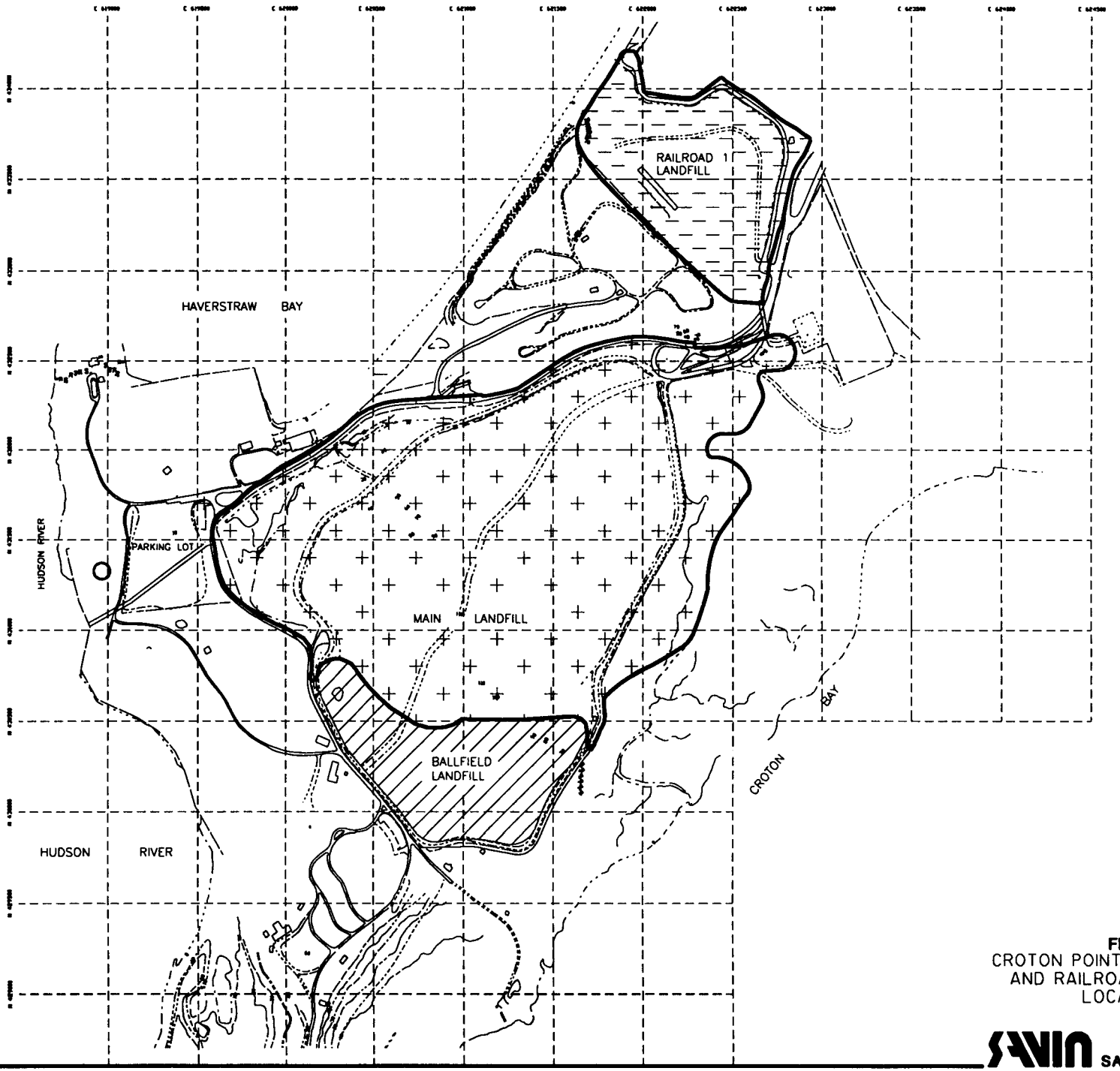


FIGURE 2
CROTON POINT MAIN, BALLFIELD
AND RAILROAD 1 LANDFILLS
LOCATION MAP

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Figure 3

Limits of Landfill Cover System

