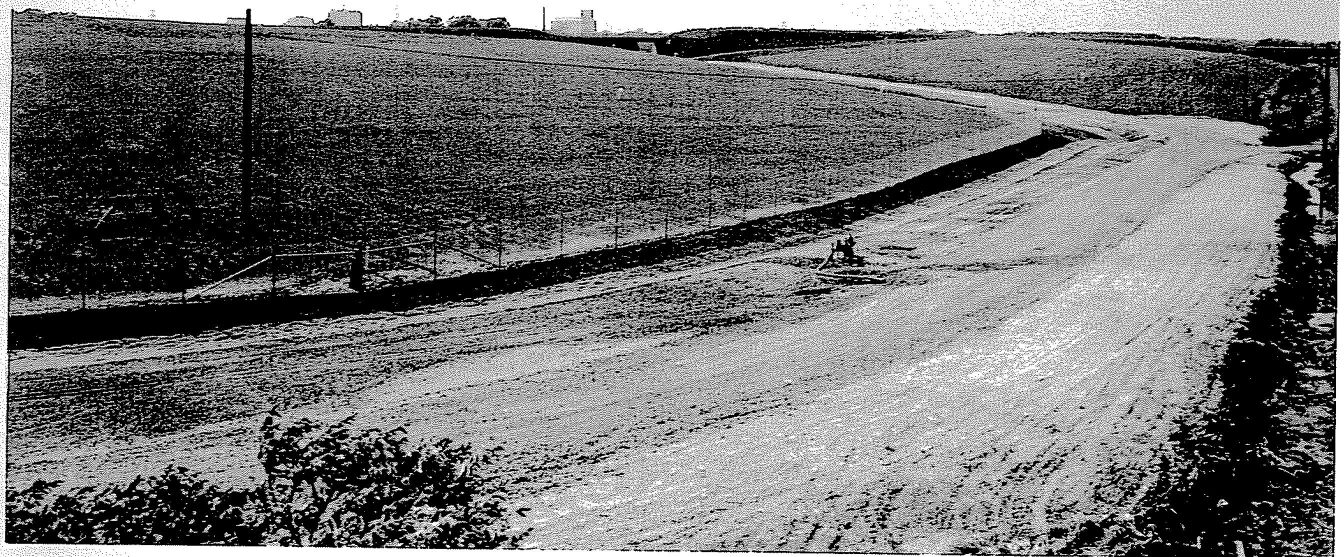
MALCOLM PIRNIE



MARILLA STREET LANDFILL CLOSURE CONSTRUCTION MONITORING REPORT FOR THE MISCELLANEOUS DEBRIS AREAS

LTV Steel Company
Cleveland, Ohio

Project No. 0848-22-3

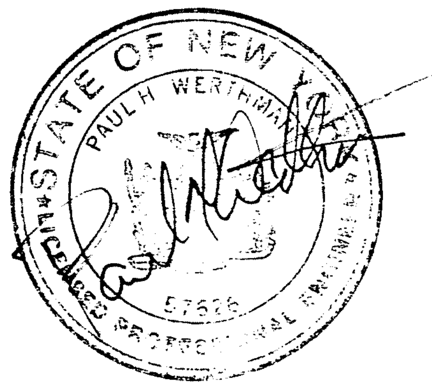
MALCOLM PIRNIE

MARILLA STREET LANDFILL CLOSURE
CONTRACT NO. 3

CONSTRUCTION MONITORING REPORT FOR THE MISCELLANEOUS DEBRIS AREAS

LTV STEEL COMPANY
CLEVELAND, OHIO

JANUARY 1994



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CONTRACT NO. 3
CONSTRUCTION MONITORING REPORT
MISCELLANEOUS DEBRIS AREAS

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1.0 INTRODUCTION

1.1 BACKGROUND

LTV Steel Company (LTV) owns the Marilla Street Landfill, which is located on an approximate 100-acre parcel of property in the City of Buffalo, New York. Regional and vicinity maps illustrating the location of the landfill site are presented as Figures 1 and 2, respectively. The landfill is separated into five (5) fill areas: Basic Oxygen Furnace (BOF) Dust Area, Clarifier Sludge Area, Miscellaneous Debris and Fine Refuse Area, Fine Refuse Area and Railroad Fill Area, for a total of approximately 80 acres. For the purpose of this report, the Miscellaneous Debris and Fine Refuse Area, the Fine Refuse Area and the Railroad Fill Area will be referred to as the Miscellaneous Debris Areas.

