Closure and Post-Closure Care Costs
Third Creek Monofill
City of Statesville
EPA ID Number 000 001 602
Statesville, North Carolina

September 13, 1996

Prepared For

City of Statesville
Statesville, North Carolina

For Submittal To

North Carolina Department of Environment,
Health, and Natural Resources
Division of Waste Management
Hazardous Waste Section
Raleigh, North Carolina

OCT 4

Prepared By

Aquaterra, Inc.
Charlotte, North Carolina

aquaterra®
A GREAT LAKES CHEMICAL CORPORATION COMPANY
ENVIRONMENTAL CONSULTANTS:
POST OFFICE BOX 668107 • CHARLOTTE, NC 28266-8107 • (704) 525-8680 • FAX (704) 527-2792

September 13, 1996

Ms. Sharron Rogers
North Carolina Department of Environment,
Health, and Natural Resources
Division of Waste Management
Hazardous Waste Section
Post Office Box 27687
Raleigh, North Carolina 27611-7687

Reference: Closure and Post-Closure Care Costs
Third Creek Monofill
City of Statesville
Statesville, North Carolina
EPA ID Number 000 001 602
Aquaterra Job No. 5205800

Dear Ms. Rogers:

On behalf of the City of Statesville, Aquaterra, Inc. (Aquaterra) is pleased to present the following revised closure and post-closure care costs associated with the Third Creek Monofill at the Third Creek Water/Wastewater Treatment Plant located near Statesville, North Carolina in Iredell County. The closure and post-closure care plans were submitted under separate cover.

The City of Statesville submitted financial assurance information pursuant to 40 CFR 265.143 on October 6, 1995, and a special report on November 5, 1995. The City's financial mechanism, Financial Test and Corporate Guarantee for Closure (265.143(e)) was approved by the HWS on December 12, 1995, with the requirement that a new test be submitted on or before September 30, 1996.

If you have any questions or comments regarding these costs, please contact Mr. Neal McElveen at (704) 525-8680 or Ms. Susan Kite at (910) 852-5003.

AQUATERRA, INC.

M. Neal McElveen

M. Neal McElveen, P.E.
Project Manager

Susan Kite

Susan Kite, P.G.
Senior Project Manager

Senior Peer Review

Bryson D. Trexler, Jr.

Bryson D. Trexler, Jr., Ph.D., P.G.
Senior Hydrogeologist/Program Manager

MNM/SK/rap:52224

pc: Mr. L. F. ("Joe") Hudson, Jr. - City of Statesville
Mr. Douglas D. Vaughn, P.E. - Pierson & Whitman
Mr. George House - Brooks, Pierce, McLendon, Humphrey & Leonard, L.L.P.

Closure and Post-Closure Care Costs
Third Creek Monofill
City of Statesville
Statesville, North Carolina
September 13, 1996

1 Introduction

1.1 Background

Aquaterra, Inc. (Aquaterra) has submitted a *Closure Plan* (Aquaterra report number 52213, dated July 12, 1996, see Appendix A) and a *Post-Closure Care Plan* (Aquaterra report number 52214, see Appendix B) for the Third Creek Monofill hazardous waste management unit (HWMU) at the Third Creek Water/Wastewater Treatment Plant (Third Creek) located near Statesville, North Carolina (see Figures 1 and 2). The following closure and post-closure care costs for the hazardous waste management (HWMU) are presented below and in Tables 1, 1A, 1B, 1C, 2, 2A, 2B, and 2C.

2 Closure and Post-Closure Care Costs

2.1 Estimated Closure Costs

The closure cost information is submitted according to the requirements of 40 CFR 265.142. An estimate of $493,366.00 will be needed to close the Third Creek Monofill HWMU. These costs include the confirmatory soil sampling and analysis of the backfill/on-site borrow soils, confirmatory analysis of stabilized material, unit closure and testing associated with the unit cap, inspections and maintenance of the cap, surveying, and reporting. The closure costs are presented in more detail in Tables 1, 1A, 1B, and 1C.

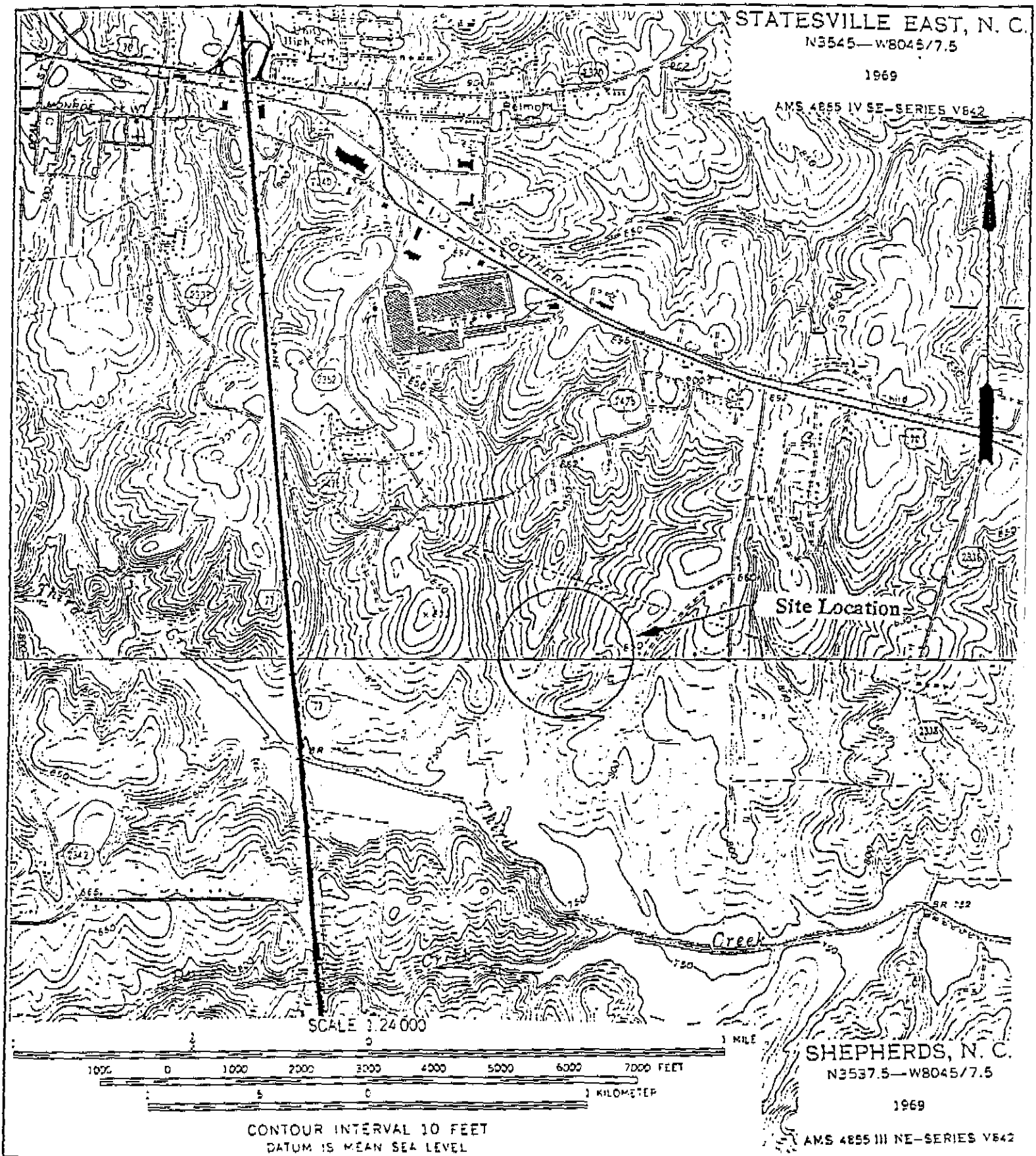
This closure cost estimate will be retained at the Third Creek facility and will be revised whenever a change in the plan affects the cost of closure. The costs will be adjusted annually from the date of its original development to reflect changes in the closure costs as a result of inflation. The United States Department of Commerce's *Annual Implicit Price Deflator for Gross National Product* will be utilized to make the adjustments.

2.2 Estimated Post-Closure Care Costs

The post-closure care cost information is submitted according to the requirements outlined in 40 CFR 265.144. An estimated maximum of $468,428.00 will be needed to perform the annual post-closure care activities (30 years) for the Third Creek Monofill HWMU. These costs are presented in more detail in Tables 2, 2A, 2B, and 2C. This amount may be reduced, however, if the post-closure care period is shortened pursuant to 40 CFR 265.117 (a)(2)(i).

This post-closure care cost estimate will be retained at the Third Creek facility and will be revised whenever a change in the plan affects the costs of post-closure care. The post-closure care costs will be adjusted as outlined in Section 2.1. Copies of the closure and post-closure care costs will be maintained at:

City of Statesville
Water/Wastewater Treatment Department
444 Third Creek Road
Statesville, North Carolina 28677
Attention: Mr. L. F. ("Joe") Hudson, Jr., Director



CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

	Author	Drawing	Layers	Date	Title
aquaterra	sk			4-07-95	Site Location Map
A GREAT LAKES CHEMICAL CORPORATION COMPANY	Job No. 5205800	Revision	Figure 1	Scale 1:24,000	Project Third Creek Monofill Statesville, North Carolina

PLEASE SEE OTHER MATERIALS

MAPS IN THE BOOK

Table 1 **Closure Cost Estimate, Third Creek Monofill – City of Statesville, Third Creek Water/Wastewater Treatment Plant, Statesville, North Carolina.**

Activity		Estimated Cost ($)[1]
• Soil Sampling – backfill/on-site borrow soils/natural subsurface soils – confirmatory soil sampling 9 samples/trench – background soil sampling (4 soil samples)		*$54,037.00*
• Unit Closure		
– treatability study (2 studies)	$11,500.00	
– mobilization/demobilization	$ 8,625.00	
– soils/solids excavation (3,505 cubic yards)	$18,340.00	
– solids/sludge treatment (3,257 tons)	$100,570.00	
– treatment chemical (Enviroblend (5% add mixture))	$97,720.00	
– backfilling/liners/compaction/restoration	$85,100.00	
– run-on/run-off control	$9,600.00	
– transportation	$5,962.00	
– stabilization testing (based on 15 samples for TCLP cadmium)	$1,275.00	
	Subtotal:	***$338,692.00***
• Project Management, Oversite, and Reporting		
– manage field work; consult w/HWS, City of Statesville	$2,960.00	
– Aquaterra's oversite of closure activities	$16,600.00	
– fill and cover materials testing (compaction)	$6,000.00	
– professional engineer's certification of closure	$3,000.00	
– surveying/deed registration	$4,025.00	
– reporting	$3,700.00	
	Subtotal:	***$36,285.00***
	Total Estimated Closure Costs:	**$429,014.00**
• Contingency (15%)		$64,352.00
	Grand Total Estimated Closure Costs:	**$493,366.00**

1 costs as of September 1996

Table 1-A **Cost Associated with the Closure Soil Sampling, Third Creek Monofill – City of Statesville, Third Creek Water/Wastewater Treatment Plant, Statesville, North Carolina.**