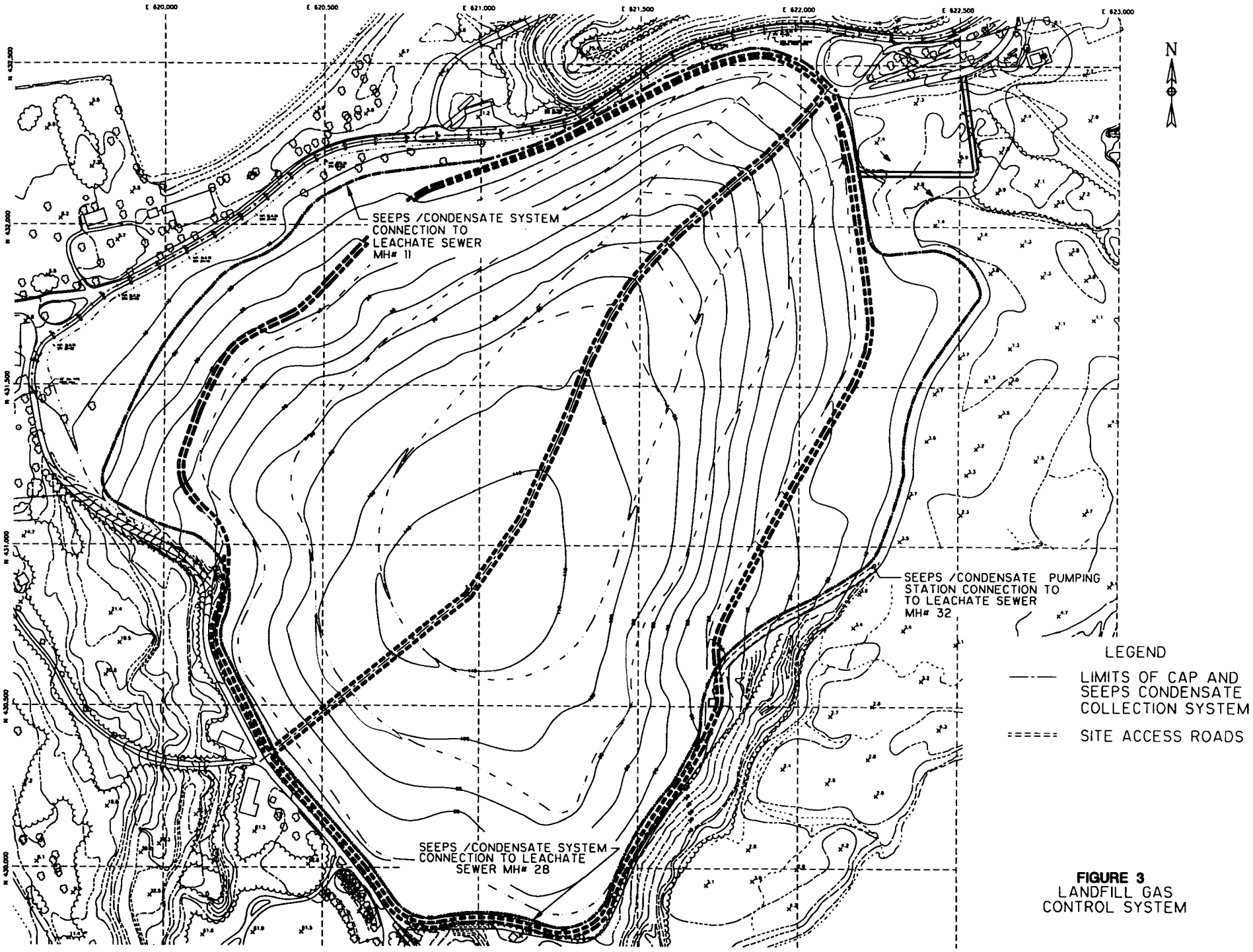

FIGURE 3
LANDFILL GAS
CONTROL SYSTEM

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Figure 4

Landfill Cover System Cross Section

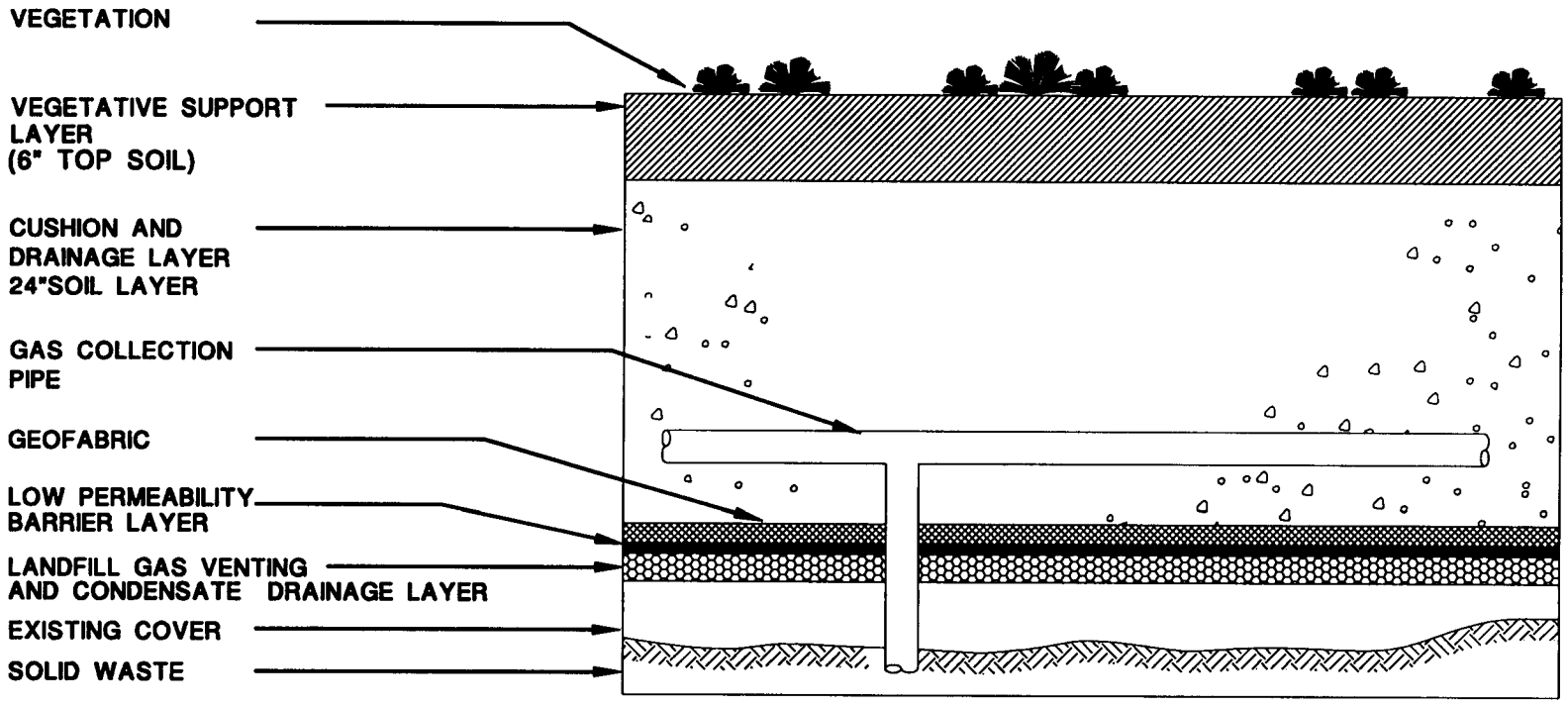