Construction activities in the Miscellaneous Debris Areas were performed under two separate contracts. Contract No. 2 was for the subgrade preparation work (in addition to constructing the final cover system in the Clarifier Sludge Area). Contract No. 3 was for the construction of the final cover system in the Miscellaneous Debris Areas.

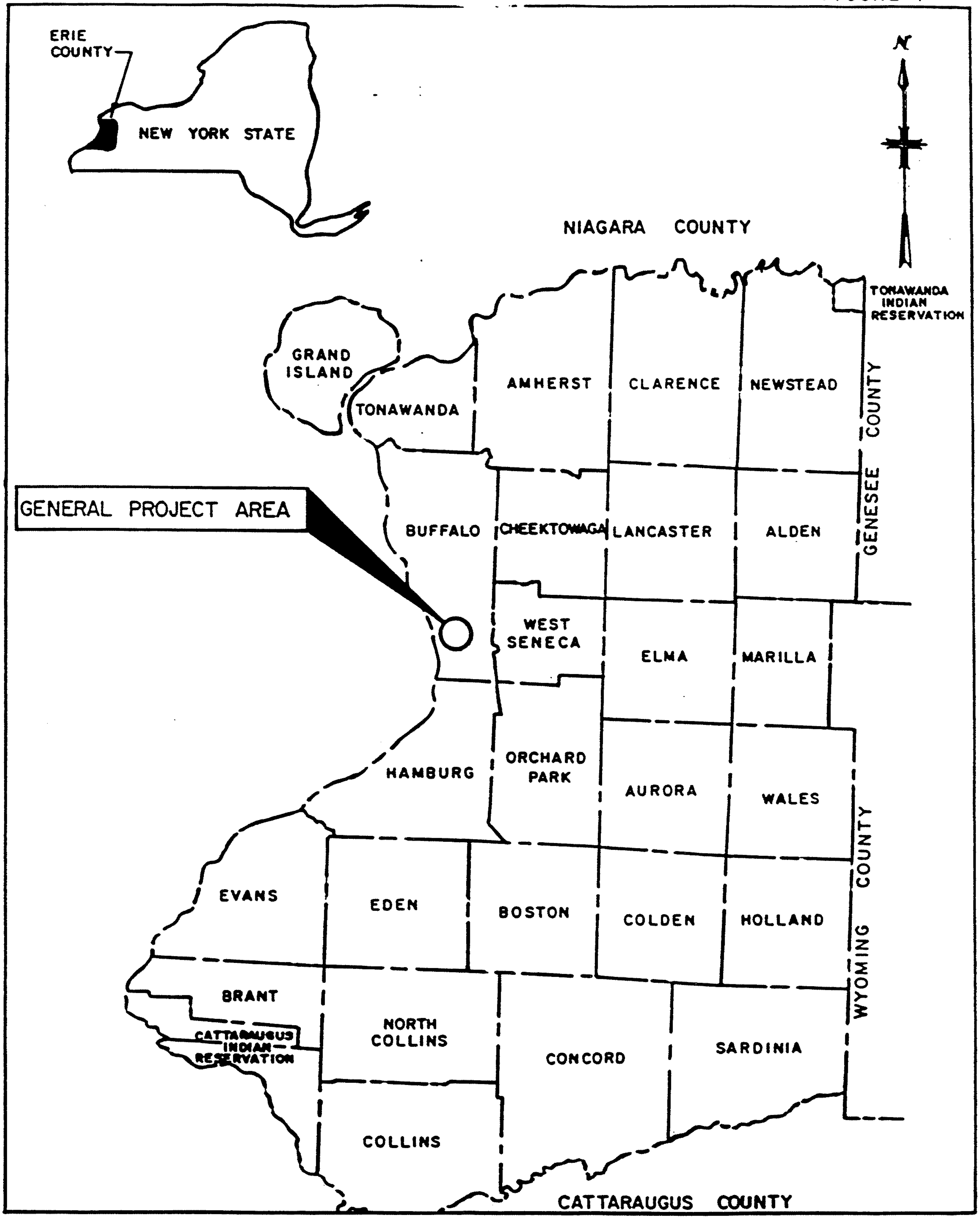
Malcolm Pirnie, Inc. prepared Contract Documents dated April 1991 for construction of the final cover system for the approximate 60-acre Miscellaneous Debris Areas. The Contract Documents were approved by the NYSDEC on July 22, 1991. The contract for the cover system construction was competitively bid and awarded to Site Contractors, Inc. Construction activities began in late August 1991 and were completed in October 1993.