Activities	Estimated Cost ($)[1]
• Field Time	
– Staff Environmental Scientist - 16 hrs. ($65/hr) (hydraulic conductivity testing)	$1,040.00
– Staff Engineer - 16 hrs ($65/hr)	$1,040.00
– Water Level Probe	$ 20.00
– Nuclear Density Gauge	$ 30.00
– Miscellaneous Supplies	$150.00
– Mileage - 430 miles ($0.40/mile)	$172.00
– Meals - 3 days ($7/day)	$ 21.00
Subtotal	*$2,473.00*
• Laboratory Testing	
– 4 Background Soil Samples (8 RCRA Metals @ $100/sample) (15% mark-up)	$460.00
– Grain Size Analysis - 2 tests ($50/test; 15% mark-up)	$115.00
– Standard Proctor Compaction Test - 3 test ($90/test; 15% mark-up)	$310.00
– 3 (#8240 @ $130/sample) (15% mark-up)	$449.00
– 3 (#8270 @ $300/sample) (15% mark-up)	$1,035.00
– 3 (8 RCRA Metals @ $100/sample) (15% mark-up)	$345.00
– 72 (Total cadmium, barium, lead, and silver @ $100/sample)(15% mark-up)	$8,280.00
– 72 (volatile organics @ $190/sample)(15% mark-up)	$15,730.00
– 72 (semivolatile organics @ $300/sample)(15% mark-up)	$24,840.00
Subtotal	*$51,564.00*
Total	**$54,037.00**

1 costs as of September 1996

Table 1-B **Cost Associated with the Unit Closure, Third Creek Monofill – City of Statesville, Third Creek Water/Wastewater Treatment Plant, Statesville, North Carolina.**

Activities	Estimated Cost ($)[1]
• Unit Closure Contractor Cost	
– Treatability Study (2 studies @$5,000/study) (15% mark up)	$11,500.00
– Mobilization/Demobilization ($7,500) (15% mark up)	$ 8,625.00
– Soil Excavation (3,505 cubic yards @ $4.55/yd.^{3}) (15% mark up)	$18,340.00
– Sludge Treatment (3,257 tons @ $26.85/ton) (15% mark up)	$100,570.00
– Treatment Chemical (Enviroblend - 165 tons @ $515/ton) (15% mark up)	$97,720.00
– Construction of Run-on/Runoff Control Ditches	$9,600.00
– Transportation (Enviroblend - 8 loads @ $648/load) (15% mark up)	$5,962.00
– Backfilling (4,000 yd^3 @ $18.50/yd^3) (15% mark up)	$85,100.00
– Analytical Testing of Stabilized Material	
TCLP.EXT. (15 samples @ $65/sample) (15% mark up)	$1,120.00
cadmium (15 samples @ $9/sample) (15% mark up)	$ 155.00
Subtotal	***$338,692.00***
Total	**$338,692.00**

1 costs as of September 1996

Aquaterra Job No. 5205800
52224

Table 1-C **Cost Associated with the Closure Project Management/Oversite and Reporting, Third Creek Monofill – City of Statesville, Third Creek Water/Wastewater Treatment Plant, Statesville, North Carolina.**

Activities		Estimated Cost ($)[1]
• Manage Field Work; consult with HWS and City of Statesville		
– Project Manager - 20 hrs ($85/hr)		$1,700.00
– Senior Project Manager - 12 hrs ($105/hr)		$1,260.00
	Subtotal	*$2,960.00*
• Closure Oversite		
– Staff Engineer - 240 hrs ($65/hr)		$13,200.00
– Project Manager/Professional Engineer - 40 hrs ($85/hr)		$3,400.00
	Subtotal	*$16,600.00*
• Fill and Cover Material Testing		
– Compaction Testing - 50 tests ($120/test)		*$6,000.00*
• Professional Engineers Certification		
– Site Visits - 20 hrs ($105/hr)		$2,100.00
– Certification		$ 900.00
	Subtotal	*$3,000.00*
• Surveying/Deed Registration		
– Surveyor - $3,500 (15% mark up)		$4,025.00
	Subtotal	*$4,025.00*
• Reporting		
– Project Manager - 30 hrs ($85/hr)		$2,550.00
– Senior Review - 5 hrs ($105/hr)		$ 525.00
– Clerical - 5 hrs ($35/hr)		$ 175.00
– Drafting		$ 300.00
– Copying, postage, etc.		$ 150.00
	Subtotal	*$3,700.00*
	TOTAL	**$36,285.00**

1 costs as of September 1996

Table 2 **Post-Closure Care Cost Estimate, Third Creek Monofill – City of Statesville Third Creek Water/Wastewater Treatment Plant, Statesville, North Carolina.**

Activity	Estimated Cost ($)[1]
• Installation of 2 additional monitoring wells 2-inch wells to 40 feet	$4,515.00
• Ground Water Sampling (quarterly, one year)	
– quarterly sampling of 7 wells for first year[2]	$44,696.00
– disposal of purged ground water, per year[3]	$1,200.00
Subtotal	*$45,896.00*
• Ground Water Sampling (semiannual, 29 years)	
– semiannual sampling of 7 wells	$8,506.00
– disposal of purged ground water, per year[3]	$600.00
Subtotal	*$9,106.00*
• Inspection and Maintenance (per year) – Third Creek Monofill cover – monitoring wells – survey benchmarks – security system – mowing/vegetative cover	$3,015.00
• Annual Report (per year)	$2,000.00
Subtotal - First Year Cost:	*$55,426.00*
Subtotal - Annual Costs ($14,121 for 29 years):	*$409,509.00*
• Well Abandonment (8 wells) (one time cost)	$3,493.00
Total Post-Closure Care Costs for 30 Years:	**$468,428.00**

1 costs as of September 1996
2 included as one time cost for analysis of parameters listed in AOC
3 assumes generating four 55-gallon drums of purge water for each sampling event

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52224

Table 2-A **Cost Associated with the Post-Closure Care, Ground Water Monitoring, Third Creek Monofill -- City of Statesville Third Creek Water/Wastewater Treatment Plant, Statesville, North Carolina.**

Activity	Estimated Cost ($)[1]
• Installation of two 2-inch monitoring wells to 40 ft.	
– drilling charges (15% mark-up)	$3,140.00
– contractor oversight - 6 hrs. ($65/hr)	$390.00
– well development - 2 hrs ($65/hr)	$130.00
– mileage (100 miles @ $0.40/mile)	$40.00
– disposal of soil cuttings 4 - 55-gallon drums ($150/drum)	$600.00
– transportation for drums (40 x 4)	$200.00
– meals ($15/day)	$15.00
Total	***$4,515.00***
• Field Time/per sampling event	
– staff environmental scientist - 16 hrs ($65/hr)	$1,040.00
– meals ($15/day)	$15.00
– mileage (100 miles @ $0.40/mile)	$40.00
– water level probe	$20.00
– pH probe	$20.00
– conductivity probe	$20.00
– sampling supplies ($15/well - 6 wells)	$105.00
Subtotal	***$1,260.00***
• Ground Water Analytical (per quarterly event) (Arsenic, Barium, Cadmium, Chromium, Iron, Lead, Manganese, Mercury, Selenium, Silver, Sodium) 7 samples ($136/sample) (15% mark up)	$1,094.00
– VOCs 6 (#8240) ($130/sample) (15% mark up)*	$1,032.00
– SVOC 6 (#8270) ($300/sample) (15% mark up)*	$2,070.00
– TOC 6 (#9060) ($30/sample) (15% mark up)*	$207.00
– TOX 6 (#9020/9021) ($64/sample) (15% mark up)*	$442.00
– Pesticide/Herbicides 3 (#8080/8150)* ($224/sample) (15% mark up)	$773.00
– Pesticide 3 (#8080)($120/sample) (15% mark up)	$414.00
– Chloride 7 (#9251/9252) ($10/sample) (15% mark up)*	$81.00
– Sulfate 7 (#9036/9038) ($20/sample) (15% mark up)*	$161.00
– Nitrate 7 (#9200) ($20/sample) (15% mark up)*	$161.00
– Phenols 3 (#8040) ($25/sample) (15% mark up)*	$86.00
– Radium 7 (#903.1) ($150/sample) (15% mark up)*	$1,208.00
– Gross Alpha/Beta 7 (#900.0) ($87/sample) (15% mark up)*	$700.00
– Trip Blank 1 (#8240/8270) ($430/sample) (15% mark up)	$495.00
– Field Blank 1 (#8240/8270) ($430/sample) (15% mark up)	$495.00
– Duplicate 1 (#8240/8270) ($430/sample) (15% mark up)	$495.00
Subtotal	***$9,914.00***
Total	**$11,174.00**

Table 2-A (Cont.) Cost Associated with the Post-Closure Care, Ground Water Monitoring, Third Creek Monofill -- City of Statesville Third Creek Water/Wastewater Treatment Plant, Statesville, North Carolina.

Activity	Estimated Cost ($)[1]
Quarterly Monitoring for First Year $11,174/event x 4	$44,696.00
Semiannual Sampling(includes duplicate samples) $4,253/event x 2	$8,506.00
Purge Water Disposal/Year(semiannual events)	
2-55 gallon drum/event ($100/drum) x 2	$400.00
Transportation for drums ($50) x 4	$200.00
Subtotal	***$600.00***
Purge Water Disposal/Year(quarterly events)	
2-55 gallon drum/event ($100/drum) x 4	$800.00
Transportation ($50) x 8	$400.00
Subtotal	***$1,200.00***

1 costs as of September 1996

** Analysis not believed to be necessary for years 2 through 30 following first year of monitoring (quarterly). Parameters would be removed from parameter list upon approval by the HWS.*

Table 2-B **Cost Associated with the Post-Closure Care, Inspection and Maintenance, Third Creek Monofill – City of Statesville Third Creek Water/Wastewater Treatment Plant, Statesville, North Carolina.**

Activity		Estimated Cost ($)1
• Annual Inspection		
– Project Manager (P.E.) 8 hrs ($85/hr)		$680.00
– mileage - 100 miles ($.40/mile)		$ 40.00
– camera/film		$ 15.00
	Subtotal	*$735.00*
• Maintenance		
– mowing $150/two weeks (12)	*Subtotal*	*$1,800.00*
• Monthly Facility Inspection (1 hour @ $40/hr) (12)	*Subtotal*	*$480.00*
	TOTAL	**$3,015.00**

1 *costs as of September 1996*

Aquaterra Job No. 5205800
52224

Table 2-C **Cost Associated with the Post-Closure Care, Annual Report, Third Creek Monofill – City of Statesville Third Creek Water/Wastewater Treatment Plant, Statesville, North Carolina.**

Activity	Estimated Cost ($)[1]
• Annual Report	
– 16 hours ($85/hr)	$1,360.00
– 4 hours ($105/hr)	$ 420.00
– CAD - 2 hours ($50/hr)	$ 100.00
– clerical/copies/postage	$ 120.00
Total	*$2,000.00*
• Well Abandonment (8 wells) (45'/well) (8 wells) ($7.00/ft) (15% mark-up)	$2,898.00
– field supervision (8 hrs) ($65/hr)	$520.00
– mileage (110) ($0.40)	$40.00
– meals	$15.00
– water level probe	$20.00
Total	*$3,493.00*

1 costs as of September 1996

Aquaterra Job No. 5205800
52224

Closure Plan
Third Creek Monofill
City of Statesville
Statesville, North Carolina
EPA ID Number NCR 000 001 602

July 12, 1996

Prepared For

City of Statesville
Statesville, North Carolina

For Submittal To

North Carolina Department of Environment,
Health, and Natural Resources
Division of Solid Waste Management
Hazardous Waste Section
Raleigh, North Carolina

Prepared By

Aquaterra, Inc.
Charlotte, North Carolina

July 12, 1996

Ms. Sharron Rogers
North Carolina Department of Environment,
Health, and Natural Resources
Division of Solid Waste Management
Hazardous Waste Section
Post Office Box 27687
Raleigh, North Carolina 27611-7687

Reference: Closure Plan
Third Creek Monofill
City of Statesville
Statesville, North Carolina
EPA ID Number NCR 000 001 602
Aquaterra Job No. 5205800

Dear Ms. Rogers:

On behalf of the City of Statesville, Aquaterra, Inc. (Aquaterra) is pleased to present the following revised closure plan detailing the closure activities required for the Third Creek Monofill site located southeast of the City of Statesville, North Carolina. This closure plan was prepared at the request of the City of Statesville pursuant to the Administrative Order on Consent (Docket #94-191) entered into by the City of Statesville and the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR). Revisions are in response to the NCDEHNR, Division of Solid Waste Management, Hazardous Waste Section letters, *Comments on Closure and Post-Closure Plans, Third Creek Monofill*, dated November 17, 1995, and *Revised Closure and Post Closure Plans*, dated April 11, 1996.

