Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS

Construction Documentation Report

Landfill Closure

Town of Moreau, New York

Report

July 2001

CONSTRUCTION DOCUMENTATION REPORT

LANDFILL CLOSURE

TOWN OF MOREAU, NEW YORK

Prepared for:

TOWN OF MOREAU, NEW YORK

Prepared by

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July 2001

Project No. 70011PA

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CHAPTER 1

INTRODUCTION

This report documents the construction activities performed to close the approximately 38-acre Town of Moreau landfill. This report summarizes the quality control and quality assurance testing results for the individual components of the cover system, as well as any deviations from the approved closure plan.

1.1 LOCATION

The Town of Moreau is located in the northeast corner of Saratoga County. The landfill is located on a 276-acre parcel of town-owned property which lies between U.S. Route 9 and the Hudson River, and at a point where the Hudson River changes in flow from an easterly direction to a northeasterly direction. This occurs approximately 2.5 miles north of the intersection of U.S. Route 9 and Interstate 87 (Figure 1-1). The majority of the land is low in elevation and is bound by the river. Approximately 38 acres of this site have been dedicated to landfill development, thus defining the "footprint" of the landfill. The footprint is approximately 12 feet higher than the normal water level in the Hudson River. The shortest distance between the landfill and the river is approximately 800 feet. The Town Highway Department uses a small portion of the site, near the intersection of U.S. 9 and Butler Road. The entrance to the landfill is from Butler Road along the top of an escarpment. After entering the landfill, vehicles proceeded downward to the active portion of the landfill.

1.2 SITE HISTORY

The site was first used as a landfill in 1966. A variety of municipal waste materials were deposited in the landfill between 1966 and 1973. In 1973, a predecessor company to the James River Corporation began delivering paper mill sludge materials to the landfill, thereby increasing (rather substantially) the amount of waste deposited daily. From this point forward, the landfill has received construction and demolition material, industrial waste, general municipal solid waste, and various sludges. Around 1986, the James River Corporation began receiving and processing relatively low grades of recyclable paper materials, resulting in a proportionately greater amount of material leaving the plant as residue or sludge. Approximately 90 percent of the materials received at the landfill over the past several years have been paper mill sludges. The Town placed the sludge in the landfill using a 1 to 1 mixture of sand purchased at a local sand pit. Over the years, attempts were made to reduce the sand-to-sludge ratio; however, the landfill became unstable as the sand percentage dropped. Encore Paper Corporation decreased the moisture content of the sludge being delivered to the landfill by dewatering the sludge at their mill. The dewatering of the sludge aided in the placement; however, the sand was still necessary to provide a stable surface for the landfill equipment. Throughout the entire life of the landfill, the overall percentage of paper mill waste was approximately 75 percent by volume. The landfill stopped accepting waste on April 1, 1994, and ceased accepting paper byproduct for grading operations on April 1, 1996.

1.3 REGULATORY HISTORY

Regulatory involvement at the site appears to date back to the early 1980s. Initial closure plans were developed by O'Brien & Gere in November 1983. Negotiations and correspondence related to operations, acceptance of additional waste streams, and closure schedules continued through the late 1980s. At that time, the State of New York initiated legal action against the Town for non-compliance with state solid waste regulations.

In late 1989, the Town selected Stearns & Wheler to assist them with bringing the landfill into compliance with state regulations and directives. A landfill closure work plan was developed to address both site investigation and engineering requirements to determine whether the facility should be considered a New York State inactive hazardous waste site due to the reputed presence of PCB and foundry sand wastes. The work plan was originally issued in May 1990 and finalized in August 1990.

Site investigation and closure plan preparation were performed during the summer and fall of 1990, with reports issued in February 1991. The findings of the site investigation report resulted in a reclassification of the site from a Class 2A to a Class 3 inactive hazardous waste disposal site. This allowed the landfill to be considered as one possible site within Saratoga County to be kept open as a consolidation landfill until a state-of-the-art county-wide facility could be developed. A waste stream analysis and a landfill operations plan were prepared to support the consolidation landfill concept.

An Order on Consent was initiated in October 1991, which allowed the facility to remain open as a consolidation landfill until March 31, 1994. The Order was subsequently modified three times to