1.2 PURPOSE AND SCOPE

The purpose of this report is to present the observations and data collected during the construction of the final cover system for the Miscellaneous Debris Areas. Specifically, this construction monitoring report provides:

- Daily construction logs indicating work performed each day, weather conditions, field testing results, problems encountered and remedial activities undertaken to correct these problems;
- Laboratory test results;

FIGURE 1



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MARILLA STREET LANDFILL CLOSURE
CONSTRUCTION MONITORING REPORT
MISCELLANEOUS DEBRIS AREAS
REGIONAL MAP

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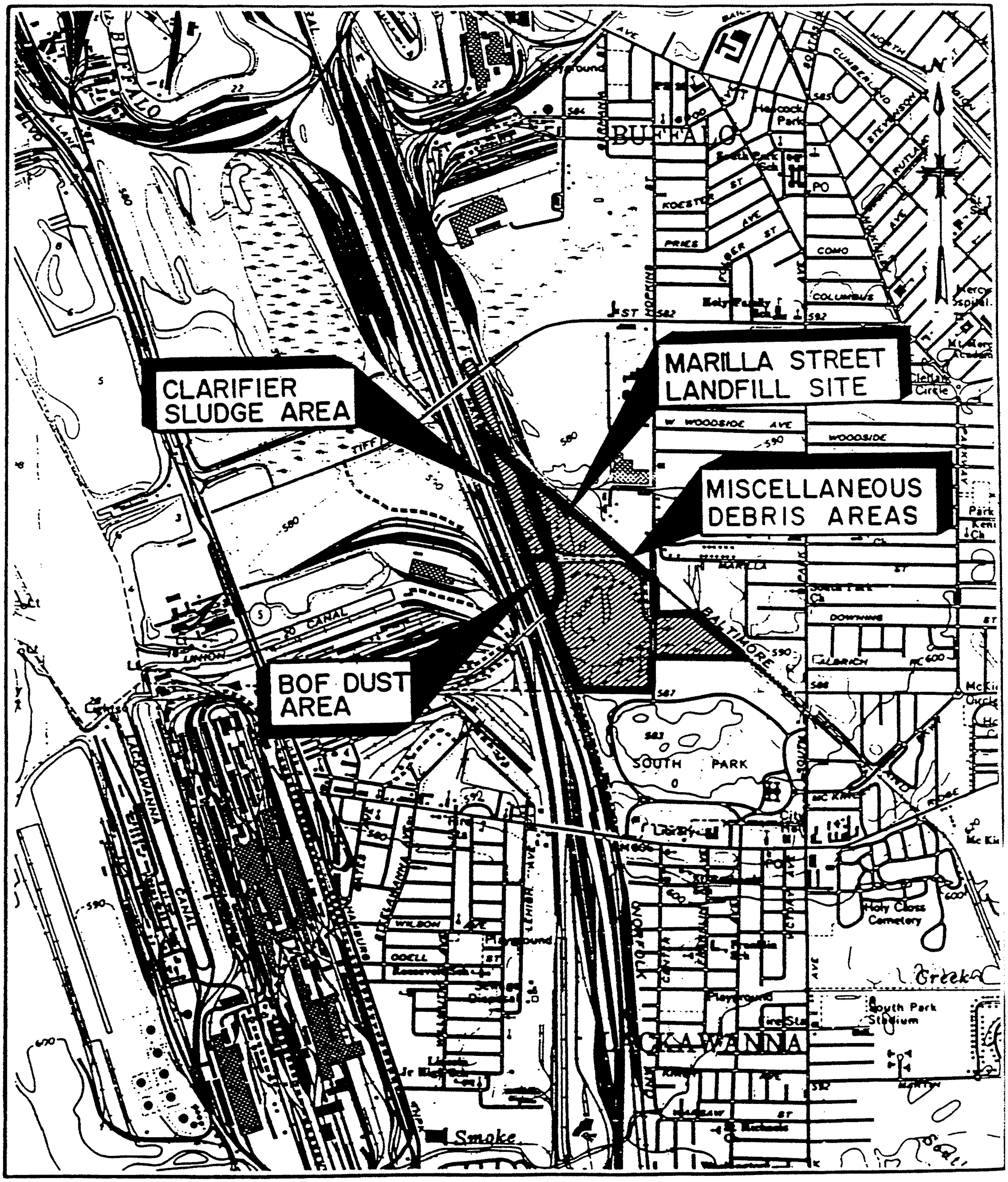

NOTE: TOPOGRAPHY TAKEN FROM 1965 BUFFALO S.E., N.Y. U.S.G.S. QUADRANGLE 7.5 MIN. SERIES.