This Closure Plan is based on interim status (40 CFR Part 265 and as adopted by the State of North Carolina) under *Subpart G - Closure and Post-Closure* in accordance with 40 CFR 265.110 through 265.116; *Subpart H - Financial Requirements* in accordance with 40 CFR 265.140 through 265.142 and 265.146; and *Subpart N - Landfills* in accordance with 40 CFR 265.310.

If you have any questions or comments concerning this plan, please contact Mr. Neal McElveen at (704) 525-8680 or Ms. Susan Kite at (910) 852-5003.

AQUATERRA, INC.

M. Neal McElveen, P.E.
Project Manager

Susan Kite, P.G.
Senior Project Manager

Senior Peer Review

Bryson D. Trexler, Jr., Ph.D., P.G.
Senior Hydrogeologist/Program Manager

MNM/SK/rap
52213

pc: Mr. L. F. ("Joe") Hudson, Jr. - City of Statesville
Mr. Douglas D. Vaughn, P.E. - Pierson & Whitman
Mr. George House - Brooks, Peirce, McLendon, Humphrey & Leonard, L.L.P.

Closure Plan
Third Creek Monofill
City of Statesville
Statesville, North Carolina
EPA ID Number NCR 000 001 602

July 12, 1996

1 Introduction

1.1 Background

The City of Statesville (the "City") operates a wastewater treatment system at the Third Creek site located southeast of the city limits of Statesville, Iredell County, North Carolina (see Figure 1). The site is situated on a dirt road off of Third Creek Road southeast of Statesville. The site is bordered to the north by pasture land. To the south of the facility is Third Creek. To the east of the property is residential property and to the west woodlands. The site operates under an National Pollutant Discharge Elimination System (NPDES) permit (Permit No. 0020591) and a non-discharge permit (Permit No. WQ0004040). Concern from elevated concentrations of cadmium in the treatment system was raised in 1993. The non-discharge permit was modified to allow the removal and landfilling of over 20 years of accumulated solids from Aeration Basins 1 and 2 and the digester in an effort to reduce the amount of cadmium in the wastewater treatment system. A composite core sample of this sludge was taken at the start of the clean-out in April 1993, and it passed TCLP.

The sludge was placed in eight landfill trenches on property near the wastewater treatment plant (see Figure 2). Based on information obtained from the City of Statesville Water/Wastewater Treatment Department, a sump pump was initially utilized to draw down Aeration Basin No. 2 and the sludge was pumped to the digester followed by a belt press for dewatering. The dewatered solids were then transported to the trenches. The remaining sludge/solids from the aeration basin was initially removed utilizing a clam shell until a front end loader could be operated within the basin. The clam shell removed the sludge/solids in long narrow strips generally removing the top layers first. The sludge removed by the front end loader was first pushed into a pile and then loaded onto trucks for transport to the monofill.

During the final removal of the sludge from the basin, a second sample was collected and analyzed. The results of this sample revealed high concentration of cadmium; however, this sample was analyzed for total cadmium rather than cadmium by the TCLP method. Based upon this result, the City immediately ceased removal operations and contacted the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR). The City then contracted with International Technology Corporation ("IT") to sample the monofill trenches.

IT began sampling the monofill trenches on February 5, 1994, and completed sampling on February 10, 1994. Due to poor weather conditions and difficulty maneuvering the drill rig, borings were installed along the apparent center line of each trench. Sludge materials were not found in every boring. Samples were obtained using 5 feet long split spoon samplers. Generally, the trenches were divided

into four sections. As per Mr. Jesse Wells of the NCDEHNR, one composite sample from each trench was analyzed for TCLP organics and inorganics (the volatile constituents were collected as grab samples). One composite TCLP metals sample per trench section, except for the section where a full TCLP analysis was completed, was also analyzed. Subsequent sampling of the monofilled sludge identified cadmium levels in excess of the regulatory limit for cadmium according to TCLP in seven of the trenches. TCLP cadmium levels in one trench, Trench 20 (Trench H), were below action levels. Sampling protocols, boring locations, documentation, and analytical results were presented in the *IT Sampling and Analysis Trip Report*, dated February 1994.

The variation in TCLP cadmium levels could be directly related to the method in which the sludge/solids were removed from the basin and also the amount of digested sludge materials placed in these trenches. As discussed above, the dewatered solids, which would typically have a lower leachable metals concentration were separately transported and placed in the monofill trenches. In addition, the fact that sludge materials were not noted in all borings shows the variability in placement of sludge in the monofill. Furthermore, as the initial sampling indicates, some of the sludge placed in the monofill (i.e. the top layer) was not hazardous. Therefore, Trench 20 (Trench H) could contain a combination of non-hazardous sludge and non-hazardous dewatered solids. Because it was not required at the time, the City did not document the order in which the trenches received sludge and dewatered solids.

Based upon this investigation and the laboratory analytical results, the City entered into an Administrative Order on Consent (Order) with the NCDEHNR, Division of Solid Waste Management (DSWM) that was signed by the City of Statesville on March 8, 1995. In accordance with this Order, the City of Statesville submitted a *Phase I Subsurface Characterization Work Plan* and a *Ground Water Sampling and Analysis Plan* to address the requirements of the Order. This work plan was submitted on April 8, 1995. The subsurface characterization was completed in mid-April 1995, and a report of *Phase I Subsurface Characterization* was submitted on May 8, 1995. *The Ground Water Sampling and Analysis Plan* was also submitted on May 8, 1995. A *Revised Ground Water Sampling and Analysis Plan* was submitted on October 31, 1995, and approved by the Hazardous Waste Section (HWS) on December 6, 1995. A *Closure Plan*, *Post-Closure Care Plan*, and *Closure and Post-Closure Care Costs* were submitted on August 7, 1995. A *Revised Closure Plan*, *Revised Post-Closure Care Plan*, and *Revised Closure and Post-Closure Care Costs* were submitted on February 27, 1996, in response to the NCDEHNR DSWM, HWS letter, *Comments on Closure and Post-Closure Plans, Third Creek Monofill*, dated November 17, 1995. Additional comments were received in the HWS letter *Revised Closure and Post Closure Plans*, dated April 11, 1996. The following *Revised Closure Plan* addresses the comments from the HWS.

1.2 Closure Plan Development

The City of Statesville has contracted Aquaterra to develop and implement the Closure Plan in accordance with 40 CFR 265.110 through 265.116. The financial requirements for closure will be developed as outlined in 40 CFR 265.140 through

265.143 and 265.146. Also, 40 CFR 265.310 (*Subpart N - Landfills*) will be used as a guideline in developing the closure care activities.

The Closure Plan for the Third Creek Monofill is presented in Section 2.0.

1.3 Maintenance of Closure Plan

The City of Statesville will maintain an on-site copy of the approved Closure Plan and all revisions until the certificate of closure has been submitted and accepted by the HWS as outlined in 40 CFR 265.112(a). The Closure Plan copy and all revisions will be maintained at the Third Creek water treatment facility by a designated employee of the City of Statesville. The current facility designee's address and phone number are as follows:

Mr. L. F. ("Joe") Hudson, Jr., Director
Water/Wastewater Treatment Department
City of Statesville
Post Office Box 1111
Statesville, North Carolina 28687-1111
Phone: (704) 878-3438

2 Closure Plan

2.1 Introduction

The following Closure Plan has been prepared to address the closure performance standards outlined in 40 CFR 265.111. The City of Statesville will close the Third Creek Monofill site so that:

- there is minimal need for further maintenance of the Hazardous Waste Management Unit (HWMU) (265.111(a));
- the closure protects human health and the environment and minimizes or eliminates the post-closure escape of hazardous waste decomposition products to the ground water, surface water, and atmosphere (265.111(b)); and
- the Closure Plan complies with the requirements of Subpart G - Closure and Post-Closure and Subpart N - Landfills (40 CFR 265.310).

This plan addresses the eight trenches (Third Creek Monofill) varying in length from approximately 50 to 140 feet, width from approximately 10 to 15 feet and depth of approximately eight feet where the sludge was placed. Seven of the trenches exhibited cadmium concentrations above the TCLP regulatory level of 1.0 milligram per liter (mg/L). As required by the HWS, the eighth trench which had cadmium concentrations below the TCLP regulatory limit and trace amounts of volatile organic and semivolatile organic compounds will also be closed in accordance with the following this *Closure Plan*. The site is located approximately 2,000 feet west of Third Creek Road and 5,000 feet south of Highway 70.

2.2 *Maximum Inventory of Hazardous Waste*

In 1993, concerns arose over elevated cadmium levels in the wastewater treatment system. The Third Creek facility modified an existing non-discharge permit (Permit No. WQ0004040) to allow removal and landfilling of over 20 years of accumulated solids from Aeration Basins 1 and 2 and the facility digester. The solids were placed in eight trenches near the site. According to the Third Creek facility records, approximately 1,750 cubic yards of material were placed in the trenches. Based on the February 1994 sampling data collected by IT Corporation of Knoxville, Tennessee, concentrations of cadmium using the TCLP ranged from 0.15 to 38.0 parts per million. The estimated volume of hazardous waste generated (as required by (265.111(b)(3)) at the Third Creek facility is 1,750 cubic yards of solids (cadmium contaminated) from the aeration and digester basins. There are no records of additional hazardous wastes generated at the facility. The wastewater treatment plant has been in operation since the early 1970's.

2.3 *Closure of the Third Creek Monofill*

2.3.1 *On-Site Stabilization*

Prior to closure of the HWMU, a treatability study will be conducted on materials contaminated with high concentrations of cadmium. The objective of the treatability study will be to determine the effectiveness of stabilization/solidification for minimizing the leachability of cadmium. Testing will be conducted following a phased approach. The preliminary treatment phase will evaluate a number of reagents and reagent formulations for stabilation of the sludge materials. The preliminary treatment criteria will be leachability of cadmium as measured by TCLP. Optimum reagents/reagent formulations will be evaluated during a confirmation testing phase. Details of the treatability study are included in Appendix A.

The HWMU will be closed by stabilizing the sludge and installation of a capping system. A treatment plant consisting of a concrete staging pad, power screen, and pugmill will be set on-site. The concrete pad will be used to stage materials awaiting treatment. An estimated 2 to 3 feet of overburden soil from each trench will be excavated, staged on-site, and laboratory tested for potential use as fill material. The sludge/solids will be excavated and staged on a concrete pad. The sludges/solids will be loaded into the power screen and discharged into the pugmill batch mixer. A predetermined percentage of fixation chemical (determined from bench scale tests described in Appendix A) will be added and thoroughly mixed. The treated material will be staged on plastic, covered to prevent stormwater contact, and allowed to cure as determined in the treatability study. Following the curing time for the stabilized material, and prior to placement of the media back into the trenches, treated materials will be tested for leachable cadmium using TCLP on a 250 ton to 500 ton interval.

To determine baseline concentration levels of metals in on-site soils, four background soil samples will be obtained at locations upgradient from the monofill and in an area that has had limited or no development. The soil samples will be

obtained at approximately 5 feet below ground surface and will be analyzed for the eight RCRA metals.