FIGURE 4
LANDFILL COVER SYSTEM
CROSS SECTION

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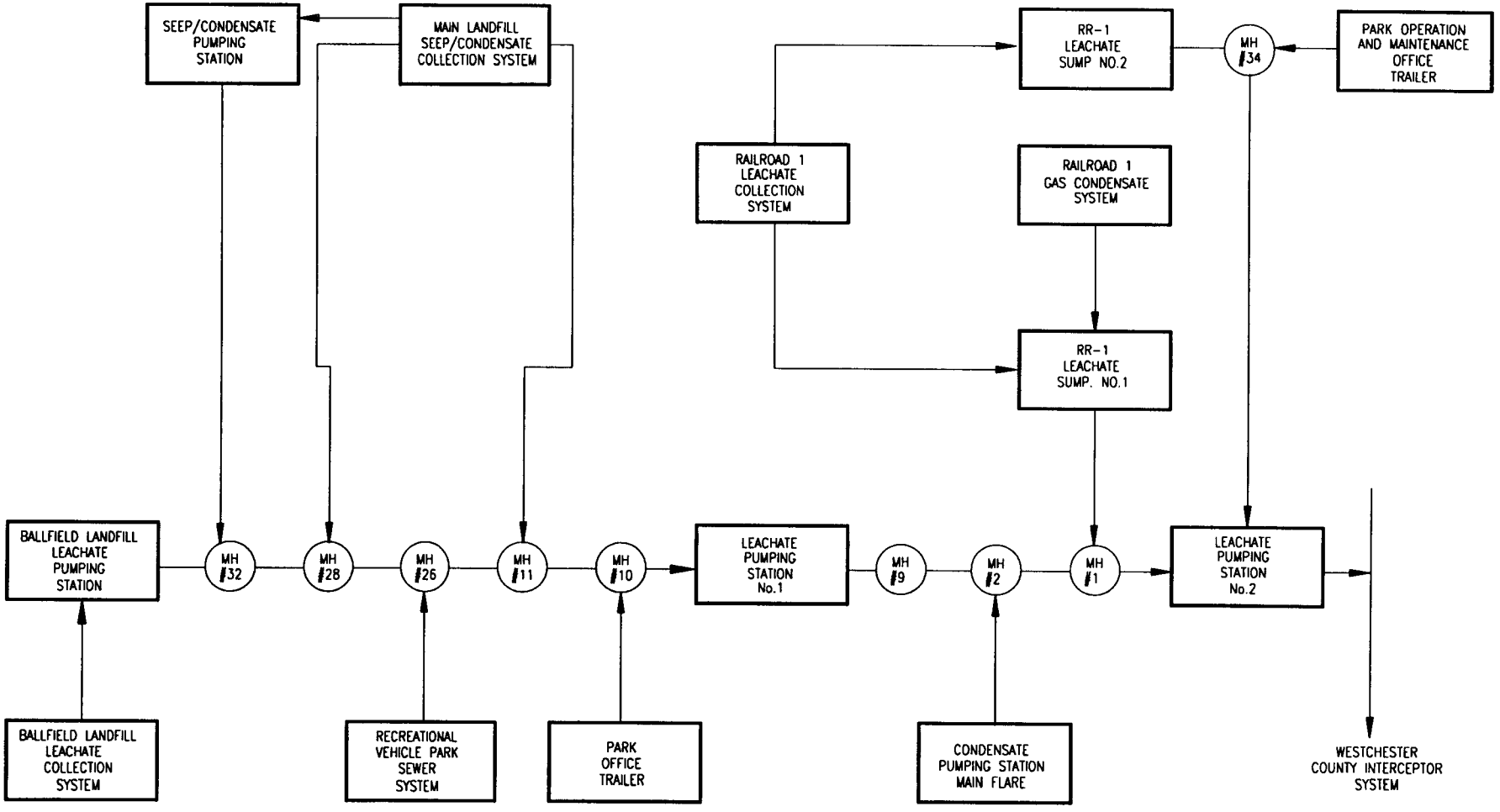
Figure 5

Leachate and Landfill Gas Condensate Collection System Schematic



NOTE:

THE FOLLOWING MANHOLES HAVE BEEN PROVIDED WITH STUBS FOR FUTURE SEWER CONNECTIONS

MANHOLE No. 13
MANHOLE No. 16
MANHOLE No. 18
MANHOLE No. 24
MANHOLE No. 25
MANHOLE No. 27
MANHOLE No. 34

FIGURE 5
LEACHATE AND GAS CONDENSATE COLLECTION SYSTEM FLOW SCHEMATIC

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Figure 6

Leachate and Landfill Gas Condensate Collection System

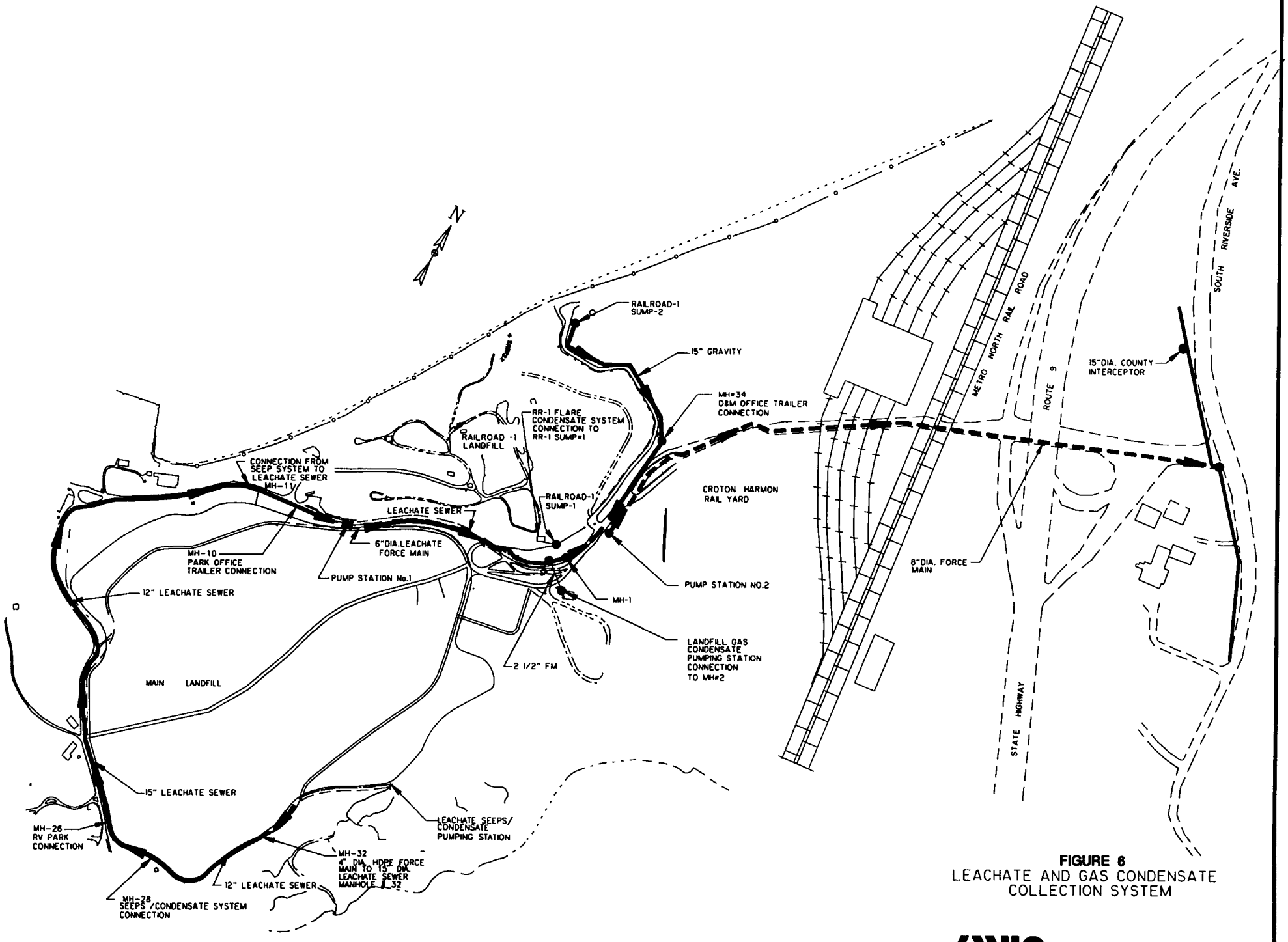

FIGURE 6
LEACHATE AND GAS CONDENSATE COLLECTION SYSTEM

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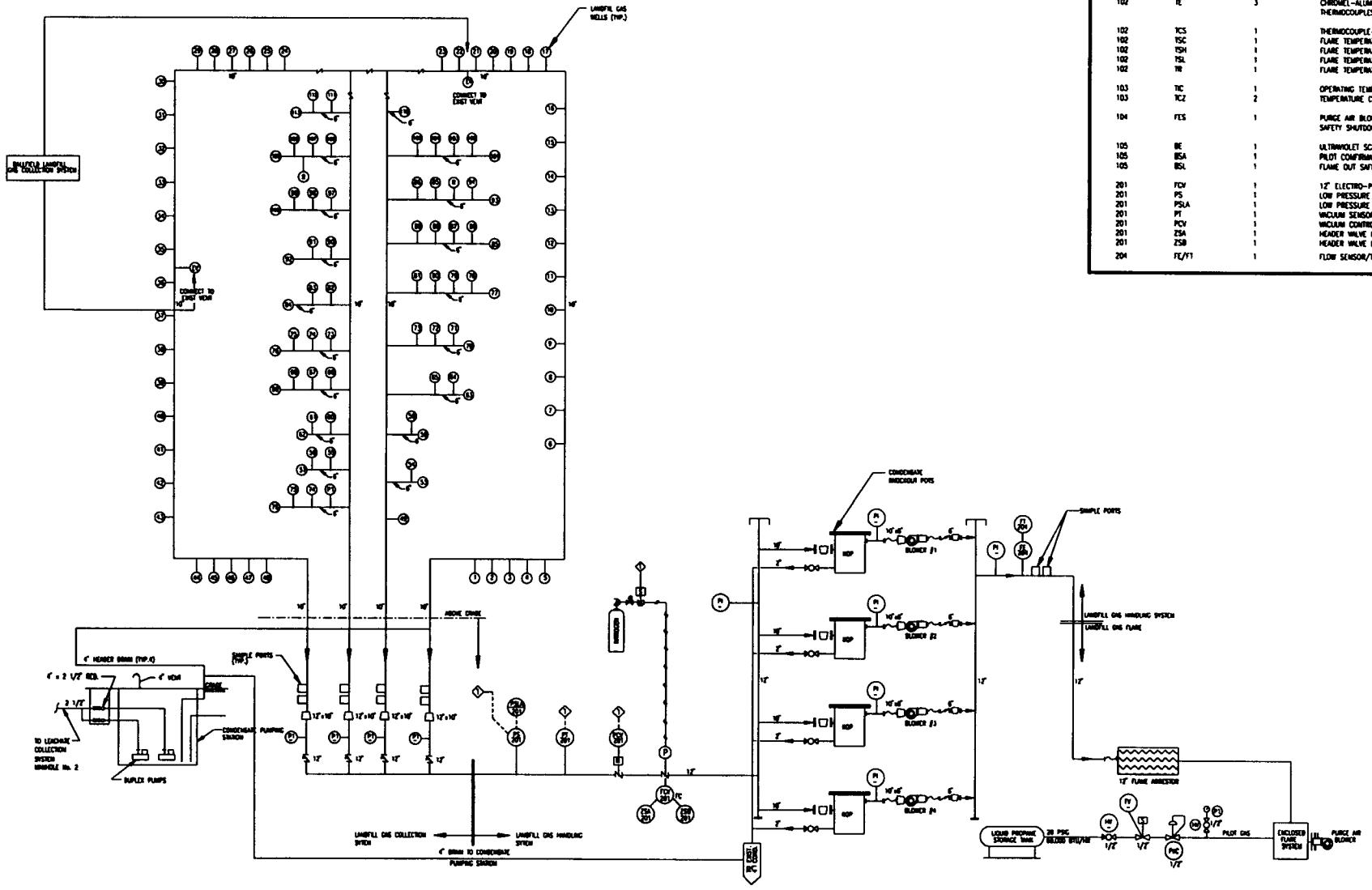
Figure 7