COMPANY	ACTIVITY
NYSDEC Region 5 Hudson Street, P. O. Box 220 Warrensburg, NY 12885-0220	Regulatory agency
Kubricky Construction Corporation 237 Bay Street, P. O. Box 3202 Glens Falls, NY 12801-7202	General Contractor
Solmax Geosynthetics, Inc. P. O. Box 556 Newtonville, NY 12128	Geomembrane manufacturer/installer
New Linings Solution, Inc. 6610 Nelson Avenue West Vancouver, B.C. V7W-2B1 Canada	Geomembrane/geocomposite installer (subcontractor to Solmax)
Wheels, Places & Things, Inc. P. O. Box 376 Selkirk, NY 12158	Trucking of barrier protection material and topsoil
AGP Laboratories, Inc. P. O. Box 170907 Arlington, TX 76003	Geomembrane quality assurance laboratory
J&L Testing Company, Inc. 938 South Central Avenue Canonsburg, PA 15317	Geomembrane conformance testing (Owner-contracted laboratory)
Soil & Material Testing, Inc. 57 South Main Street Castleton, NY 12033	Soil quality assurance laboratory
W. J. Rourke Associates 10264 Saratoga Road South Glens Falls, NY 12803	Surveyor
Chase Photography 405 Saratoga Road South Glens Falls, NY 12803	Construction photographer
Donnelly Construction, Inc. P. O. Box 58 Mechanicville, NY 12118	Erosion/sediment control installer
Simpson Seeding, Inc. P. O. Box 237 West Stockholm, NY 13696	Landfill seeding and fertilization
Saratoga County Soil & Water Conservation District	Moreau Recreation Park mine plan
Southern Tier Consulting P.O. Box 30 West Clarksville, NY 14786	Wetland enhancement around landscape berm
North Country Landscaping P.O. Box 371 Plattsburg, NY 12901	Wetland Creation

CHAPTER 2

SUBGRADE PREPARATION AND GAS VENT INSTALLATION

2.1 GENERAL

Included in this chapter are the construction activities that preceded the installation of the geomembrane liner. These activities included general earthwork, installation of gas venting risers, placement of paper byproducts sludge (PBP), and preliminary grading. The first three items were performed by the Town of Moreau under force account work. The preliminary grading activity was completed by Kubricky Construction Corporation. The force account work ended September 8, 1998, when Kubricky Construction Corporation took over the site.

A variance for the deletion of the 12-inch gas venting layer was obtained from the NYSDEC. A copy of this variance is located in Appendix B. As a condition of this variance, the number of gas vents was increased to two per acre.

2.2 EARTHWORK

Shaping and perimeter grading to achieve maximum 25 percent slopes was completed by force account during 1996. PBP sludge was placed on the landfill by Town employees until September 8, 1998, and by Kubricky Construction Corporation from September 8 through September 28, 1998. Relocation of silt deltas from adjacent wetlands was completed by Kubricky Construction Corporation in 1998.

2.3 GAS VENTING RISERS

Seventy-six gas venting risers were installed in 1997 by the Town of Moreau with engineering oversight. The gas venting risers were constructed of 6-inch PVC Schedule 40 pipe. The gas venting risers extended 5 feet into MSW and 3 to 4 feet above grade. The vertical portion of the vents was slotted from the bottom to just below the surface. Following installation of the gas vents, daily operations damaged several of the riser pipes. Repair of the damaged riser pipes and completion of the gas vents was completed by Kubricky Construction Corporation in 1998. Kubricky excavated the damaged risers to a good section of pipe, cut off the risers, and added a coupling and new section of riser pipe to extend above the surface. After geomembrane installation, Kubricky cut off the riser pipe approximately 12 inches above the geomembrane and installed a breakaway coupling, 3-1/2 feet of riser pipe, two 90° bends, and vermin prevention screens between the two 90° bends to complete the installation of the 76 gas venting risers. A typical gas venting riser is illustrated on Figure 2-1.

2.4 MODIFICATIONS DURING CONSTRUCTION FOR GAS VENTING

During the geomembrane installation and placement of barrier protection material, "gas bubbles" appeared under the geomembrane. Some of these bubbles dissipated, while others remained or increased. Options for treating the gas bubbles were discussed as follows:

1. Lance geomembrane and patch after gas escapes.

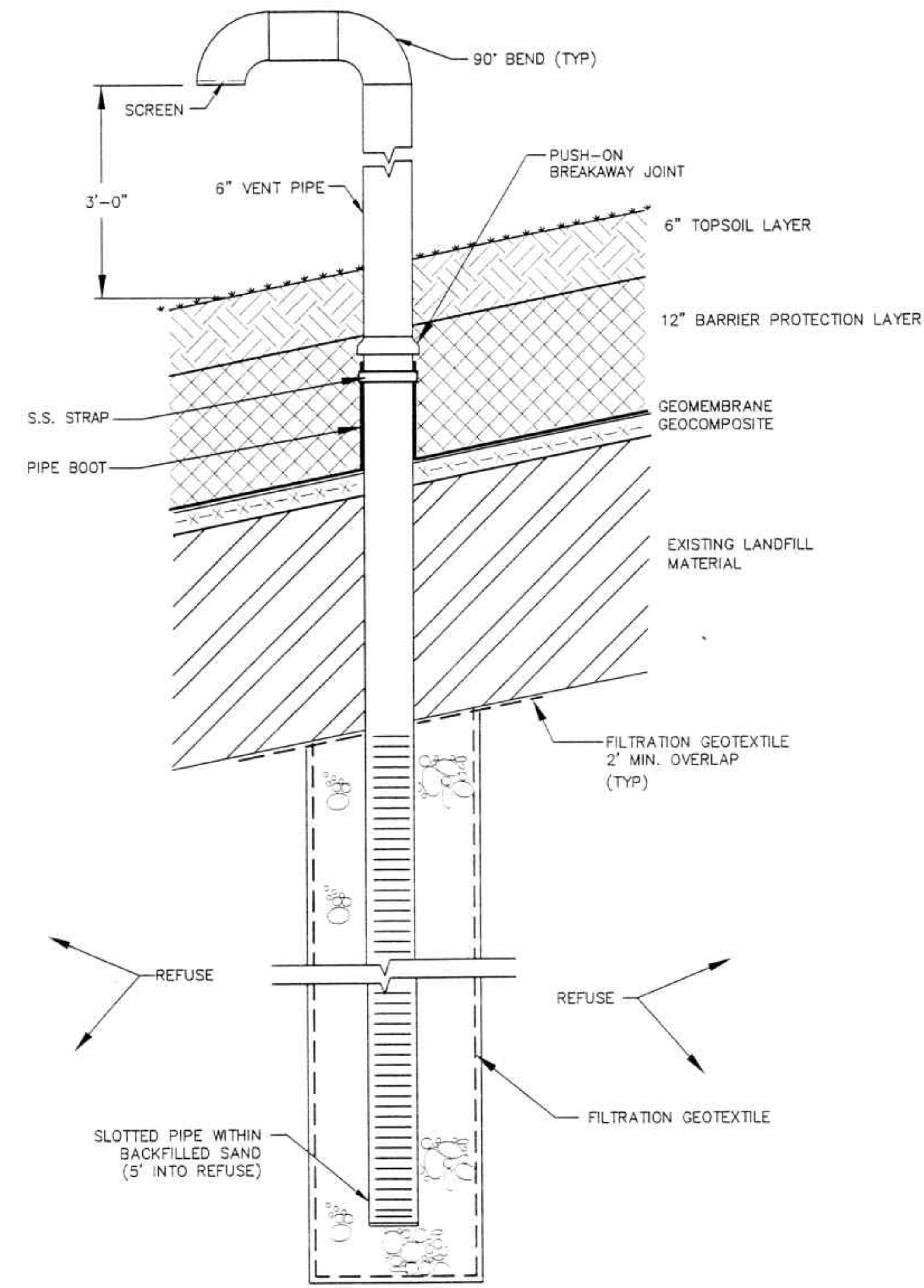
2. Placement of barrier protection material and topsoil. Push gas into subgrade and eventually to gas venting risers.

3. Install supplemental (additional) gas venting risers.

4. Review areas of the landfill that had not been covered to date with geomembrane and address as a separate issue.

5. Modify gas venting risers to allow the gas to enter the gas vents without having to travel through the subgrade material.

It was decided to utilize all options at various areas of the landfill, depending on the size of the gas bubble, proximity to an existing gas vent, and subgrade surface condition. To this end, 36 gas vents were modified as shown on Figure 2-2. Seventeen new gas vents with modifications were added and 5.7 acres of geocomposite material were added as a gas venting layer. The geocomposite material and 14 of the gas vents modified were on the north slope of the landfill. The remaining gas vent modifications were located mostly on the north half of the landfill. The supplemental gas vents were located throughout the landfill as needed.