To confirm that all the contaminated sludge/solids have been excavated from each trench, confirmatory soil samples will be obtained from the bottom of each trench at 20-foot intervals (5 soil samples per 100 feet) and from the side walls and end walls of the trench (4 soil samples) utilizing a decontaminated stainless steel hand auger. Each trench will be gridded on 5-foot intervals. For each 20-foot length, one sample will randomly be collected. In a similar manner, the sides and ends of the pit will be gridded, and one sample per side and end randomly chosen. The soil samples will be collected from bottom or wall surface to 6-inches deep, thoroughly mixed by quartering, and then a sample collected. The soil samples will be analyzed for total cadmium, total barium, total lead, total silver, volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) following SW-846 Methodology. The total metals analysis will be compared to the baseline total metals. Any contaminated soils will be excavated, placed on the concrete pad, and treated with the sludge/solids. The treated material will then be placed back into the trenches in 12-inch lifts and compacted to a density of 90 percent using a sheeps foot roller. The treated material will be capped following the procedures in Section 2.3.2.

2.3.2 Closure and Post-Closure of Landfills

For the purposes of closure, post-closure, and financial responsibility, the Third Creek Monofill is considered to be a landfill and the City of Statesville must meet the requirements for landfills specified in Subparts G, H, and F of 40 CFR 265 as per 40 CFR 265.310. Under Subpart N - Landfills (Section 40 CFR 265.310), Closure and Post-Closure requirements include:

(a) At final closure of the landfill, the owner or operator must cover the landfill with a final cover designed and constructed to:

- (1) provide long-term minimization of migration of liquids through the closed landfill;
- (2) function with minimum maintenance;
- (3) promote drainage and minimize erosion or abrasion of the cover;
- (4) accommodate settling and subsidence so that the cover's integrity is maintained; and
- (5) have a hydraulic conductivity less than or equal to the hydraulic conductivity of any bottom liner system or natural subsoils present.

(b) After final closure, the owner or operator must comply with all post-closure requirements contained in Sections 265.117 - 265.120, including maintenance and monitoring throughout the post-closure care period. The owner or operator must:

- (1) maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events;

(2) maintain and monitor the ground water monitoring system and comply with all other applicable requirements of Subpart F of this part;
(3) prevent run-on and run-off from eroding or otherwise damaging the final cover; and
(4) protect and maintain surveyed benchmarks used in complying with Section 265.309.

The owner or operator of a landfill must maintain the following items in the operating record required in Section 265.73:

- on a map, the exact location and dimensions, including depth, of the landfill with respect to permanently survey benchmarks, and
- the contents of the landfill and the approximate location of each hazardous waste type within each landfill cell.

2.3.2.1 Impermeable CAP System

Following placement of the stabilized material, closure will be completed with an impermeable cap system that will cover each of the eight trenches.

The impermeable cap will consist of a geotextile fabric followed by a compacted two-foot layer of clayey silty sand to sandy silt with a hydraulic conductivity less than or equal to 1E-7 centimeters per second (cm/sec) after compaction or at a minimum have a hydraulic conductivity less than or equal to the underlying backfill and natural soil. Overlying the compacted soil layer will be a 30 mil high density polyethylene (HDPE) liner followed by a 12-inch sand layer for drainage. A geotextile filter fabric will be placed over the sand layer followed by two to three feet of lightly compacted topsoil or fill dirt. The topsoil will be seeded to prevent erosion. A grade of one to two percent will be maintained from the compacted impermeable soil layer up to the topsoil or fill layer to promote drainage.

After the capping of the trenches has been completed, the City of Statesville will upgrade the existing facility security system in accordance with 40 CFR 265.14 (a),(b). In addition, permanent monuments will be placed at the four corners of the landfill cap(s) and surveyed with respect to a permanent benchmark.

2.3.2.2 Placement of Compacted Layer

The two-foot layer of clayey silty sand to sandy silt shall be placed in horizontal lifts not to exceed 12-inches in uncompacted thickness. Each lift shall be compacted by compaction equipment to a minimum density of 90 percent of the maximum dry density as determined in accordance with ASTM D-698. Materials shall be placed at no less than 2 percentage points below the optimum moisture content as determined in accordance with ASTM D-698 and no greater than 3 percentage points over the optimum moisture content. At no time will the minimum number of passes be reduced. The soils shall be free of trash, perishables or other deleterious materials. No cobbles, stones, or rock greater than 3-inches in diameter will be placed in the compacted layer.

Upon completion of placement, the upper surface shall be trimmed to a smooth surface and then compacted by three passes of a smooth wheel roller to provide a smooth, flat surface. In addition, a hydraulic conductivity test will be conducted following the placement of the 2-foot compacted layer.

2.3.2.3 Placement of Topsoil Material

Topsoil material shall consist of clean off-site borrow materials. Topsoil shall be free of trash, perishable or other deleterious materials. No cobbles, stones, or rock fragments greater than 3 inches in diameter will be placed in the topsoil layer. Topsoil materials will be sufficiently compacted by placement activities; no further compaction of the topsoil will be required. No in-place density testing will be required on the topsoil materials.

2.3.2.4 Runoff/Run-on Control

The topsoil cover will be sloped such as to prevent drainage to the HWMU. The topsoil cover grade will be approximately one to two percent. In addition, the cover will be protected from erosion by planting vegetation such as perennial grasses. To control storm water run-on and runoff, trapezoidal ditches with vegetative cover will be constructed on the topographically upgradient side of each cell. The ditches will be constructed at a minimum of five feet from each cell to prevent compromise of the capping system. Based on a 25-year design storm and a conservative drainage area of 9.18 acres, the vegetative lined ditches will be constructed with a base of 4 feet, a depth of 1.5 feet (includes a 6-inch freeboard), a side slope of 2:1 and a total width of 10 feet. Details of the ditches are shown on Figure 3.

2.3.2.5 Testing and Monitoring

All borrow sources for the fill soil, capping soil, and topsoil will be sampled and analyzed for volatile organic compounds (VOCs) according to SW-846 Method 8240, semivolatile organic compounds (SVOCs) according to SW-846 Method 8270, and the eight Resource Conservation and Recovery Act (RCRA) metals. No contaminated borrow material will be allowed on-site.

Hydraulic conductivity testing will be conducted on natural soils at the site and following placement of the compacted two-foot cap layer. Hydraulic conductivity testings will be in accordance with the Fall-head Test.

All placement activities will be continuously monitored by a qualified engineer or geologist familiar with soil placement, testing techniques, and procedures. On-site testing will consist of determining in-place density by the Sand Cone method in accordance with ASTM D-1556, the Rubber Balloon method in accordance with ASTM D-2167, or by the Nuclear method in accordance with ASTM D-2922.

Prior to placement activities, moisture/density tests will be performed on representative samples of each material to be placed. The results of these tests will be the basis for determining acceptable in-place density criteria. If there is any discrepancy between testing results using different methods, the Sand Cone method

shall be the standard to which all results shall be compared. Natural subsoils on-site will be tested in-place by the Nuclear method in accordance with ASTM D-2922.

Testing frequency shall be a minimum of one test per lift. Any in-place materials not meeting the minimum density requirements shall be recompacted. Upon completion of the in-place test, the hole created for the test shall be cleaned of any remaining sand or other materials and shall be backfilled with commercially produced bentonite clay pellets, hydrated and hand compacted in a maximum of two inch lifts.

2.3.2.6 Subsidence

The potential subsidence of the capping system should be negligible. The materials placed in accordance with the above procedures will exist in a compacted condition and will be over-consolidated due to the compactive effort during placement. Since there will be no surcharge load placed on the area by surface load and minimal seepage will be flowing downward through the placed material, there is no mechanism available to cause further compression of the cap, fill, or subgrade materials.

2.3.2.7 Closure Schedule

The closure activities outlined above will be completed within 180 days in accordance with the AOC (Docket #94-191), 40 CFR 265.113(b)(codified at 15A NCAC 15A NCAC 13A.0010), and after receiving approval from the HWS. As the AOC sets forth, the site is considered one unit rather than eight separate units. Therefore, the City of Statesville is not submitting eight separate schedules for closure and post-closure care, but rather will adhere to the schedule set forth in the AOC.

2.4 Decontamination of Equipment

All equipment and tools will be decontaminated on-site using power washing with water (pH 6.0-7.0). A self-contained decontamination pad will be utilized to collect washdown from the decontamination process. Equipment will be positioned during decontamination so that washdown water or fluid is collected without runoff to any unlined portion of the soil. All washdown in the self-contained steel decon pad will be removed following completion of the project by a vacuum system and placed in drums and will be disposed of by the contractor. Additional materials, such as plastic sheeting, personnel protective equipment, etc., will be placed in drums. The decon wastewater from the washdown and other solid waste materials will be sampled and analyzed for leachable cadmium using total metals and TCLP, respectively. If the decon wastewater or other solid waste is hazardous, the material will be disposed of at a permitted Treatment, Storage, and Disposal Facility (TSDF). Documentation, manifests, and certification will be performed in accordance with all applicable regulations including 40 CFR 260, 261, 262, 263, and 268. Completion of decontamination will be determined by visual inspection to ensure all soils have been removed from the equipment.

2.5 Inspection and Maintenance

The City of Statesville will ensure that the closed Third Creek Monofill is properly maintained by inspecting it monthly for the following:

- erosion damage
- vegetative cover
- run-on/run-off control system

The capping system will be sloped to provide positive site drainage away from the HWMU. The cover grade will be approximately 1 to 2 percent. The cap's slope is designed so that the maximum drainage velocity leaving the cap is less than the velocity likely to cause erosion for the selected vegetation. The cap will be visually inspected annually by a professional engineer to ensure that the positive drainage slope is maintained. Should minor subsidence or spot irregularities be discovered, new topsoil will be placed on the cap and it will be regraded.

The cap will also be protected from erosion by maintaining an appropriate vegetative cap. Maintenance activities for the vegetative cap will include mowing, seeding, and fertilizing during the year. The activities will be performed on an as-needed basis due to the seasonal nature of vegetation.

2.6 Closure Cost and Financial Assurance

The closure costs required under 40 CFR 265.142 will be submitted under separate cover by the City of Statesville. The closure cost estimate and any revisions will be retained at the Third Creek Wastewater Treatment facility and updated on an annual basis to reflect cost changes as a result of inflation or changes in the Closure Plan activities.

The City of Statesville submitted financial assurance information pursuant to 40 CFR 265.143 on October 6, 1995, and a special report on November 5, 1995. The City's financial mechanism, Financial Test and Corporate Guarantee for Closure (265.143(e)) was approved by the HWS on December 12, 1995, with the requirement that a new test be submitted on or before September 30, 1996.

2.7 Certification of Closure

Within 60 days of completing closure, the City of Statesville will submit to the HWS a certification by both the City of Statesville and an independent professional engineer registered in the State of North Carolina that the Third Creek Monofill has been closed according to the approved Closure Plan. Documentation supporting the independent registered professional engineer's certification will be maintained until the HWS releases the City of Statesville from the financial assurance requirements for Closure under 40 CFR 265.143(h).

2.8 Notice to Local Land Authority

Within 60 days after closure is completed, the City of Statesville will submit to the Iredell County Register of Deeds and to the HWS a survey plat indicating the location and dimensions of the trenches with respect to permanently surveyed benchmarks. This plat will be prepared and certified by a professional land surveyor registered in the State of North Carolina. The plat will contain a note, prominently displayed, which states the City of Statesville's obligation to restrict disturbances of the site in accordance with the applicable Subpart G regulations (40 CFR 265.116 as adopted in 15 NCAC 13A .0010).

3 Post-Closure Care Plan

"Clean" closure of the Third Creek Monofill can be achieved by complete removal and fixation/solidification of the sludge. "Clean" closure can be confirmed through analysis of soil samples that show that all the materials have been removed from the trenches and that the constituent of concern is bound in the fixated sludge. If "clean" closure is unachievable, a Post-Closure Care Plan will be implemented after the closure is complete. This plan will be submitted to the HWS under separate cover. The following items will be included in the post-closure care plan:

- Ground Water Sampling and Analysis Plan – A ground water sampling and analysis plan prepared by a licensed geologist in accordance with 40 CFR 265.93(d)(2) was submitted to the HWS on May 8, 1995 (Aquaterra report number GR5041). A revised ground water sampling and analysis plan was submitted on October 31, 1995 and approved on December 6, 1995.