Landfill Gas Control System Schematic



LEGEND–FLARE INSTRUMENTATION

ITEM NO.	ABBREV-IATION	QTY	DESCRIPTION
101	TE	1	CHROMEL–ALUMEL (TYPE K) THERMOCOUPLE–SENSE PILOT TEMPERATURE
101	TSC	1	PILOT TEMPERATURE SENSING CONTROLLER
101	TSA	1	PILOT SAFETY SHUTDOWN AND ALARM
102	TE	3	CHROMEL–ALUMEL (TYPE K) THERMOCOUPLES–SENSE FLARE TEMPERATURE
102	TCS	1	THERMOCOUPLE–SELECTOR SWITCH
102	TSC	1	FLARE TEMPERATURE SENSING CONTROLLER
102	TSH	1	FLARE TEMPERATURE SAFETY SHUTDOWN HIGH
102	TSL	1	FLARE TEMPERATURE SAFETY SHUTDOWN LOW
102	TR	1	FLARE TEMPERATURE MONITOR/RECORDER
103	TIC	1	OPERATING TEMPERATURE CONTROLLER
103	TCZ	2	TEMPERATURE CONTROLLLED AIR LOUVER/ACTUATOR
104	FES	1	PURGE AIR BLOWER FLOW SENSOR SWITCH SAFETY SHUTDOWN
105	BE	1	ULTRAVIOLET SCANNER
105	BSA	1	PILOT CONFIRMATION
105	BSL	1	FLAME OUT SAFETY SHUTDOWN
201	FCV	1	12" ELECTRO–PNEUMATIC BUTTERFLY VALVE
201	PS	1	LOW PRESSURE SWITCH
201	PSLA	1	LOW PRESSURE SWITCH ALARM
201	PT	1	VACUUM SENSOR AND TRANSMITTER
201	PCV	1	VACUUM CONTROL VALVE
201	ZSA	1	HEADER VALVE LIMIT SWITCH (OPEN)
201	ZSB	1	HEADER VALVE LIMIT SWITCH (CLOSED)
204	FE/FT	1	FLOW SENSOR/TRANSMITTER