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QUADRANGLE LOCATION

MARILLA STREET LANDFILL CLOSURE
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VICINITY MAP

LTV STEEL COMPANY

- Survey data showing the elevations of the subgrade (prior to cover system construction) recompacted soil barrier layer, and topsoil layer;
- Color photographs depicting major project aspects; and
- Material and Construction Quality Assurance information.

2.0 FINAL COVER SYSTEM DESIGN

2.1 GENERAL

This section briefly describes the design of the final cover system for the Miscellaneous Debris Areas at the Marilla Street Landfill. The final cover system design consisted of the following components:

- Subgrade Preparation
- Gas Control Vents
- Recompacted Soil Barrier Layer
- Topsoil and Vegetative Growth
- Surface Water Control
- Access Road Construction

2.2 SUBGRADE PREPARATION

The design subgrade elevations were achieved to the maximum extent possible by balancing cut and fill quantities. The fill mixture in the Miscellaneous Debris Areas is predominately composed of a mixture of railroad ties, bricks, plant construction debris, blast furnace slag and mixed rubble. The grades were designed to provide positive drainage of the landfill area. The original design grades called for a maximum slope of 33 percent (1V on 3H) on the landfill side slopes and a minimum slope of four (4) percent on the uppermost area.

2.3 GAS CONTROL VENTS

The decomposition of the solid wastes contained in a landfill can lead to the production of various gases, of which methane is of most concern. The buildup and migration of methane gas must be controlled to prevent explosion hazards. Due to the inert nature of the waste disposed of in the Miscellaneous Debris Areas, a gas venting system was not considered necessary; however, a passive gas venting system consisting of sixty-two (62)

PVC pipes (6-inches in diameter) was designed to facilitate gas migration through the final cover system, in response to NYSDEC requests as a precautionary measure to prevent the buildup of gases; if any.

2.4 RECOMPACTED SOIL BARRIER LAYER

A nominal 18-inch thick recompacted soil barrier layer was designed to minimize leachate generation by reducing surface water infiltration into the landfill. The final cover system as a whole was designed to limit infiltration, promote surface water drainage and minimize erosion. The recompacted soil barrier layer was designed to achieve a maximum permeability of 1.0×10^{-7} cm/s.

2.5 TOPSOIL AND VEGETATION

A nominal 12-inch thick topsoil layer was designed to be placed over the barrier layer to support the establishment of vegetative growth (viz. grass). The grass mixture was designed specifically to prevent soil erosion and minimize long-term maintenance.

2.6 SURFACE WATER CONTROL

To minimize the potential for erosion and damage to the barrier layer, drainage ditches were designed to be constructed around the periphery of the Miscellaneous Debris Areas and adjacent to the site access roads. The final cover system was designed to extend through the bottom of all drainage ditches to further reduce surface water infiltration. Vegetative cover was to be established in the drainage ditches to prevent surface soil erosion. In addition, all ditches were to be lined with an anti-erosion matting as an aid to turf establishment and to prevent soil and vegetative washout during periods of high rainfall. Riprap was required in ditches where the slope exceeded 5 percent. The drainage system is designed for a 25-year, 24-hour storm.

2.7 SITE ACCESS ROADS

To allow for access to the landfill site and the adjoining South Buffalo Railroad, site access roads were designed within the Marilla Street right-of-way and adjacent to the railroad tracks located between the BOF Dust/Clarifier Sludge Areas and the Miscellaneous Debris Areas. The design of the access roads consisted of an 18-inch thick soil barrier layer, a filter fabric and a 12-inch thick layer of crushed stone or gravel.