GAS VENTING DETAIL

NOT TO SCALE

Stearns & Wheler, LLC
ENVIRONMENTAL ENGINEERS & SCIENTISTS
CAZENOVIA, NEW YORK

DATE:07/01 JOB No.:70011PA

TOWN OF MOREAU, NEW YORK
LANDFILL CLOSURE
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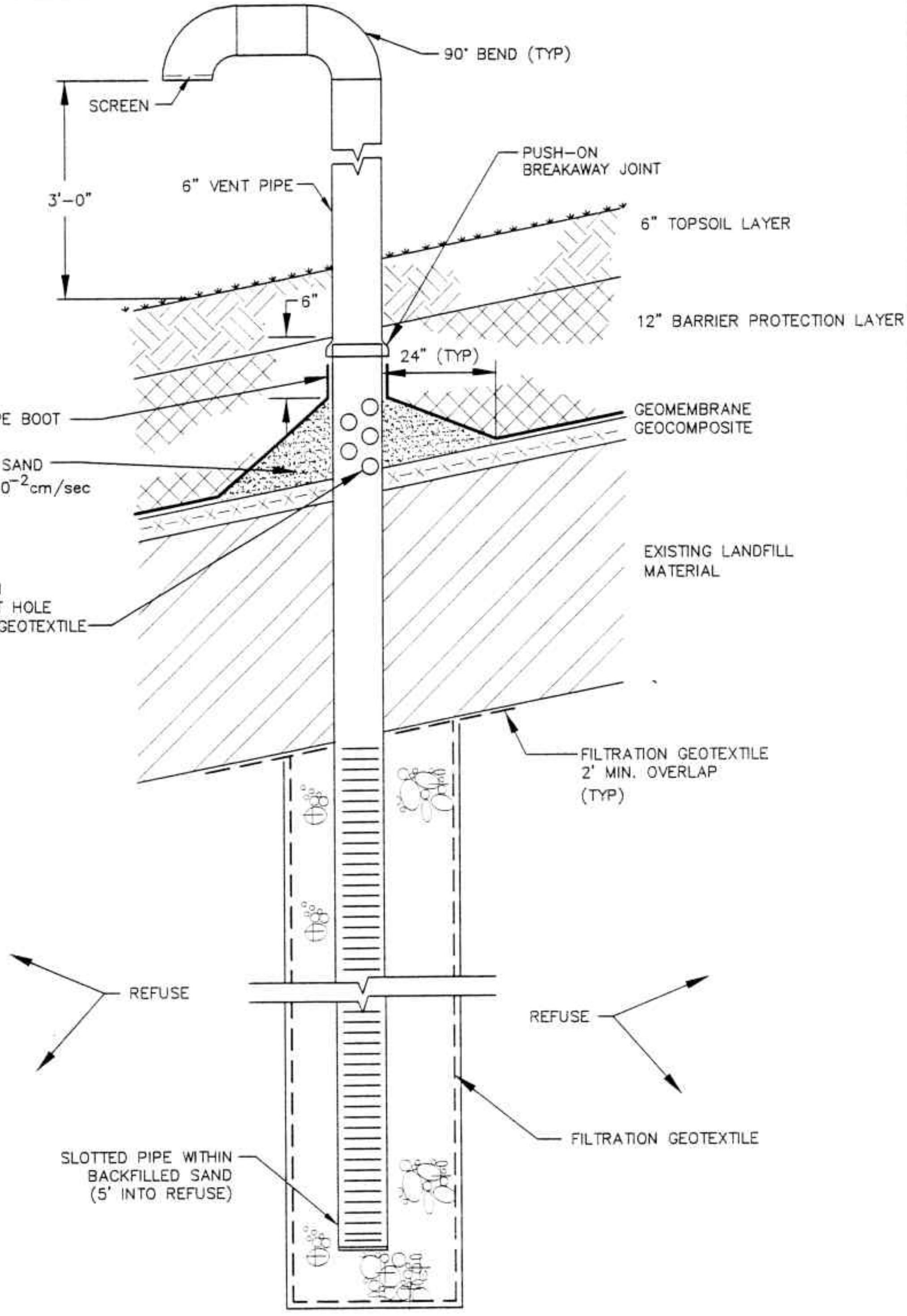
FIGURE 2 – 1
GAS VENTING RISER DETAIL



GAS VENTING DETAIL

NOT TO SCALE

NOTES:

1.) CONTRACTOR SHALL UTILIZE NEW GAS VENT DETAIL AS SHOWN ABOVE AT THE LOCATIONS IDENTIFIED ON ATTACHED SHEET.

2.) CONTRACTOR SHALL COMPLETE ALL EXISTING GAS VENTS FROM THE PUSH-ON BREAKAWAY JOINT UP, AS SHOWN IN THIS DETAIL.

Stearns & Wheler, LLC ENVIRONMENTAL ENGINEERS & SCIENTISTS CAZENOVIA, NEW YORK	TOWN OF MOREAU, NEW YORK LANDFILL CLOSURE CONSTRUCTION DOCUMENTATION REPORT
DATE: 11/98 JOB No.: 70011PA	FIGURE 2 – 2 REVISED GAS VENTING RISER DETAIL

CHAPTER 3

GEOMEMBRANE INSTALLATION

3.1 GENERAL

Kubricky Construction Corporation contracted with Solmax Geosynthetics, Inc., to supply and install a 40 mil textured LLDPE geomembrane and install the 5.7 acres of geocomposite material supplied by the Town of Moreau. Solmax Geosynthetics, Inc. contracted with New Linings Solution, Inc. to install the geomembrane and geocomposite. New Linings Solution, Inc. contracted with AGP Laboratories to perform the geomembrane quality assurance testing. Test results were received by Stearns & Wheler and compiled. Qualifications for New Linings Solution, Inc. and AGP Laboratories are listed in Appendix D.

3.2 GEOMEMBRANE QUALITY CONTROL (QC) REQUIREMENTS

The geomembrane was provided by Solmax Geosynthetics of Quebec, Canada. A total of eight lots were used. Each lot was tested for Melt Flow Index (ASTM D-1238) and density (ASTM D-1505). The maximum Melt Flow Index was 0.48 g/10 min, which met the project specifications of a Melt Flow Index of less than 0.6 grams/10 min. The densities of the resin ranged between 0.9192 g/cc and 0.9211 g/cc, which met the project specifications for densities between 0.910 g/cc and 0.925 g/cc. The carbon black testing was not performed on the resin, as none is included in the delivered resin. Solmax added carbon black prior to manufacture. The carbon black testing was between 2.09 and 2.85 percent, which met project specifications for carbon black between 2.0 and 3.0 percent.