FIGURE 7
LANDFILL GAS CONTROL
SYSTEM SCHEMATIC

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Figure 8

Landfill Gas Control System

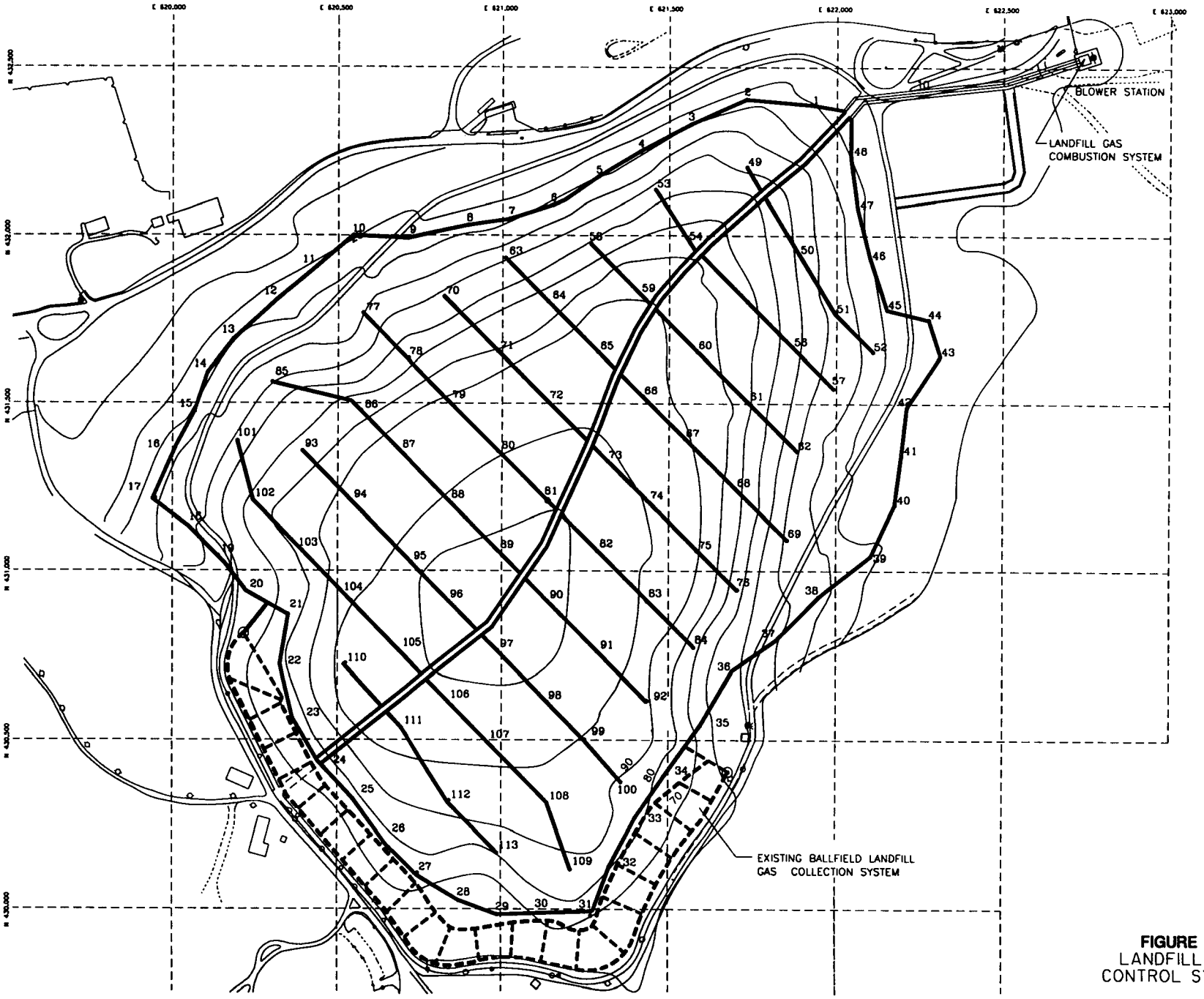

FIGURE 8
LANDFILL GAS
CONTROL SYSTEM

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Figure 9

Stormwater Control System

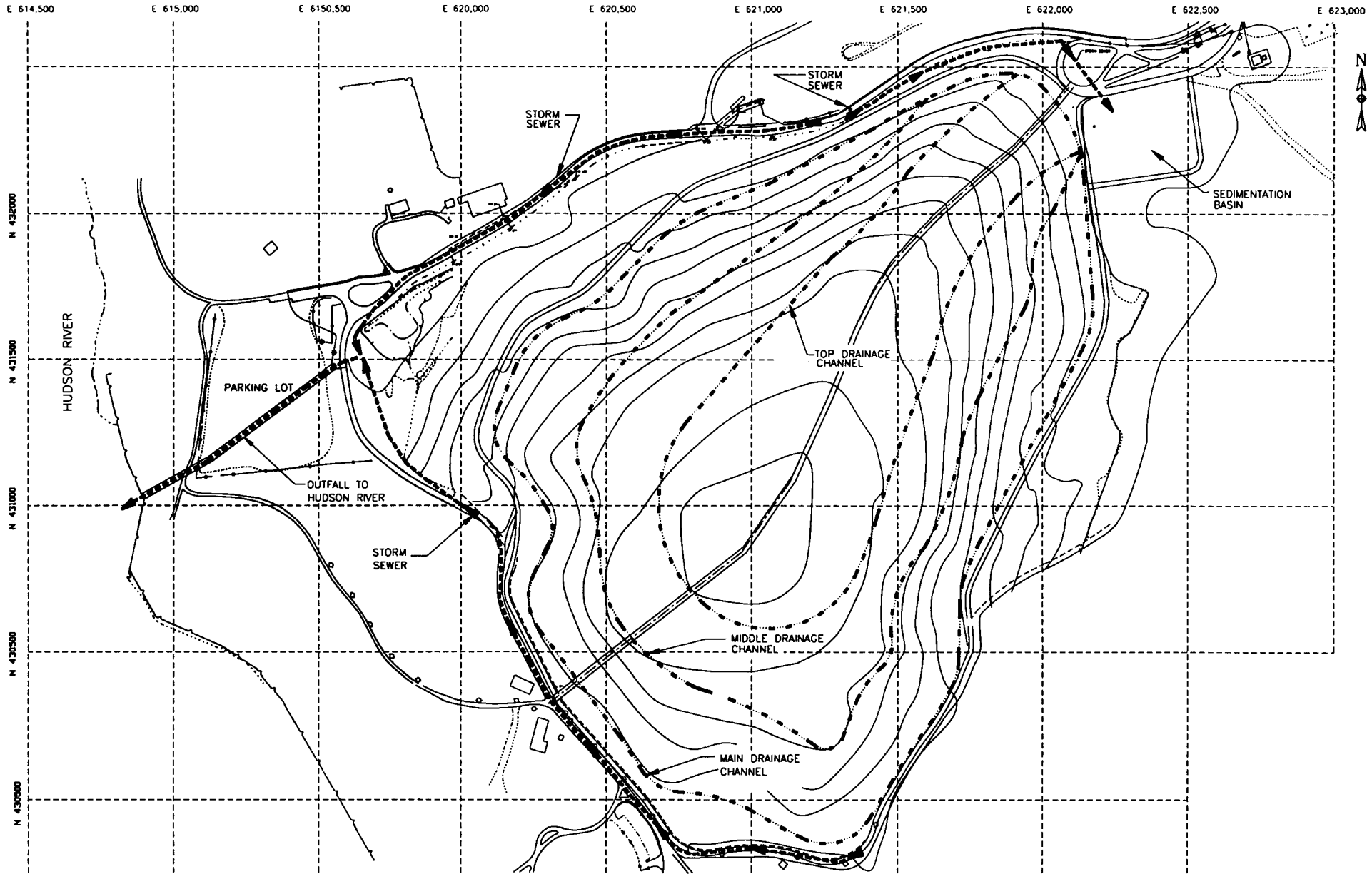