  The ground water sampling and analysis plan addresses:

  - the number, location, and depth of wells;
  - sampling and analytical methods for those hazardous wastes or hazardous waste constituents found present at the facility;
  - evaluation procedures, including use of previously gathered ground water quality information; and
  - a schedule of implementation.

- A description of the planned ground water monitoring activities and frequencies at which they will be performed.

- A description of the planned maintenance activities and frequencies at which they will be performed for the cap, security system, and monitoring wells.

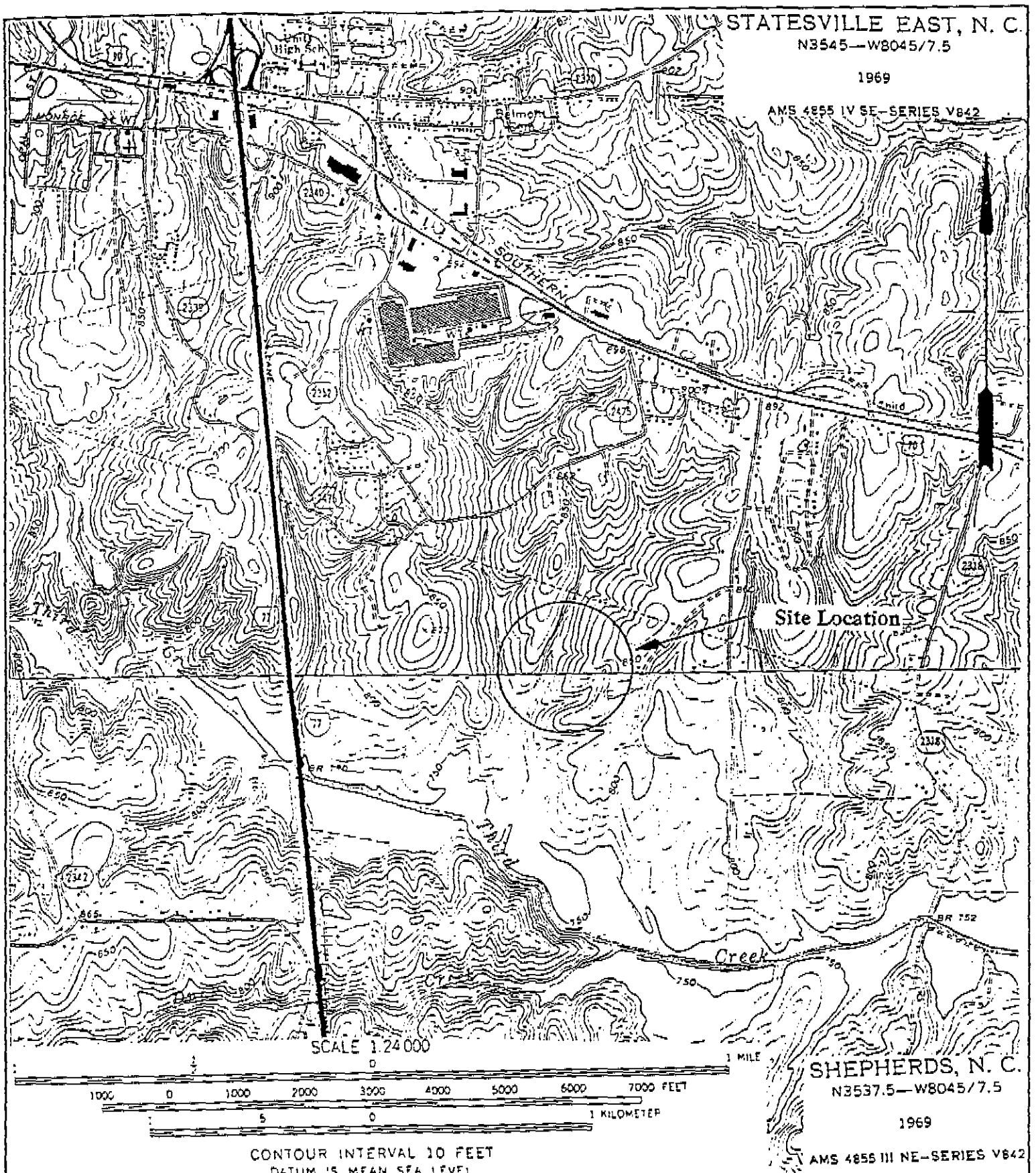
- The name, address, and phone number of the person or office to contact about the hazardous waste disposal unit during the post-closure care period.

- Recordkeeping and reporting during post-closure:
  - ground water monitoring data and evaluation of data;
  - annual report;
  - updates on costs of post-closure care; and
  - maintenance of all records for the post-closure care period.

- Copies of the Post-Closure Care Plan will be maintained at:

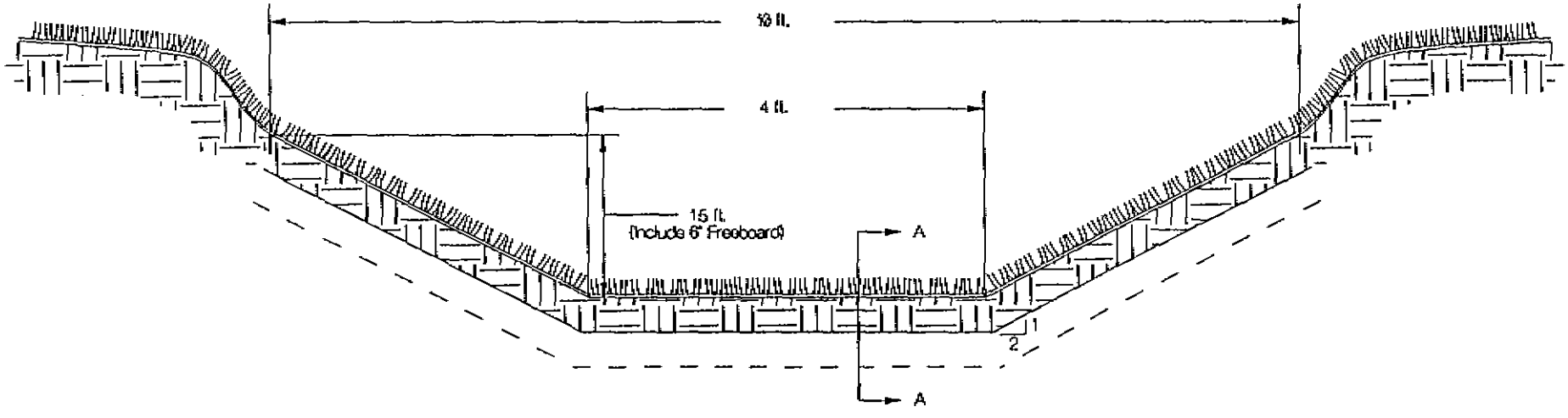
  City of Statesville
  Water/Wastewater Treatment Department
  Post Office Box 1111
  Statesville, North Carolina 28687-1111
  Attention: Mr. L.F. ("Joe") Hudson, Jr., Director

  The person responsible for updating the Post-Closure Care Plan will be the facility representative mentioned or his designee. As the Post-Closure Care Plan is updated or amended, the date and number of the revision will be placed on the lower left corner of each page revised and the revision will be noted on the plan's title page.

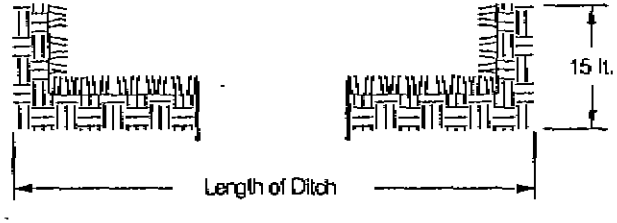


aquaterra	Author	Drawing	Layers	Date	Title	
	sk			4-07-95		Site Location Map
A GREAT LAKES CHEMICAL CORPORATION COMPANY	Job No.	Revision	Figure	Scale	Project	
	5205600		1	1:24,000		Third Creek Monofill Statesville, North Carolina

Detail



Longitudinal Section A – A



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	Job No.	Revision	Figure	Scale	Project
	5206800	2-15-96	3	1" = 1'	Third Creek Monofill Statesville, North Carolina

KIBER ENVIRONMENTAL SERVICES, INC.
FOUR SEASONS ENVIRONMENTAL, INC.
TREATABILITY STUDY PROPOSAL

SCOPE OF WORK

Kiber Environmental Services, Inc. (Kiber) developed the following scope of work in accordance with information provided by Four Seasons Environmental, Inc. (Four Seasons). The following discussions include information on the untreated characterization and treatability testing program.

INTRODUCTION

The treatability study will be conducted on materials contaminated with high concentrations of cadmium. The objective of the treatability study will be to determine the effectiveness of solidification/stabilization for minimizing the leachability of cadmium from soils sampled from the site. Testing will be conducted using a phased approach. The preliminary treatment phase will evaluate a number of reagents and reagent formulations for stabilization treatment of materials sampled from the site. The performance criteria during preliminary treatment evaluations will be leachability of cadmium as measured in the extract produced by the Toxicity Characteristic Leaching Procedure (TCLP). Optimum reagents and reagent formulations developed during the preliminary treatment phase will be further evaluated during a confirmation testing phase.

UNTREATED MATERIAL CHARACTERIZATION

Upon receipt, Kiber will place the materials into refrigerated storage maintained at a temperature of 4 degrees Celsius (°C) until initiation of the treatability testing. Kiber will then homogenize the untreated material to better ensure uniform materials for treatability testing. Homogenization will be conducted on the material after cooling to a temperature of 4 degrees Celsius (°C). Kiber will utilize stainless steel mixing instruments and minimize volatilization of organic compounds through the use of low energy mixing techniques. For bench-scale testing, Kiber will remove all particles larger than 3/8 inches in diameter from each waste material.

After homogenizing the waste material, representative aliquots of the waste will be collected for characterization testing. The establishment of the baseline level of contamination is important for comparing and determining the effectiveness of solidification treatment. The results of the untreated characterization testing will also

allow Kiber to estimate the reagents and reagent concentrations necessary for effective treatment. The following chemical analyses will be conducted on aliquots of each untreated material in accordance with the specified methods:

Total Cadmium	EPA Method 6010
TCLP Cadmium	EPA Methods 1311/6010
Material pH	EPA Method 9045

Geotechnical characterization provides basic information on the handling properties of the contaminated soils. Physical properties are used to prepare cost estimates and design specifications with regard to full-scale treatment, material excavation, transport and storage. The information generated is critical to making sound engineering decisions. The following analyses will be conducted on the untreated treatability sample in accordance with the referenced American Society of Testing and Materials (ASTM) test methods:

Moisture Content	ASTM D 2216
Bulk Unit Weight / Bulk Specific Gravity	ASTM D 5057

Preliminary Treatment Evaluations

Kiber has found that the most effective approach for stabilizing difficult materials is to screen a wide range of treatment reagents and reagent concentrations. Non-proprietary reagents, including Type I Portland cement, cement kiln dust (CKD), pozzolime, blast furnace slag, hydrated lime, fly ash, ferric sulfate, ferrous sulfate, sodium silicate, organophillic clay, and quick lime may be evaluated for treatment of the waste materials. Whenever possible, Kiber will identify reagent suppliers located close to the site. Schedule permitting, samples of these reagents will be obtained prior to initiating the treatability study.