3.0 FINAL COVER SYSTEM MATERIALS AND CONSTRUCTION

3.1 GENERAL

This section describes the various materials and methods of construction utilized for the final cover system construction in the Miscellaneous Debris Areas. Construction activities began in August 1991 with the collection of barrier layer material soil samples from the borrow area. The landfill surface was then divided into sixty-eight sections, each approximately an acre in size, to help monitor and control construction quality assurance procedures and testing during the placement of the barrier layer material. See the Record Drawings for the location of these sections in relation to the vertical and horizontal control grid system.

3.2 SUBGRADE PREPARATION

Prior to initiation of the barrier layer construction, the subgrade was prepared under Contract No. 2 by The Beaver Excavating Company, Inc. Subgrade preparation began in July 1990 and was completed in June 1991. During the regrading operations a bulldozer with a ripper and two track backhoes were used to loosen material and load trucks. Two off-road trucks and two tandem trucks were utilized to transport subgrade material from excavation areas to fill areas. Three bulldozers and one road grader were used to fine grade the subgrade before it was proof-rolled with a sheepsfoot roller. Actual sideslope grades varied from a minimum of 3.6 percent to a maximum of 33 percent.

3.3 GAS CONTROL

Two methods were used for installing the gas vents. The first method was used in the 1991 Construction Season after the barrier layer had been constructed. A small backhoe was utilized to excavate holes through the barrier layer and approximately three feet into the subgrade waste material. The holes were then lined with nonwoven filter fabric (Mirafi 140 N) prior to backfilling with crushed stone. After the lined holes were backfilled, the filter fabric envelope was lapped over the top of the stone.

Vent pipes were constructed of 6-inch Schedule 40 PVC pipes extending approximately 1½ feet into the stone. Each pipe extends a minimum of three feet above the final cover system and is fitted with a 180° return bend and birdscreen.

The barrier layer material around the gas vents was repaired by recompacting the soil material in 6-inch thick compacted lifts using a mechanical tamper.

During the 1992 and 1993 construction seasons, the gas vents were installed prior to placement of the barrier layer material. The same general construction methods regarding the fabric and stone were used as during the 1991 season. A mechanical tamper was utilized in the vicinity of each gas vent pipe to provide adequate compaction in the immediate area of the vent pipe. The final locations of the gas vents are shown on the Record Drawings.

3.4 RECOMPACTED SOIL BARRIER LAYER

3.4.1 Material Evaluation

The material utilized for construction of the barrier layer was off-site material excavated from the Zylinski mining area located on Snyder Road in the Town of Concord, New York. The project specifications for the soil barrier material required that it conform to the following general gradation requirements:

Sieve Size	Minimum Percent Passing By Weight
3-inch	100
No. 4	85
No. 200	50
0.002 MM	25

In addition, the material specifications required that the laboratory recompacted permeability of the soil be less than or equal to 1×10^{-7} cm/s. Although Atterberg Limits were not an acceptance requirement, they were monitored to aid in classifying the soils encountered and, in correlation with other soil properties, to help define the soils behavior (such as permeability and compactibility).

Moisture-density relationships were also developed during materials evaluation testing and were used as the primary indication of whether optimal moisture content and minimum compaction requirements were achieved during construction. All soil material evaluations were performed by the Malcolm Pirnie, Inc. Soils Testing Laboratory.

Soil samples were generally collected from stockpiles of material which had been excavated and piled at the mining site by the Contractor. Prior to sample collection, each stockpile was first surveyed to determine its total volume. Each pile was then sectioned to isolate approximate 1000 cubic yard increments for sampling. A composite sample was collected from each 1000 cubic yard section to obtain a representative sample for laboratory analysis.

Malcolm Pirnie personnel collected all barrier layer material soil samples for materials testing. Malcolm Pirnie Inc.'s soils laboratory then conducted the following analyses on the material to determine if it was acceptable for use as soil barrier layer material:

Test	Method	Frequency
Grain Size	ASTM 421, 422	1 per 1,000 cu. yd.
Moisture Content	ASTM D 2216	1 per 1,000 cu. yd.
Atterberg Limits (Liquid and Plastic Limit)	ASTM D 4318	1 per 1,000 cu. yd.
Modified Proctor Test	ASTM D 1557	1 per 5,000 cu. yd.
Standard Proctor Test	ASTM D698	1 per 5,000 cu.yd.
Recompacted Permeability	Current Literature	1 per 5,000 cu. yd.
Specific Gravity	ASTM D854	1 per 5,000 cu. yd.