FIGURE 9
STORM WATER CONTROL SYSTEM

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OM\FIGURE 9/6/95

Figure 10

Environmental Monitoring and Sampling Locations

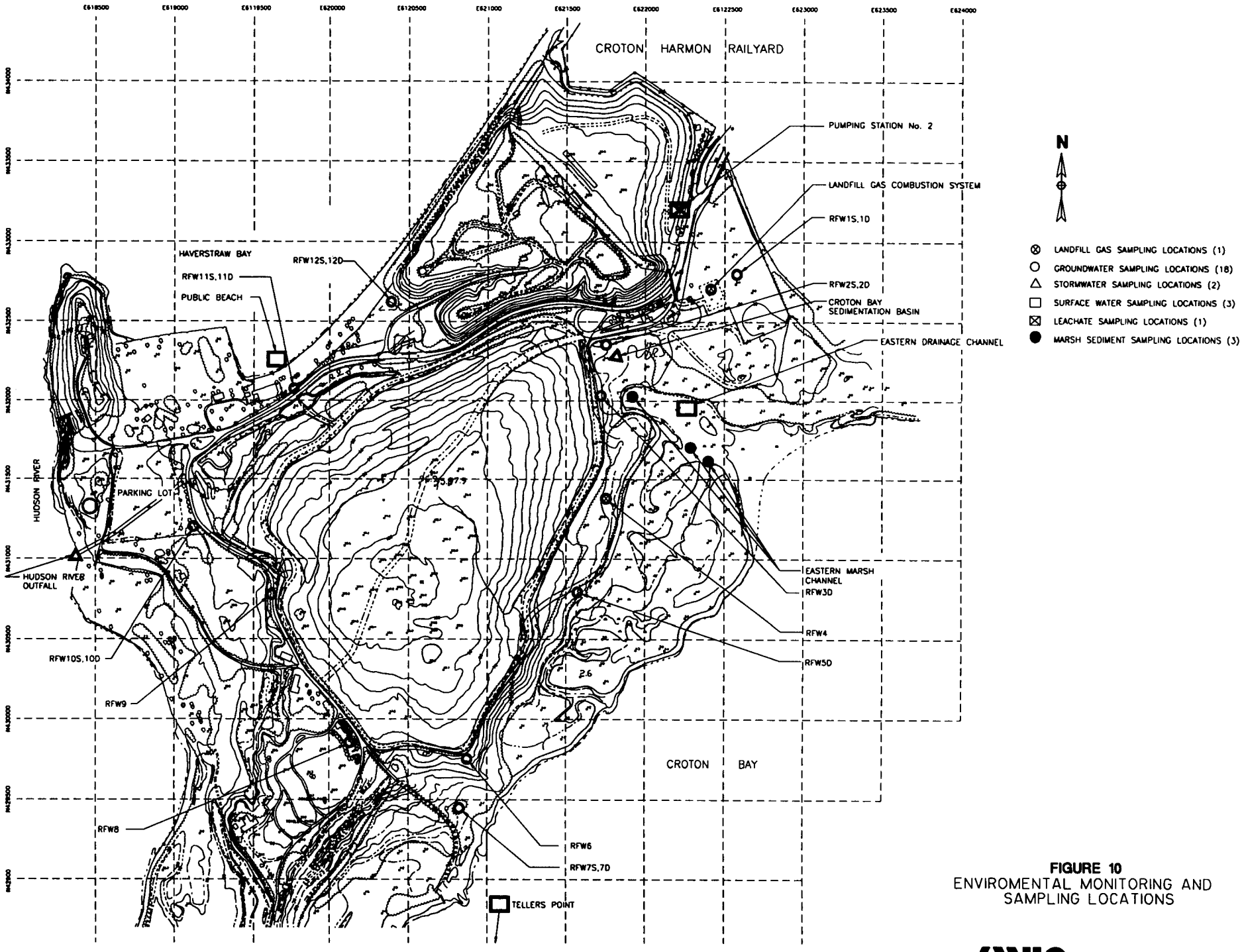

FIGURE 10
ENVIROMENTAL MONITORING AND SAMPLING LOCATIONS

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Figure 11

Perimeter Soil Gas Survey