Due to the difficulty associated with treating high concentrations of cadmium, Kiber may also evaluate proprietary reagents for the treatment of the contaminated wastes. Proprietary reagents typically treat contaminants through fixation, a process which chemically alters the contaminants to a form less susceptible to leaching. Proprietary processes evaluated by Kiber include reagents developed by ETUS, Inc. and International Waste Technologies (IWT). In addition, Kiber may evaluate a patented technology developed by RMT, Inc. Note that Kiber has considerable experience evaluating the proprietary and patented reagents developed by these firms. These reagents often provide successful treatment where more traditional reagents have failed. Kiber can evaluate these or any other reagents or processes identified by Four Seasons.

Reagents and reagent addition rates will be selected based on 1) previous bench-scale testing results on the site materials, 2) Kiber's experience treating similar waste materials, 3) the results of the untreated characterization testing, and 4) recommendations from Four Seasons. Kiber requests that the results of any previous bench-scale stabilization studies be provided for review prior to initiation of the treatability study.

The blending process to be implemented for the treatability study is a cost-effective process intended to mimic full-scale stabilization processes as much as possible on the laboratory scale. This laboratory procedure will be modified as necessary to simulate full-scale systems suggested by Four Seasons for application of the stabilization treatment. Specifically, the process is intended to provide Four Seasons with a basis for valid comparison between the different treatment reagents.

Each mixture will be developed by placing aliquots of the untreated material into a blending chamber. To the untreated material, reagent will be added and blended at a rate of approximately 30 to 40 rotations per minute (rpm) until visually homogeneous, approximately 60 to 90 seconds. Water will be added based on 1) Kiber's experience performing full-scale solidification projects, or 2) review of the treatment processes to be implemented during pilot-scale treatment. Typically, Kiber will achieve a treated material with the consistency of a low slump concrete.

The treated materials will be compacted into cylinders and allowed to humid cure for a period of 7 days. During the curing period, Kiber will conduct penetrometer strength testing at cure times of 1, 2, 3 and 7 days. Penetrometer testing is used to estimate the setting and strength properties of the treated materials. A good correlation between unconfined compressive strength and penetrometer testing is often obtained. It is stressed, however, that penetrometer testing only provides an estimate of the strength of the treated materials.

Upon completion of the 7-day cure, aliquots of each mixture will be submitted for TCLP cadmium analyses in accordance with EPA Methods 1311/6010.

CONFIRMATION TREATMENT EVALUATIONS

Confirmation treatment evaluations will be performed to 1) evaluate the potential variability of the stabilization process, and 2) confirm the effectiveness of candidate processes. Kiber and Four Seasons will select two candidate treatment processes for the confirmation treatment evaluations. The candidate mixtures will be developed in general accordance with the procedures outlined for the preliminary evaluations.

Upon completion of the mixture preparation, each treated material will be compacted into molds and allowed to humid cure. Penetrometer evaluations will be performed throughout the curing process, at cure times of 1, 2, 3 and 7 days. Upon completion of the 7 day cure, Kiber will evaluate the volumetric increase due to addition of the treatment reagents. This information is useful for pilot and full-scale cost estimations concerning final waste placement or disposal. The volumetric expansion due to addition of the treatment reagents is performed by compacting a pre-weighed aliquot of soil into a cylindrical sample mold. The volume of the untreated soil is then measured and recorded. Next, the soil is removed from the mold, and treated in accordance with the protocols outlined above. Upon completion of the treatment process, the material is again compacted into the same type of sample mold and allowed to cure. After completion of the 7-day cure, the volume and weight of the treated material is measured and recorded. The percent volumetric expansion or shrinkage is determined based on the following equation: [(Final Volume - Initial Volume) / Initial Volume]*100.

Upon completion of 7 days of curing, each candidate mixture will be subjected to TCLP cadmium analysis in accordance with EPA Methods 1311/6010.

Post-Closure Care Plan
Third Creek Monofill
City of Statesville
EPA ID Number NCR 000 001 602
Statesville, North Carolina

September 13, 1996

Prepared For

City of Statesville
Statesville, North Carolina

For Submittal To

North Carolina Department of Environment,
Health, and Natural Resources
Division of Waste Management
Hazardous Waste Section
Raleigh, North Carolina

Prepared By

Aquaterra, Inc.
Charlotte, North Carolina

September 13, 1996

Ms. Sharron Rogers
North Carolina Department of Environment,
Health, and Natural Resources
Division of Waste Management
Hazardous Waste Section
Post Office Box 27687
Raleigh, North Carolina 27611-7687

Reference: Post-Closure Care Plan
Third Creek Monofill
City of Statesville
Statesville, North Carolina
EPA ID Number NCR 000 001 602
Aquaterra Job No. 5205800

Dear Ms. Rogers:

On behalf of the City of Statesville, Aquaterra, Inc. (Aquaterra) is pleased to present the following revised post-closure care plan detailing the post-closure activities required for the Third Creek Monofill located at the Third Creek Waste Water Treatment Plant located southeast of Statesville, North Carolina. This plan was prepared at the request of the City of Statesville and pursuant to the Administrative Order on Consent (AOC) Docket No. 94-191 and settlements entered into by the City of Statesville and the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR). Revisions are in response to the NCDEHNR, Division of Waste Management, Hazardous Waste Section letters, *Comments on Closure and Post-Closure Plans, Third Creek Monofill*, dated November 17, 1995, *Revised Closure and Post Closure Plans*, dated April 11, 1996, and *Parameter List and Monitoring Well System*, dated September 3, 1996.

This Post-Closure Care Plan is based on interim status (40 CFR Part 265 and as adopted by the state of North Carolina) under *Subpart G - Closure and Post-Closure* in accordance with 40 CFR 265.110, and 265.117 through 265.120; *Subpart H - Financial Requirements* in accordance with 40 CFR 265.140 through 265.141, and 265.144 through 265.146; and *Subpart N - Landfills* in accordance with 40 CFR 265.310.

If you have any questions or comments concerning this plan, please contact Mr. Neal McElveen at (704) 525-8680 or Ms. Susan Kite at (910) 852-5003.

AQUATERRA, INC.

M. Neal McElveen, P.E.
Project Manager

Susan Kite, P.G.
Senior Project Manager

Senior Peer Review

Bryson D. Trexler, Jr., Ph.D., P.G.
Senior Hydrogeologist/Program Manager

MNM/SK/rap
52214

pc: Mr. L.F. ("Joe") Hudson, Jr. - City of Statesville
Mr. Douglas D. Vaughn, P.E. - Pierce & Whitman
Mr. George House - Brooks, Peirce, McLendon, Humphrey & Leonard, L.L.P.

Post-Closure Care Plan
Third Creek Monofill
City of Statesville Site
Statesville, North Carolina
September 13, 1996

1 Introduction

1.1 Background

The City of Statesville (the "City") operates a waste water treatment system at the Third Creek site located southeast of the city limits of Statesville, Iredell County, North Carolina (see Figure 1). The site is situated on a dirt road off of Third Creek Road southeast of Statesville. The site is bordered to the north by pasture land. To the south of the facility is Third Creek. To the east of the property is residential property and to the west woodlands. The site operates under an National Pollutant Discharge Elimination System (NPDES) permit (Permit No. NC0020591) and a non-discharge permit (Permit No. WQ0004040). Concern from elevated concentrations of cadmium in the treatment system was raised in 1993. The non-discharge permit was modified to allow the removal and landfilling of over 20 years of accumulated solids from Aeration Basins 1 and 2 and the digester in an effort to reduce the amount of cadmium in the waste water treatment system. A composite core sample of this sludge was taken at the start of the clean-out in April 1993, and it passed TCLP.

The sludge was placed in eight landfill trenches at the Third Creek Monofill (see Figure 2). Based on information obtained from the City of Statesville Water/Waste Water Treatment Department, a sump pump was initially utilized to draw down Aeration Basin No. 2 and the sludge was pumped to the digester followed by a belt press for dewatering. The dewatered solids were then transported to the trenches. The remaining sludge/solids from the aeration basin was initially removed utilizing a clam shell until a front end loader could be operated within the basin. The clam shell removed the sludge/solids in long narrow strips generally removing the top layers first. The sludge removed by the front end loader was first pushed into a pile and then loaded onto trucks for transport to the monofill.

During the final removal of the sludge from the basin, a second sample was collected and analyzed. The results of this sample revealed high concentration of cadmium; however, this sample was analyzed for total cadmium rather than cadmium by the TCLP method. Based upon this result, the City immediately ceased removal operations and contacted the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR). The City then contracted with International Technology Corporation ("IT") to sample the monofill trenches.

IT began sampling the monofill trenches on February 5, 1994, and completed sampling on February 10, 1994. Due to poor weather conditions and difficulty maneuvering the drill rig, borings were installed along the apparent center line of each trench. Sludge materials were not found in every boring. Samples were obtained using 5 feet long split spoon samplers. Generally, the trenches were divided into four sections. As per Mr. Jesse Wells of the NCDEHNR, one composite sample from each trench was analyzed for TCLP organics and inorganics (the volatile

constituents were collected as grab samples). One composite TCLP metals sample per trench section, except for the section where a full TCLP analysis was completed, was also analyzed. Subsequent sampling of the monofilled sludge identified cadmium levels in excess of the regulatory limit for cadmium according to TCLP in seven of the trenches. TCLP cadmium levels in one trench, Trench 20 (Trench H), were below action levels. Sampling protocols, boring locations, documentation, and analytical results were presented in the *IT Sampling and Analysis Trip Report*, dated February 1994.

The variation in TCLP cadmium levels could be directly related to the method in which the sludge/solids were removed from the basin and also the amount of digested sludge materials placed in these trenches. As discussed above, the dewatered solids, which would typically have a lower leachable metals concentration were separately transported and placed in the monofill trenches. In addition, the fact that sludge materials were not noted in all borings shows the variability in placement of sludge in the monofill. Furthermore, as the initial sampling indicates, some of the sludge placed in the monofill (i.e. the top layer) was not hazardous. Therefore, Trench 20 (Trench H) could contain a combination of nonhazardous sludge and non-hazardous dewatered solids. Because it was not required at the time, the City did not document the order in which the trenches received sludge and dewatered solids.

Based upon this investigation and the laboratory analytical results, the City entered into an Administrative Order on Consent (Order) with the NCDEHNR, Division of Waste Management (DWM) that was signed by the City of Statesville on March 8, 1995. In accordance with this Order, the City of Statesville submitted a *Phase I Subsurface Characterization Work Plan* and a *Ground Water Sampling and Analysis Plan* to address the requirements of the Order. This work plan was submitted on April 8, 1995.

The subsurface characterization was completed in mid-April 1995, and a report of *Phase I Subsurface Characterization* was submitted on May 8, 1995. *The Ground Water Sampling and Analysis Plan* was also submitted on May 8, 1995. A *Revised Ground Water Sampling and Analysis Plan* was submitted on October 31, 1995, and approved by the Hazardous Waste Section (HWS) on December 6, 1995.

A *Closure Plan*, *Post-Closure Care Plan*, and *Closure and Post-Closure Care Costs* were submitted on August 7, 1995. A *Revised Closure Plan*, *Revised Post-Closure Care Plan*, and *Revised Closure and Post-Closure Care Costs* were submitted on February 27, 1996, in response to the NCDEHNR DWM, HWS letter, *Comments on Closure and Post-Closure Plans, Third Creek Monofill*, dated November 17, 1995. Additional comments were received in the HWS letters *Revised Closure and Post Closure Plans*, dated April 11, 1996 and *Parameter List and Monitoring Well System*, dated September 3, 1996. The following *Revised Closure Plan* and the attached *Ground Water Sampling and Analysis Plan* address the comments from the HWS.

1.2 Potential Receptors

On February 8,1996, Aquaterra personnel conducted a one mile potential receptor survey around the Third Creek Monofill. During the one mile survey, twenty water supply wells were noted to be within one mile of the site. Eighteen of those wells exist

on residential areas located northwest, north and east of the site. Two water supply wells were located at Piedmont Water and Construction. All water supply wells noted during the survey are located topographically and hydraulically(based on the shallow ground water flow direction) upgradient of the Third Creek Monofill.