The resin was manufactured into 120 rolls for this project, each 22 feet wide by 780 feet long, totaling 2,059,200 square feet (228,800 square yards) of material.

Quality control testing of the geomembrane was specified for every 100,000 square feet. As a result, 20 test series were required. Solmax submitted a total of 50 tests.

The following table summarizes the specified QC tests, required results, and range of actual results.

TEST DESCRIPTION	METHOD	REQUIREMENT	RANGE
Density	ASTM D-1505	0.910 - 0.925 g/cc	0.9192 - 0.9211 g/cc
Thickness	ASTM D-5199*	All tests > 36 mils Average > 40 mils	Minimum 36 mils Average > 40 mils
Water Vapor Transmission	ASTM D-96	<0.03 $g/m^2/day$	0.010 – 0.014 $g/m^2/day$
Tensile Break Strength	ASTM D-638	>75 lb/in	107.1 – 168 lb/in
Tensile Break Strain	ASTM D-638	≥400 percent	471- 621 percent
Puncture Resistance	FTMS 101C/2065	>50 lb	61.1-72.8 lbs.

*Thickness was performed per ASTM D5994 in lieu of specified ASTM 5199, which was acceptable to Stearns & Wheler.

The geomembrane quality control test results are listed in Appendix E. Quality assurance results are listed in Appendix F.

3.3 GEOMEMBRANE LINER INSTALLATION AND QUALITY ASSURANCE

A. **Geomembrane Deployment.** Deployment of the geomembrane liner began on October 13, 1998 and was completed on December 5, 1998. The geomembrane panels were rolled out utilizing a forklift equipped with a spreader bar to hold the roll of geomembrane. The rolls were then pulled from top of the slope to the toe with either an ATV two-wheel drive Gator or a Snow Cat dozer (ski slope wide track groomer), depending on subgrade condition. Deployment began on the southeast quadrant, progressing to the west slope of the southwest quadrant, northeast quadrant, and lastly, the northwest quadrant.

The original panel layout drawing was modified during deployment to meet installation requirements and site conditions. The modified geomembrane panel layout diagram can be found in Appendix N. A schedule of panel deployment is listed in Table F-1.

B. **Geomembrane Trial Seams.** Trial seams were performed on pieces of textured geomembrane to verify that seaming conditions, equipment, and technician were satisfactory for specific weather conditions. Coupons from these trial seams were utilized for the quality assurance program. The trial seams were conducted at the start of each seaming period and at least once every four hours of seaming for each piece of equipment used for seaming/repairs. Trial seams were a minimum of 42 inches in length and 1 foot in width, with the seam centered in the 1-foot width.

Three test specimens were cut from each trial seam at one-third the distance from each end. Each test specimen was approximately 1 inch in width. The test specimens were field tested for peel and shear strength. If any of the specimens did not meet the acceptable criteria, the seamer and seaming apparatus and/or methods were not accepted and were not used for seaming until the deficiencies were corrected and a new trial seam was successful.

Peel strength testing required a minimum strength of 48 lb/in for an acceptable test. Two specimens were tested for peel on each a and b weld. Shear strength testing required a minimum strength of 55 lb/in for an acceptable test. One specimen was tested for shear on each a and b welds. Both tests were based on Film-Tear Bond (FTB) criteria, meaning that the parent material failed before the seam failed.

A Trial Seam Qualification Summary was kept on the trial seam and is attached as Table F-2. The geomembrane Trial Seam Qualification Summary table lists the results of the field tests, the apparatus number, the type of weld, the setup temperatures, and the time and date that the sample was tested.

C. **Geomembrane Seaming.** Geomembrane panels were seamed as they were deployed. Three-foot wide rolls of roofing felt paper were placed under the seams prior to seaming to aid in keeping the paper byproduct out of the seam and seaming apparatus. The panels were welded together using automatic dual hot wedge machines. These units were automatic with speeds and temperatures being adjustable and determined during trial seaming.

T-joint seams as well as repairs were welded using extrusion welding machines. The extrusion welding machines used for this project had two heaters. One heater is used to preheat the seam, and the other heater melts ground-up extrusion rod into extrudate, which is then molded/welded to the two pieces of geomembrane being seamed. As part of the extrusion process, the seam edges were heat tacked together, and the surfaces to receive extrudate were roughed with hand-held grinders.

The following information is provided in Tables F-2 and F-3 for the seams:

1. Seam number/panels seamed (F-2).
2. Seaming process (F-3).
3. Type of welder and welder unit number (F-2)
4. Length of seam (F-3).

5. Seamer initials (F-2, F-3).
6. Seaming date (F-2, F-3).

A resume for each individual who seamed geomembrane is included in Appendix D.