The Miscellaneous Debris Areas are 59.6 acres in size. They received a minimum of 18 inches of recompacted barrier layer material during final cover system construction. Appendix 4.2 summarizes which individual samples comprise the various soil composites.

184 Grain Size, 184 Moisture Content, 184 Atterberg Limits, 38 Modified and Standard Proctor Curves, 38 Recompacted Laboratory Permeability Tests, and 38 Specific Gravity Tests were performed to demonstrate conformance of the barrier material soil with the Contract Documents. A summary of the grain size analyses, moisture contents and

Atterberg Limits are presented in Appendix 4.3. The laboratory test reports for moisture-density relationships, and laboratory recompacted permeability tests are presented in Appendix 4.4.

3.4.2 Placement and Compaction

Prior to placing barrier layer soil on the Miscellaneous Debris Areas, a test patch was constructed at the mining area to determine the compactive effort required for construction and to check the suitability of the material. The test patch results were sent to the NYSDEC for review on August 15, 1991 and approved on August 27, 1991 (see Appendix 3).

Artmeier Trucking performed the transportation of material for Site Contractors. Tandem-end dump trucks were utilized to move soil from the mining area to the landfill where it was dumped and then graded by a Dresser TD15E bulldozer to approximately 8-inch thick loose lifts. Lift thickness was controlled by grade stakes set in a 100-foot grid pattern and tied into the previously established grid system (grade stake holes were filled with bentonite as grade stakes were removed). Site Contractors placed the soil in three nominal 6-inch thick (after compaction) lifts, to form a recompacted barrier layer 18 inches thick. Each lift was compacted with a pull behind sheepsfoot roller, a Bomag pad foot roller and an Ingersoll Rand smooth drum vibrating roller to achieve a minimum density of not less than 90 percent of the Modified Proctor dry density as determined by ASTM D 1557. The moisture content of the soil was adjusted as necessary using either a water truck or by spraying the loose lift area with a hose to achieve a moisture content greater than optimum as determined by representative Proctor moisture-density relationships.

Upon completion of all three lifts and prior to placement of the topsoil, a final survey was performed on the recompacted soil barrier layer. The final elevations were compared against the initial elevations on the approved subgrade to confirm a minimum barrier layer thickness of 18 inches.

Construction activities for the 1991 season began on August 29, 1991. Placement of all three lifts of barrier layer material, along with 12 inches of topsoil over Sections 48 through 61, were completed prior to the Contractor's winter shutdown in November 1991. These areas had been tested for moisture-density and permeability and had been determined to be acceptable at the time of shutdown.

Construction activities resumed for the 1992 season on April 29, 1992. Placement of all three lifts of barrier layer material along with 12 inches of topsoil over Sections 9-14, 23-33, 36-46, and 62-68 were completed in September 1992. All of the areas completed in 1992 were tested for moisture-density and permeability and were determined to be acceptable.

Construction activities resumed for the 1993 season on April 22, 1993. Placement of all three lifts of barrier material over areas 1-8, 15-22, 34, 35, and 47 were completed by July 1993. All areas completed in 1993 were tested for moisture, density and permeability and were determined to be acceptable.

Summaries of all nuclear densitometer, moisture density tests and shelby tube sample permeability tests results are presented in Appendix 9.

3.5 TOPSOIL AND VEGETATIVE GROWTH

3.5.1 Material Evaluation

The material utilized for the topsoil layer was off-site material delivered from various project sites in Erie County, New York. Prior to delivery and placement of topsoil, stockpiled material was sampled and laboratory Q.C. tests were performed. Topsoil was placed in two 6-inch thick lifts as required by the project specifications. The lower 6-inch thick lift (grade B topsoil) was required to meet the following approximate gradation analysis:

Sieve Size	% Passing by Weight
3-inch	100
No. 4	75
No. 200	45
0.002 mm	10

The upper 6-inch lift (Grade A topsoil) was required to have the following approximate properties:

a.

Sieve Size	% Passing by Weight
3-inch	110
1-inch	85 - 100
1/4-inch	65 - 90
No. 200	20 - 80

b. Clay content less than 30 percent.
c. pH - 5.5 to 7.6
d. Organic content - >2.5 percent
e. Soluble salt - <500 ppm

3.5.2 Topsoil Placement

The Contractor began topsoil delivery in September 1991. Topsoil was transported to the Miscellaneous Debris Area via dump trucks and placed on the top segment of the landfill. The material was then spread over the landfill with a Dresser TD15E bulldozer. Lift thickness was controlled by grade stakes which were tied into the site grid system. As grade stakes were removed, holes were filled with bentonite. Topsoil placement activities were completed in July 1993.