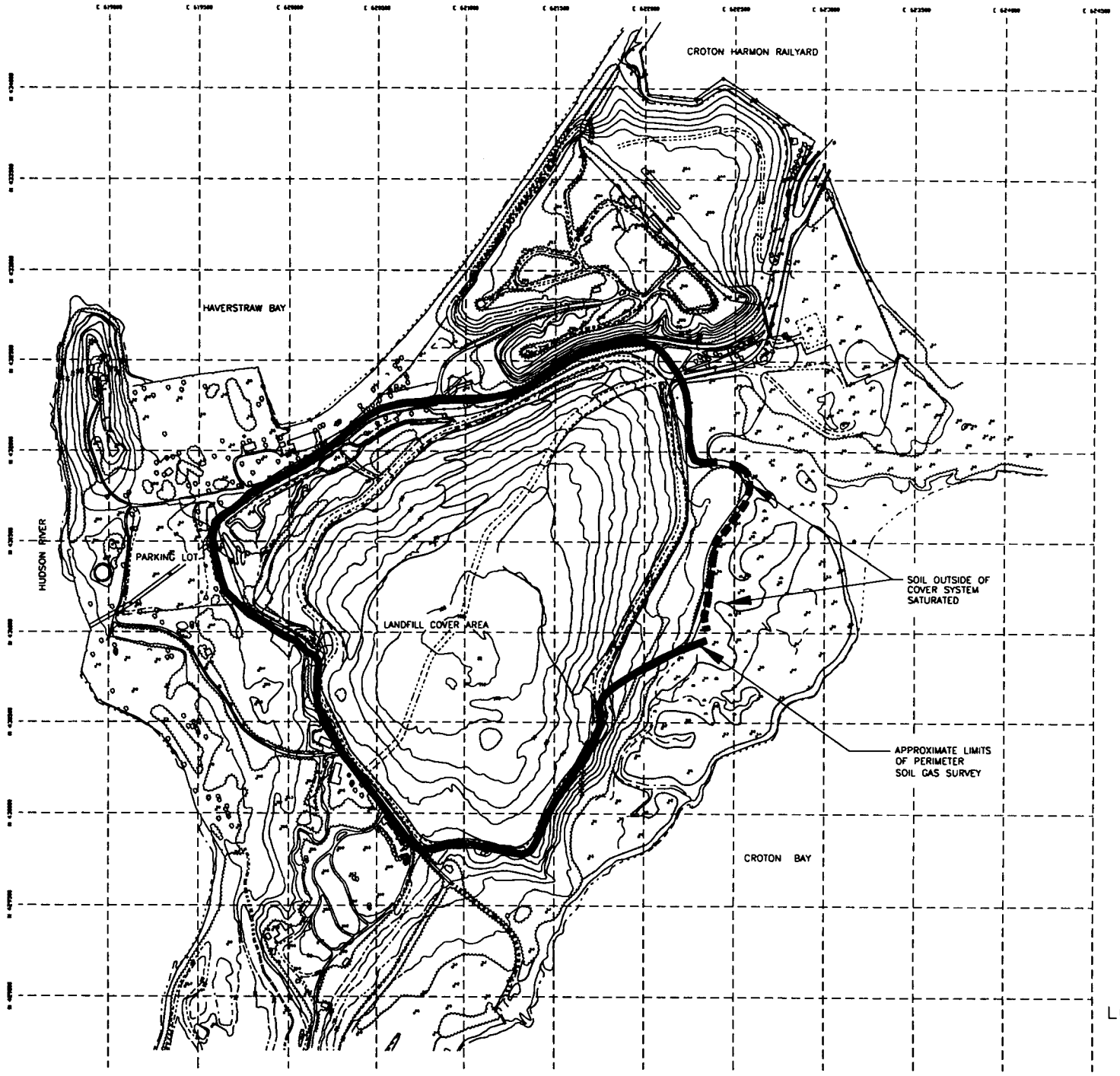

FIGURE 11
LOCATION OF PERIMETER
SOIL GAS SURVEY

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Figure 12

Facilities and Locations for Decontamination

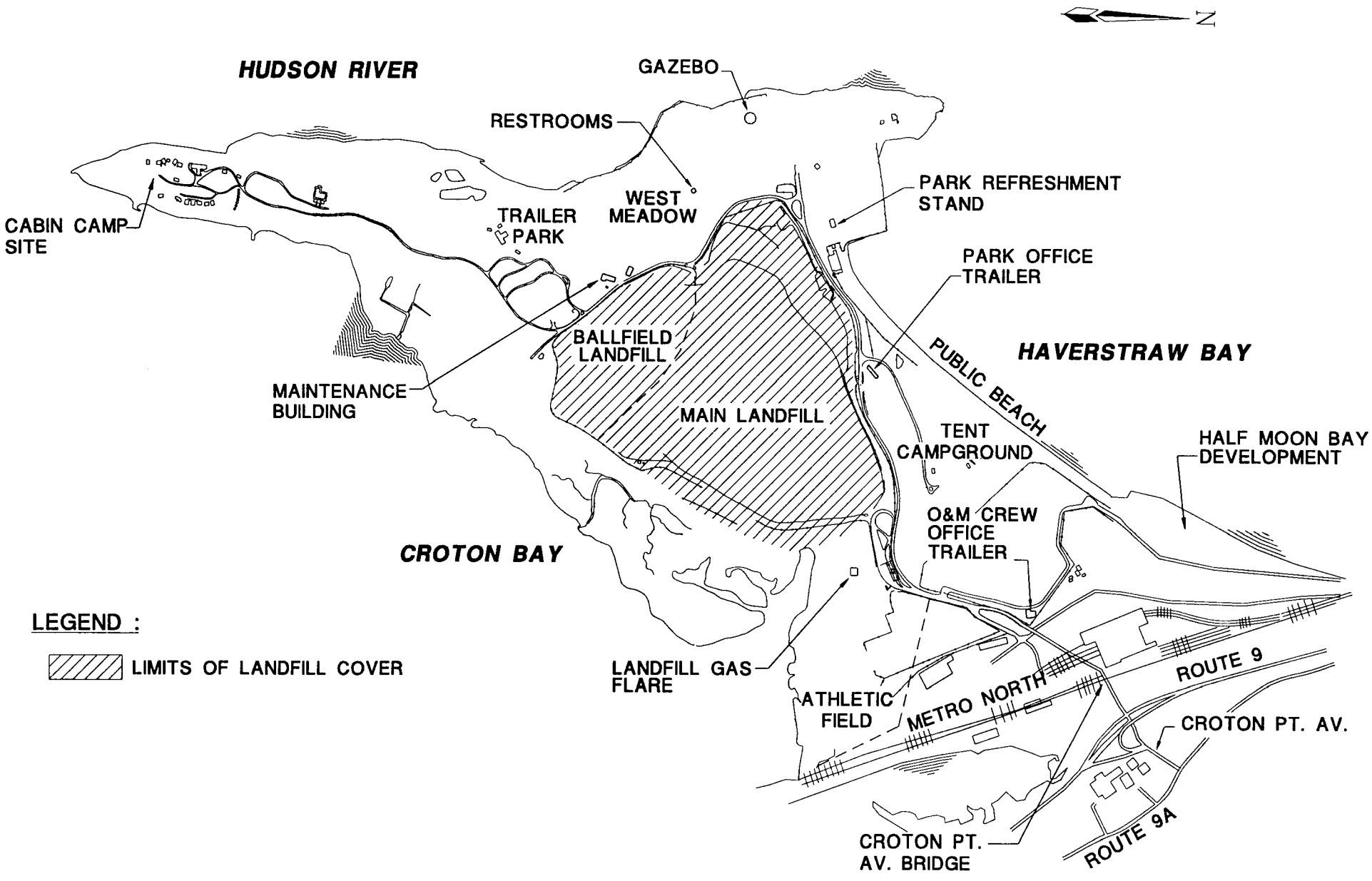

FIGURE 12
FACILITIES AND LOCATIONS
FOR DECONTAMINATION

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