D. **Geomembrane Seam Testing - Non-Destructive.** The geomembrane seams were tested either by an air pressure test or a vacuum box test. The dual hot wedge machines create a channel during the seaming process (schematic sketches are shown in Appendix E). Where possible, these seams or sections of seams were tested using the air pressure test. Each end of the section being tested was clamped off with a pair of vise grip pliers; a needle attached to an air gauge and air valve was pushed into the channel; the channel was filled with minimum of 30 psi of air; and the start time/pressure were noted on the geomembrane (see schematic sketch in Appendix E). If a pressure drop of less than 2 psi was recorded after 5 minutes, the section of seam was passed. The end time/pressure were noted on the geomembrane and the information recorded. The air pressure test passed dates are shown on Table F-3. Dual hot wedge seams/sections that did not pass air testing or seams not air tested (typically due to short lengths) were tested using a 30-inch vacuum box with a viewing window. The vacuum box test consisted of wetting the area to be tested with a soap and water solution (typically dish soap), placing the box on the seam and creating a vacuum. The section being tested was held under a 5 psi vacuum for approximately 10 seconds; if no leaks (bubbles) appeared, that section was passed. If leak(s) appeared, the leak was marked, repaired, and retested until passed. Adjacent vacuum box test locations were overlapped a minimum of 3 inches. Vacuum box test passed dates are shown on Tables F-3 and F-5.

After reviewing and compiling the air test data for the entire landfill (Table F-3), it appears that the following seam data is missing:

SEAM	POSSIBLE EXPLANATION
258-259	See note below
258-265	See note below
36-224	See note below
29-195	See note below
219-179	Appears to have been tested with vacuum box on Panels 179-178 according to length
179-218	Appears to have been tested with vacuum box on Panels 179-178 according to length
174-220	See note below
3-174	See note below
60-277	See note below

SEAM	POSSIBLE EXPLANATION
60-278B	See note below
58-279	See note below
271-278	See note below
275-278	See note below

Note: The on-site resident representative was present while all panel installation was conducted. Prior to placing any cover material, we do confirm that all required testing was conducted and passed. All data without available hard copy results are in regard to tests performed on butt seams and may have been recorded as vacuum box tests under adjacent or adjoining panels.

E. **Geomembrane Repairs.** Geomembrane repairs were required for imperfections located during the non-destructive seam testing, destructive sample locations, damaged geomembrane panels, and T-joints of adjacent geomembrane panels. The patches were constructed of pieces of geomembrane from the original rolls. These patches were rounded at the edges, extended beyond the edge of the defect a minimum of 6 inches, blended to the existing geomembrane panel with a hand-held grinder, and extrusion welded. In the case of small crimps, cuts in the geomembrane or too small overlap at dual hot wedge seams, an extrusion weld was applied directly. All repairs were tested using the vacuum box. Table F-5 lists geomembrane repairs and passed test dates.

F. **Gas Venting Riser Boot Installation.** A total of 93 gas venting risers were placed within the limits of the geomembrane liner. The boots for these 93 gas venting risers were fabricated on site using excess geomembrane from the original rolls. The extrusion weld between the boots and the geomembrane was vacuum box tested.

G. **Destructive Testing and Laboratory Results.** Destructive seam samples were taken every 500 linear feet of seam. A total of 189 destructive samples were cut from the approximately 81,902 feet of geomembrane seams. The destructive test samples were cut at a minimum of 42 inches in length by 12 inches in width. Two subsamples were cut from the test sample at one-third the distance from each end for on-site destructive seam testing. The central portion of the test sample was sent to AGP Laboratories for off-site destructive seam testing, tested, and the results sent to Stearns & Wheler and compiled. Table F-4 lists geomembrane laboratory destructive test results. The remaining end portions of the test sample were labeled with job name, date collected, seam number, and sample number. One of these was delivered to the Engineer for the Owner and one was kept by the contractor. The Engineer delivered the destructive samples to the Owner on December 23, 1998. The two subsamples were tested on site for peel and shear strength.

The destructive samples were tested for peel strength and shear strength at AGP Laboratories. Peel strength testing was based on a minimum strength of 48 lb/in and an average strength of 50 lb/in using test method ASTM D-4437. Shear strength testing was based on a minimum strength of 55 lb/in and an average strength of 60 lb/in using test method ASTM D4437. Both tests were based on FTB criteria.

DS-64 failed the FTB criteria; therefore, additional destructive samples were collected on either side of DS-64. Initially, the contractor only sampled one side, DS-64N, and subsequently, destructive samples were taken on either side, DS-64-3 and DS-64-4. The seam in question, 97-124, is located on the southwest finger of the landfill with an approximately 4 percent slope. Table F-4 lists the destructive samples and results. Approximate locations of the destructive samples are listed in Table F-5 and shown on the panel layout diagram in Appendix N.