The Contractor's surveyors then performed a topographic survey verifying that a minimum of 12-inches of topsoil were placed (see the Record Drawings).

3.5.3 Vegetative Growth

Site Contractors began the seeding operation in September 1992. The seeding operations continued intermittently throughout the three-year construction period of the final cover system. This allowed the Contractor to utilize prime seeding conditions in both the spring and fall seasons. Seeding was permitted to begin once the final topsoil layer was in place, raked of small debris and stones, and the final elevations were surveyed. The Contractor prepared both a dry seed bed and Hydro-seeded all areas (even though he was not required to do so). The dry seed bed was established by reworking the soil, applying a starter fertilizer (18-24-6), then applying dry seed.

Once the dry seed was applied, a hydroseed slurry consisting of seed, fertilizer and wood mulch was applied. The entire surface of the Miscellaneous Debris Area was seeded with a minimum of 100 lbs/acre of seed conforming to the following mixture:

Name of Grass	Application Rate
Perennial Ryegrass	10 lbs/acre
Kentucky Bluegrass	20 lbs/acre
Strong Creeping Red Fescue	20 lbs/acre
Chewings Fescue	20 lbs/acre
Hard Fescue	20 lbs/acre
White Clover	10 lbs/acre

In addition, drainage ditches were seeded with approximately 62 lbs/acre of the following seed mixture to help prevent ditch erosion:

Name of Grass	Application Rate
Tall Fescue (Kentucky 32)	20 lbs/acre
Creeping Red Fescue	20 lbs/acre
Red Top	4 lbs/acre
Empire Birdsfoot Trefoil	8 lbs/acre
Garrison Creeping Foxtail	10 lbs/acre

After the seeding was completed, biodegradable anti-erosion matting manufactured by North American Green, Type S-75, was used to line ditches with slopes less than 5 percent.

3.6 SURFACE WATER CONTROL

The Contractor placed biodegradable anti-erosion matting manufactured by North American Green, Type S-75, on the perimeter ditches with slopes less than 5%. On ditch slopes greater than 5%, nonbiodegradable anti-erosion matting manufactured by Mirafi, Type 140N, was placed along with riprap to control erosion.

3.7 SITE ACCESS ROADS

A 20-foot wide access road was designed to be constructed within the existing Marilla Street right-of-way for access into and out of the landfill. Two 15-foot wide access roads were constructed from Marilla Street up to the east edge of the South Buffalo Railroad for railroad maintenance purposes. A minimum 18-inch thick layer of recompacted barrier layer material was placed under the access roads. For road stabilization purposes, Mirafi 600X woven filter fabric was placed over the barrier layer material prior to placing a 12-inch thick layer of crushed stone and gravel conforming to NYSDOTSS Item No. 304-3.03 specifications.

4.0 CONSTRUCTION MONITORING DOCUMENTATION

4.1 GENERAL

This section describes the field and laboratory testing activities used during construction of the final cover system. Survey control procedures used to measure the construction lines and grades are also discussed.

4.2 ON-SITE SUPERVISION

Malcolm Pirnie personnel were on-site on a daily basis during construction to observe the construction activities, take field measurements, and to perform, record and summarize on-site testing results. Daily inspector's reports were prepared by Malcolm Pirnie personnel to document the construction activities. The inspector reports (for the period of August 1991 through August 1993) are included in Appendices 5, 6 and 7.

4.3 SURVEY DATA

Site Contractors, Inc. utilized Douglas C. Meyers as their Professional Land Surveyor to perform all survey work required for the final cover system construction at the Marilla Street Landfill. All survey work is referenced to the 100-foot x 100-foot horizontal grid system and bench marks established for the project. Spot elevations are shown on the Record Drawings for the top of the finished subgrade, the recompacted soil barrier layer, and the topsoil layer. Thicknesses for each layer are tabulated in Appendix 8. Survey data confirmed that in all locations, the minimum design thicknesses for each layer of the cover system were achieved.