The only potential off-site receptor that could be affected by the Third Creek Monofill closure is Third Creek, which is located approximately 2000 feet downgradient and south of the Third Creek Monofill. The location of the wells are shown on Figure 3 and the street address locations are included in Appendix A.

1.3 Post-Closure Care Plan Development

The City of Statesville has contracted Aquaterra to develop the Post-Closure Care Plan in accordance with 40 CFR 265.110, and 265.117 through 265.120. In addition, the financial requirements for post-closure care will be developed as outlined in 40 CFR 265.140 through 265.141, and 265.144 through 265.146. Also, 40 CFR 265.310 will be used as a guideline in developing the post-closure care activities (*Subpart N - Landfills*).

1.4 Maintenance of Post-Closure Care Plan

The City of Statesville will maintain an on-site copy of the approved Post-Closure Care Plan and all revisions until the certificate of closure has been submitted and accepted by the NCDEHNR, HWS as outlined in 40 CFR 265.120. The Post-Closure Care Plan copy and all revisions will be maintained at the Third Creek Waste Water Treatment Plant by a designated employee of the City of Statesville. The current facility designee's address and phone number are as follows:

Mr. L. F. ("Joe") Hudson, Jr., Director
City of Statesville
444 Third Creek Road
Statesville, North Carolina 28677
Phone: (704) 878-3438

2 Post-Closure Care Plan

As required by the HWS, a Post-Closure Care Plan has been developed for the Third Creek Monofill Hazardous Waste Management Unit (HWMU). The following items have been developed and are included in this plan:

- A description of the planned ground water monitoring activities and frequencies at which they will be performed. Monitoring activities will be conducted as outlined in the attached *Ground Water Sampling and Analysis Plan*.

- A description of the planned maintenance activities and frequencies at which they will be performed for the cap, security fence, and monitoring wells.

- The name, address, and phone number of the person or office to contact about the HWMU during the post-closure care period.

- Recordkeeping and reporting during post-closure:
  - ground water monitoring data and evaluation of data;
  - annual report;
  - updates on costs of post-closure care; and
  - maintenance of all records for the post-closure care period.

- Copies of the Post-Closure Care Plan will be maintained at:

  City of Statesville
  Water/Waste Treatment Department
  444 Third Creek Road
  Statesville, North Carolina 28677
  Attention: Mr. L. F. ("Joe") Hudson, Jr., Director

- The person responsible for updating the Post-Closure Care Plan will be the facility designee listed above. As the Post-Closure Care Plan is updated or amended, the date and number of the revision will be placed on the lower left corner of each page revised and the revision will be noted on the plan's title page.

- The City of Statesville submitted financial assurance information pursuant to 40 CFR 265.143 on October 6, 1995, and a special report on November 5, 1995. The City's financial mechanism, Financial Test and Corporate Guarantee for Closure (265.143(e)) was approved by the HWS on December 12, 1995, with the requirement that a new test be submitted on or before September 30, 1996.

2.1 Ground Water Sampling and Analysis Plan

A *Ground Water Sampling and Analysis Plan* was prepared by a licensed geologist and submitted to the HWS on May 8, 1995 (Aquaterra report number GR5041). In response to the HWS Section letter *Parameters List and Monitoring Well System*, dated September 3, 1996, an updated *Ground Water Sampling and Analysis Plan* (Aquaterra report number GR6111) was submitted under separate cover to the HWS and is attached as Appendix B. In general, two new monitoring wells will be installed at the approximate locations shown on Figure 2 and existing well MW-2 will be included in the monitoring plan. Existing well MW-7 will be used as a measuring point for ground water elevation data only. The parameters for laboratory analysis are presented in the *Ground Water Sampling and Analysis Plan* in Appendix B. In summary, the ground water sampling and analysis plan addresses:

- the monitoring well installation procedures;
- sampling and analytical methods for those hazardous wastes or hazardous waste constituents currently monitored at the facility;
- evaluation procedures, including any use of previously gathered ground water quality information; and
- a schedule of implementation.

2.2 Inspection and Maintenance

The City of Statesville will ensure that the closed Third Creek Monofill unit is properly maintained by inspecting it monthly for the following:

- erosion damage
- vegetative cover
- run-on/run-off control system
- subsidence
- security fence
- monitoring wells

The cover will be sloped to provide positive site drainage away from the impoundment. The cover grade will be approximately one to two percent. The cover's slope is designed so that the maximum drainage velocity leaving the cover will be less than the velocity likely to cause erosion for the topsoil and selected vegetation. The cover will be visually inspected annually to ensure that the positive drainage slope is maintained. Should minor subsidence or spot irregularities be discovered, new topsoil/fill will be placed on the cover and it will be regraded.

The cover will also be protected from erosion by maintaining an appropriate vegetative cover and construction of grass-lined trapezoidal ditches. Maintenance activities for the vegetative cover will include mowing, seeding, and fertilizing during the year. The activities will be performed on an as-needed basis due to the seasonal nature of vegetation.

To control storm water run-on and runoff, trapezoidal ditches with vegetative cover will be constructed on the topographically upgradient side of each cell. The ditches will be constructed at a minimum of five feet from the existing cell to prevent compromise of the capping system. Details of the ditches were presented in the *Closure Plan*, submitted to the HWS on July 12, 1996.

Subsidence of the capping system is not expected since the cap materials will be compacted, run-on will be controlled, infiltration through the cap will be minimized, and no surcharge load will be placed on the cap. However, the topsoil/fill layer will be lightly compacted and may settle. The topsoil/fill layer will be visually inspected monthly for low spots and long and/or radial cracks. Annually, the topsoil/fill layer will be visually inspected by a professional engineer or licensed geologist. If subsidence is observed, topsoil/fill will be added, the topsoil layer graded to promote runoff, and reseeded to minimize erosion.

2.3 Post-Closure Care Period Contact and Plan Maintenance

During the post-closure care period, the person to contact about the hazardous waste disposal unit or facility is the facility designee. The current designee's name, address, and phone number are as follows:

Mr. L. F. ("Joe") Hudson, Jr., Director
City of Statesville
Water/Waste Water Treatment Department
444 Third Creek Road
Statesville, North Carolina 28677
Phone: (704) 878-3438

The City of Statesville' designee will maintain an on-site copy of the approved Post-Closure Care Plan and all revisions throughout the post-closure period (40 CFR 265.118(b)).

2.4 Post-Closure Care Financial Assurance

The post-closure care costs required under 40 CFR 265.145 and 265.145, respectively will be submitted under separate cover by the City of Statesville. The closure care cost estimate and any revisions will be retained at the Third Creek Wastewater Treatment facility and updated on an annual basis to reflect cost changes as a result of inflation or changes in the Closure Plan activities.

The City of Statesville submitted financial assurance information pursuant to 40 CFR 265.143 on October 6, 1995, and a special report on November 5, 1995. The City's financial mechanism, Financial Test and Corporate Guarantee for Closure (265.143(e)) was approved by the HWS on December 12, 1995, with the requirement that a new test be submitted on or before September 30, 1996.

2.5 Post-Closure of Landfills

Under *Subpart N - Landfills* (40 CFR 265.310), after final closure has been certified, the City of Statesville must comply with all post-closure requirements contained in 40 CFR 265.177 through 265.120 including maintenance and monitoring throughout the post-closure care period. The City of Statesville must perform the following tasks as part of the post-closure period:

- maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events;
- maintain and monitor the ground water monitoring system and comply with all other applicable requirements of Subpart F of this part;
- prevent run-on and run-off from eroding or otherwise damaging the final cover; and
- protect and maintain surveyed benchmarks used in complying with Section 265.309.

In addition, the City of Statesville must maintain the following items in the operating record required in Section 265.73:

- on a map, the exact location and dimensions, including depth, of each cell of the landfill with respect to permanently surveyed benchmarks, and

- the contents of each cell and the approximate location of each hazardous waste type within each cell of the landfill.

2.6 Notice to Local Land Authority

Within 60 days after closure is completed, the City of Statesville will submit to the Iredell County Register of Deeds and to the HWS a survey plat indicating the location, dimensions, and quantity of hazardous waste disposed of within each cell of the Third Creek Monofill with respect to permanently surveyed benchmarks. This plat will be prepared and certified by a professional land surveyor registered in the State of North Carolina. The plat will contain a note, prominently displayed, which states the City of Statesville's obligation to restrict disturbances of the site in accordance with 40 CFR 265.117(c) if all the hazardous waste can not be remediated and the Third Creek Monofill must begin post-closure care.

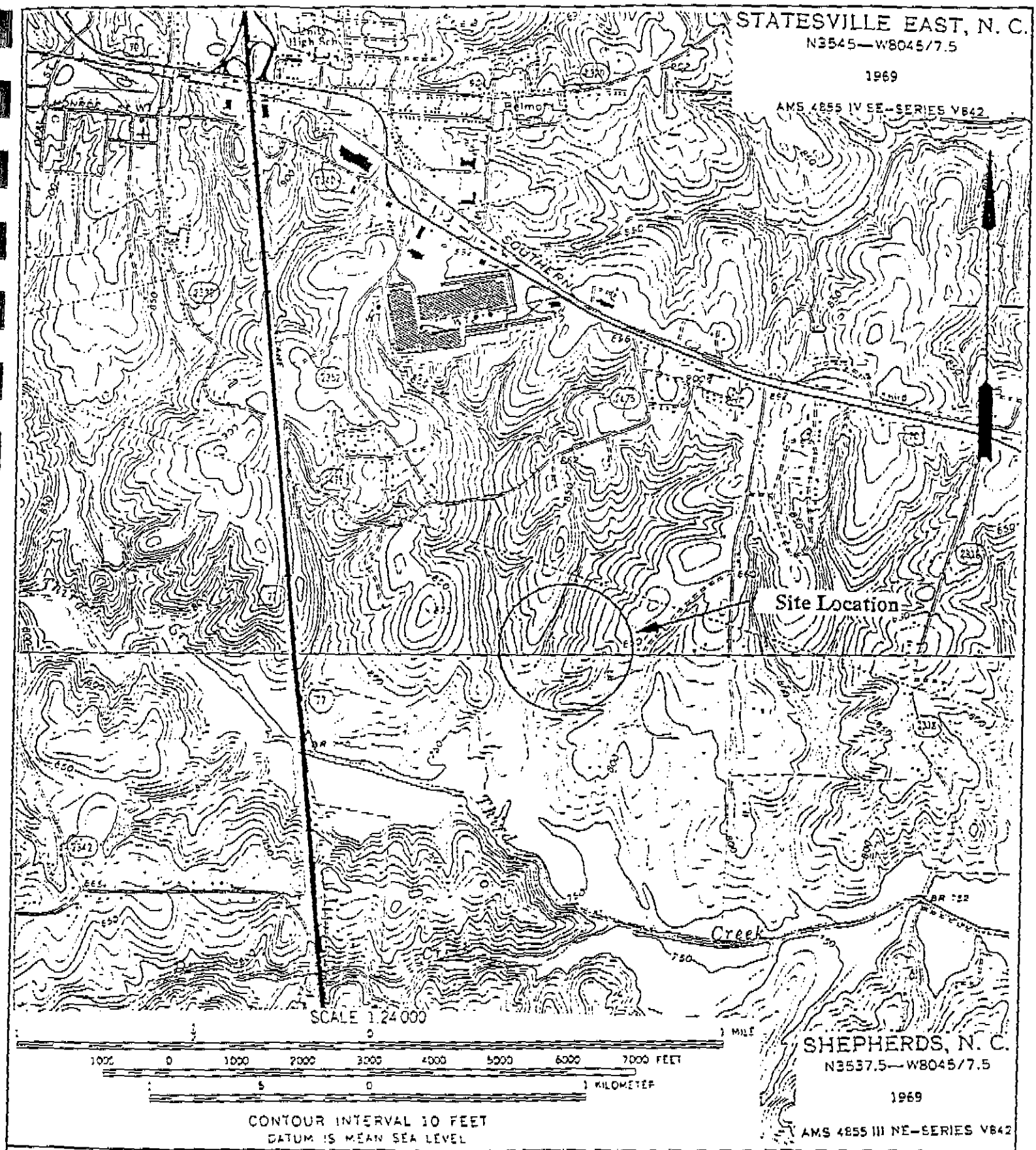
The notation, which will be placed on the deed to the facility property or on some other instrument which is normally examined during a title search, and which will notify in perpetuity any potential purchasers of the property, will state:

- the property has been used to manage hazardous wastes;
- the property's use is restricted under 40 CFR 265 Subpart G regulations, and;
- the survey plat will state the type, location, and quantity of hazardous wastes disposed of within each cell Third Creek Monofill unit as required by 40 CFR 265.116 and 265.119(a).