H. **Additional Geomembrane Testing.** A sample of geomembrane removed from one of the larger gas bubbles on the west slope was sent to J&L Laboratories for analysis for conformance with the specifications. Results of these tests were sent to NYSDEC in a letter dated February 4, 1999. A copy of the letter and attachments is included in Appendix O.

CHAPTER 4

BARRIER PROTECTION LAYER

4.1 GENERAL

A variance was received from NYSDEC reducing the barrier protection layer thickness to 12 inches. A copy of this variance is located in Appendix B. The barrier protection material was obtained from the Town of Moreau Recreation Park located approximately 2 miles northeast of the landfill, as shown on Figure 1-1. The Town applied for and obtained a mining permit for the borrow source. A copy of both can be found in Appendix Q.

The material used was classified by the Saratoga County Soil & Water Conservation District as Windsor loamy fine sand. A small quantity of sandy material was brought in from another off-site location to supplement the material from the Town Park. The material was placed directly on the geomembrane by Kubricky Construction Corporation. QA/QC testing was performed by Soils & Material Testing, and Construction Technologies under contract to Kubricky Construction Corporation. Test results were reported to Stearns & Wheler and compiled.

4.2 BARRIER PROTECTION PLACEMENT

The placement of the barrier protection material began on October 16, 1998 and continued until December 23, 1998. Work resumed on April 19, 1999 and was completed on December 8, 1999. A total of 75,000 cubic yards of barrier protection was placed on the geomembrane using a combination of dozers: John Deere 750, John Deere 850, and Komatsu D37 models. The coverage area is approximately 38 acres. In order to maintain the desired depth of barrier protection material, laborers were provided to check material depth and set grading stakes. Grid elevations were recorded and submitted to Stearns & Wheler after placement of the barrier protection layer to verify material thickness.

4.3 QUALITY CONTROL (QC) TESTING

Testing of the barrier protection material was performed in accordance with the following testing standards and frequencies:

TEST	METHOD	FREQUENCY	REQUIRED TESTS	ACTUAL TESTS
Particle size analysis	ASTM D-422	1/1,000 CY	81	81
Standard Proctor analysis	ASTM D-698	1/5,000 CY	15	15
Permeability	ASTM D-2434	1/2,500 CY	32	32
Direct Shear (on slopes > 10%)	ASTM D-3080	1/5,000 CY	4	4
Interface Friction (on slopes > 10%)	ASTM D-5321	1/10,000 CY	2	8
Moisture Content	ASTM D-2216	1/1,000 CY	81	81

A comparison of material requirements and the range of actual test results is presented in the following table:

TEST DESCRIPTION	METHOD	REQUIREMENT	RANGE
Particle size 1 ½ -inch 1-inch No. 200	 ASTM C-136 ASTM C-136 ASTM C-117	 100% 90-100% 0 - 12%	 All 100% All 100% 11.2 – 0.2 %
Minimum Compaction	ASTM D-698	90%	87.5 - 112.4 %
Permeability	ASTM D-2434	>1 x 10^{-3} cm/sec	1.3 x 10^{-1} - 1.0 x 10^{-2} cm/sec
Shear strength	ASTM D-3080	$\geq$30°	33.0° - 36.6°

See Appendix G for a summary of all quality control test results.

4.4 QUALITY ASSURANCE (QA) TESTING

Quality assurance testing was performed on the barrier protection material to verify that the installation satisfied the design criteria. The QA testing was performed in accordance with the following testing standards and minimum frequencies:

TEST	METHOD	FREQUENCY	TESTS PERFORMED	TESTS MEETING REQUIREMENTS
Moisture content	ASTM D-3017	50-foot grid	432	431
Dry unit weight	ASTM D-2922	50-foot grid	432	431
Moisture content and dry unit weight	ASTM D-1556	200-foot grid	18	18

A 100-foot grid was established to identify nuclear density test locations. Nuclear density/moisture content tests were performed across the 38-acre site. Approximately 12 tests were conducted per acre of landfill. The majority of the tests were conducted during December 1998. In addition, testing was conducted in December 1999 at the south slope region that was rehabilitated. The total number of nuclear density/moisture tests conducted was 432, with 431 meeting the minimum specified criteria of 90 percent identified in the contract documents. A 200-foot grid was used for determination of in-place moisture and density of soil by the sand cone method. Eighteen tests were performed by the sand cone method. All 18 test results met the minimum specified criteria identified in the contract documents. Compaction of the barrier protection layer is intended to stabilize the soil such that it remains stable and minimizes erosion prior to establishment of a uniform vegetative growth. At the same time, overcompaction could damage the underlying geomembrane and adversely affect the permeability characteristics of the layer. The results of quality assurance testing are presented in Table 4-1 of Appendix G.