4.4 CONSTRUCTION QUALITY ASSURANCE TESTING

4.4.1 General

Field construction quality assurance testing was required for the recompacted soil barrier layer. These quality assurance tests are discussed in detail in Section 4.4.2

4.4.2 Recompacted Soil Barrier Layer

Malcolm Pirnie on-site personnel conducted the following construction quality assurance tests during the placement of the soil barrier layer material.

Test	Method	Frequency
In-place Moisture/Density Tests	ASTM D2922-81 D3017-78	Minimum of 9 tests per acre per lift.
Undisturbed Laboratory Permeability Tests (Shelby Tests)		Minimum of 1 test per 1 acre per lift.

In-place moisture-density testing was performed by Malcolm Pirnie on-site personnel in accordance with ASTM D2922-81 and D3017-75. A Troxler 3411 Nuclear Densitometer was used to measure the in-place moisture content and dry density of the recompacted cover material during construction. The major acceptance criteria for the in-place recompacted barrier soil layer was a dry density of not less than 90% of the Modified Proctor maximum dry density as determined by ASTM D 1557 plus an in-place moisture content that was wet of optimum. In addition, in accordance with the QA Plan and recent NYSDEC recommendations, the measured in-place moisture content and density were considered acceptable only as long as eighty percent (80%) of the data plotted above a line on a graph which was determined by the line of optimums less two (2) percent moisture and all points plotted above a line which was determined by the line of optimums less four (4) percent moisture. Representative modified and standard Proctor curves were used. The line of optimums was a curve which passed through the maximums of both the standard and modified Proctor curves parallel to the curve of zero air voids. The daily inspector reports containing the in-place moisture-density test results and applicable Proctor curve plots are presented in Appendices 5, 6 and 7. Appendix 9.2 presents a summary of the density results from the inspector reports. In all cases, the material was wet of optimum during compaction activities.

1,893 nuclear densitometer moisture/density tests were performed over the 59.6-acre landfill surface area (or an average of 10.6 tests per acre-lift). 204 Shelby tube soil samples (or an average of 1.1 tests per acre per lift) for undisturbed permeability testing were collected by Malcolm Pirnie on-site personnel. The acceptability criteria regarding the permeability of the in-place recompacted soil barrier layer was a maximum of 1×10^{-7} cm/s. Undisturbed laboratory permeability test results are presented and summarized in Appendix 9.1.

The sample and test locations of all construction quality assurance field tests are referenced to the grid system established for the project. A tabular listing indicating the sample and test locations for each of the three (3) lifts for the final cap construction are presented in Appendix 9.2.

4.5 CONSTRUCTION PHOTOGRAPHS

Color photographs of major project aspects are presented in Appendix 10.

4.6 SHOP DRAWINGS/RECORD DRAWINGS

Completed copies of the approved shop drawings necessary for the final cover system construction at the Marilla Street Landfill Miscellaneous Debris Areas may be reviewed at the Malcolm Pirnie, Inc., Buffalo, New York office, for a period of one year after acceptance of the project by LTV Steel Company. Record drawings prepared by the Contractor are presented as a separate Appendix of this report.

4.7 NOTATION OF DEVIATIONS

4.7.1 Final Grades

The landfill was designed to have a minimum slope of approximately four percent. The minimum slope on the top area of the landfill was actually 3.6 percent. This is considered a very minor variation and will have no adverse effect on the cover system.

4.7.2 Final Cover System Transition Detail at Marilla Street

The approved design plans show a final cover system transition detail at the Marilla Street entrance road area (adjacent to Hopkins Street) with the barrier and topsoil layers continuing through the ditch and keying in at the property line at the full design layer thickness (18"). The subgrade survey elevations indicated that this was not possible due to the controlling surface water elevations at both ends of the ditch. As a result, the cover system was transitioned differently for that area of the site. The modified construction detail is shown on the Record Drawings in Appendix 11. This minor deviation was approved by the NYSDEC in a letter dated September 4, 1991 as presented in Appendix 2.

5.0 DECLARATION

Malcolm Pirnie personnel monitored the final cover system construction at the Marilla Street Landfill Miscellaneous Debris Areas according to generally accepted practices. Based on the field observations made by Malcolm Pirnie personnel, field and laboratory test data, and data provided by the Contractor, the construction observed at the site complied with the Closure Plan approved by the NYSDEC, the QA/QC Plan and the Contract Documents. Notations of deviations from these documents are discussed in Section 4.7. Limitations to this report are contained in Appendix 1.