CHAPTER 5

VEGETATIVE SUPPORT LAYER AND SEED

5.1 GENERAL

This chapter discusses construction activities conducted for the placement of topsoil, grass seed, mulch, and erosion control material. Approximately 38 acres of the cap area were covered with 6 inches of topsoil. An additional 3 to 4 acres of created wetlands perimeter disturbances and drainage areas were also covered with topsoil prior to the end of construction activities. The material used was supplied and placed by Kubricky Construction Inc. and seeded by Simpson Seeding, Inc.

5.2 TOPSOIL AND SEEDING

The contractor began placing topsoil on December 11, 1998 and completed placement on March 26, 2000. The topsoil was delivered to the landfill in triaxel dump trucks and dumped over the barrier protection layer, beginning in the northeast corner and progressing around the landfill in a counterclockwise direction. The contractor placed the topsoil in one 6-inch lift utilizing John Deere 850, 750 bulldozers. After placement, all areas were cleared of any large debris using a York rake and hand picking. Grade stakes placed on a 100-foot grid were utilized to control placement. Grid elevations were recorded and submitted to Stearns & Wheler after placement of the topsoil layer to verify material thickness.

Kubricky Construction Corporation has submitted a revised seeding plan. The contract specifications allow the contractor to submit a variation to the seeding mixture and application rate based on the recommendations of a turf grass specialist. Kubricky's seeding/fertilizing subcontractor for the project, Simpson Seeding, Inc., contacted and received recommendations from the United States Department of Agriculture Natural Resources Conservation Service in Syracuse, NY. Variations were acceptable to Stearns & Wheler and have provided for development of a full, uniform stand of grass. A copy of the revised seeding plan is located in Appendix H.

5.3 EROSION CONTROL

The landfill cover area was mulched with straw. In addition, area more susceptible to erosion received a covering of erosion control matting distributed evenly over the entire area. See Appendix J for details regarding erosion control material.

CHAPTER 6

WETLAND MITIGATION

6.1 GENERAL

The landfill closure plan required a cap thickness of 18 inches, which includes the geomembrane, drainage layer, and topsoil. In addition, minor grading was required to achieve appropriate surface drainage patterns. These two activities required a 5-foot extension of the landfill slope toe to adequately cover the underlying solid waste. This extension impacted a small amount of wetlands (approximately 1.6 acres). A permit under the terms of ACOE Nationwide Permit 38 was approved for wetland mitigation.

6.2 IMPACT MITIGATION

A combination of created and enhanced wetland areas was used for mitigation. A summary of the two methods employed at the site are described below.

A. **Wetland Creation.** Creation of wetland in another area of the site that was used as a storage area and contained an area of pooled water. Excavation and grading lowered site elevations to match the water regime of the pooled water and create an undulating surface topography. The wetland surface and lower slope fringe area was seeded with a mix of grass and wildflower species. This created wetland is approximately 2.0 acres. North Country Garden Center performed the planting during spring 2000. The plants were supplied by New England Wetland Plants.

B. **Wetland Enhancement**. The lower slope of the capped landfill berm was planted with a mixture of shrubs, dense grass, and herbaceous growth. The plantings were located in a linear band approximately 10 feet in width that extended several feet into the wetland edge to approximately 2 feet in elevation above the wetland edge. Southern Tier Consulting, Inc. performed the planting and supplied the plants. Planting occurred during spring 1999.

Appendix I contains details regarding the wetland creation and enhancement area.

CHAPTER 7

SOUTH SLOPE REHABILITATION

7.1 REMEDIATION

In late October 1998, field personnel noticed undulations in the surface of the geomembrane and tension in the geomembrane itself. Observations indicated that sludge had moved (slumped) from near the top of the slope to an area near the toe of the slope. This movement was observed in an area where placement of the barrier protection material had been attempted, as well as in an area where only the temporary haul road had been constructed. A field investigation was performed at the slumped south slope of the Town of Moreau landfill. The investigation consisted of field vane shear testing, cone penetration testing, and water content sampling. Evaluation of the original failure indicated that stress imposed by loaded dump trucks on the temporary haul road caused a local bearing capacity failure within the sludge. A remedial design was approved by the NYSDEC. The remedial design components consisted of the following:

1. Regrading of excessively flat and steep subgrade areas by hand.
2. Perforation of the existing geomembrane.
3. Placing a low strength reinforcing geotextile.
4. Installing a 2-foot nominal thickness gas venting layer.
5. Installing new supplemental gas vents and laterals and modifying existing gas vents.
6. Installing a new geomembrane barrier layer.
7. Completion of the original barrier protection and topsoil cap components.

See Appendix P for details regarding the remedial design.

7.2 REPAIRS

Implementation of the remedial design began in late August 1999; however, on September 16 and 17, 1999, a significant rainfall event associated with Hurricane Floyd resulted in a failure of a portion of the south slope that was in the process of being constructed. Additional repairs were necessary due to this event. The failed material at the toe of the slope was amended with sand to create a stable matrix of sand and sludge. After replacing the sludge matrix, the material was covered with geotextile, gas vent sand, and the final cover system as identified in the remedial design.