The City of Statesville will submit a certification signed by the surveyor that he has recorded the notations above and a copy of the document in which the notations have been placed will be sent to the HWS.

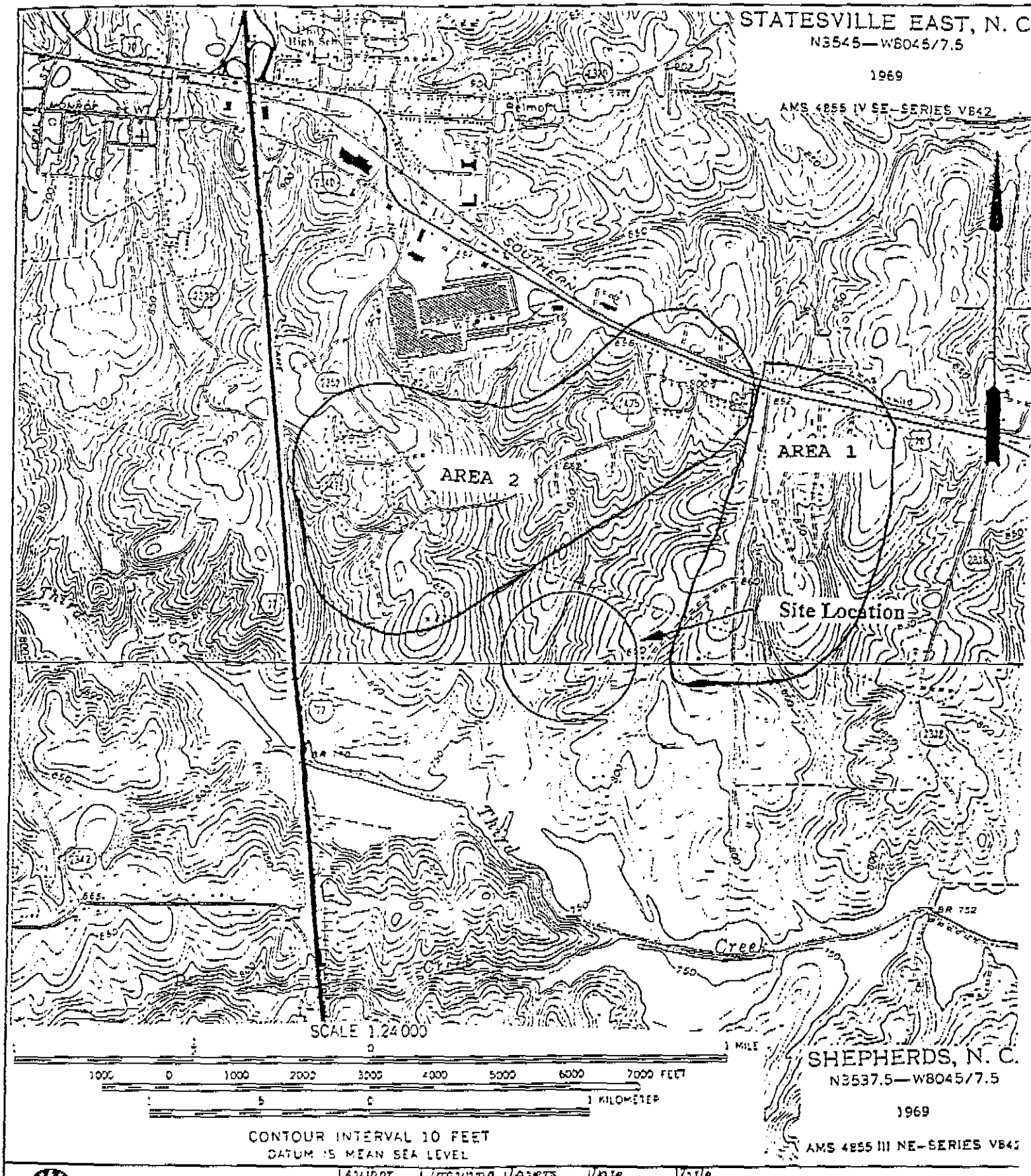
2.7 Certification of Completion of Post-Closure Care

The City of Statesville, within 60 days after the completion of the established post-closure care period for the Third Creek Monofill HWMU, will submit to the HWS by registered mail, a certification that the post-closure care for the post-closure care period was performed in accordance with the specifications in the approved post-closure care plan. The certification will be signed by the City of Statesville and an independent professional engineer. Documentation per 40 CFR 265.120 will be furnished to the HWS upon request.



CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

	Author	Drawing	Layers	Date	Title
aquaterra	sk			4-07-95	Site Location Map
A GREAT LAKES CHEMICAL CORPORATION COMPANY	Job No. 5205800	Revision	Figure 1	Scale 1:24,000	Project Third Creek Monofill Statesville, North Carolina



aquaterra

A GREAT LAKES CHEMICAL CORPORATION COMPANY

Author	Drawing	Layers	Date	Title
sk			4-07-95	Site Location Map
Job No.	Revision	Figure	Scale	Project
5205800		3	1:24,000	Third Creek Monofill Statesville, North Carolina

Well Survey - Third Creek Mobile, Statesville

Name (if known)	Address	
nown	229 Third Creek Road	Area 1
F. Smith	168 Third Creek Road	Area 1
nknown	RT 15 Box 32 Third Creek Road (US70 & Third Creek)	Area 1
known	152 Sigmon Rd. (SR 2451)	Area 1
known	30 Sigmon Rd	Area 1
rvin McCoy	19 Oak Grove Rd	Area 1
nt	RT 15 Box 126 Oak Grove Rd (SR 2355)	Area 1
	110 St. Paul Rd (SR 2353)	Area 2
e	114 St. Paul Rd	Area 2
wn	128 St. Paul Rd	Area 2
wn	126 St. Paul Rd	Area 2
nknown	127 St. Paul Rd	Area 2
ce	123 St. Paul Rd	Area 2
hren	160 Kiser Lane (SR 2407)	Area 2
arris	162 Kiser Lane	Area 2
M. Haithcox	150 Kiser Lane	Area 2
els	131 Kiser Lane	Area 2
known	110 Hodge Lane	Area 2
ant Water & Construction*	Corner of Oak Grove & Sigmon	Area 1
ant Water & Construction*	End of Sigmon Rd.	Area 1

* Wells Supply subdivision

Revised Ground Water Sampling and Analysis Plan
City of Statesville
Third Creek Monofill
Statesville, North Carolina
September 13, 1996

Prepared for

The City of Statesville
Statesville, North Carolina

Prepared by

Aquaterra, Inc.
Greensboro, North Carolina

September 13, 1996

Mr. Joe Hudson
Water/Wastewater Treatment Department
The City of Statesville
Post Office Box 1111
Statesville, North Carolina 28677-1111

Reference: Revised Ground Water Sampling and Analysis Plan
Third Creek Monofill
City of Statesville
Statesville, North Carolina
Aquaterra Job No. 5302100

Dear Mr. Hudson:

Aquaterra, Inc., (Aquaterra) is pleased to submit the attached *Revised Ground Water Sampling and Analysis Plan* (SAP) for the Third Creek Monofill site in Statesville, North Carolina. The document outlines the sampling procedures and analytical methods to be used during the quarterly sampling events required in the Administrative Order on Consent issued by the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR), Division of Solid Waste Management (DSWM) and signed on March 8, 1995, by the City of Statesville. This document represents the second revision of the SAP. The purpose of this revision is to integrate the modifications to the detection monitoring program requested by the City of Statesville and Aquaterra and approved by DSWM on September 3, 1996.

If you have any questions regarding this sampling and analysis plan, please call me at (910) 852-5003.

Sincerely,

AQUATERRA, INC.

Joseph P. Best, P.G.
Project Geologist

Susan Kite, P.G.
Senior Project Manager

cc: Mr. Douglas D. Vaughn, P.E.-Pierson & Whitman
Mr. George House-Brooks, Pierce, McLendon, Humphrey & Leonard, L.L.P.
Mr. Jimmy Carter, Section Chief-NCDEHNR, DSWM

Revised Ground Water Sampling and Analysis Plan
City of Statesville
Third Creek Monofill
Statesville, North Carolina
September 13, 1996

1 Introduction

The following *Revised Ground Water Sampling and Analysis Plan* (SAP) is for the City of Statesville's Third Creek Monofill hazardous waste management unit (HWMU) at the Third Creek Waste Water Treatment Plant (WWTP) facility located in Statesville, North Carolina (see Figure 1). This revised SAP is in response to the September 3, 1996, letter from the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR), Division of Solid Waste Management (DSWM), Hazardous Waste Section (HWS) requesting a revised SAP to reflect the approved modifications to the required sampling parameters. The SAP provides a brief site history, describes the geologic and hydrogeologic setting, outlines the procedures for sampling and analysis, and presents the schedule for reporting.

Future post-closure care and assessment sampling will be conducted according to this plan.

1.1 Site History

The City of Statesville operates a waste water treatment plant at its Third Creek Facility located in Statesville, North Carolina. The site operates under an NPDES permit (Permit No. NC0020591) and a non-discharge permit (Permit No. WQ004040). Concerns of elevated concentrations of cadmium in the treatment system were raised in 1993. The non-discharge permit was modified to allow the removal and landfilling of over 20 years of accumulated solids from Aeration Basins 1 and 2 and the Digester in an effort to reduce the amount of cadmium in the waste water treatment system. The sludge was placed in eight landfill trenches in the Third Creek Monofill. Subsequent sampling of the landfilled sludge identified cadmium levels in excess of the regulatory limit for cadmium according to the toxicity characteristic leaching procedure (TCLP).

Based upon this investigation and the laboratory analytical results, NCDEHNR, DSWM issued an AOC that was signed by the City of Statesville on March 8, 1995. Following the signing of the AOC, the City of Statesville contracted Aquaterra, Inc., (Aquaterra) to prepare, submit, and conduct a *Phase I Subsurface Characterization Work Plan* to address the requirements of the Order.

The subsurface characterization was completed in mid-April 1995, and a report of *Phase I Subsurface Characterization* was submitted on May 8, 1995. *The Ground Water Sampling and Analysis Plan* was also submitted on May 8, 1995. A *Revised Ground Water Sampling and Analysis Plan* was submitted on October 31, 1995, and approved by the Hazardous Waste Section (HWS) on December 6, 1995.

The primary objective of the subsurface characterization activities was to determine the subsurface conditions at the site, including determining the ground water flow direction. The characterization activities included the installation of four borings in the surficial aquifer, and one boring advanced to auger refusal. In addition, four shallow ground water monitoring wells were

installed and sampled. Aquaterra completed the subsurface characterization activities in mid-April 1995.

1.2 Overview of the Revised Ground Water Sampling and Analysis Plan

The purpose of this *Revised Ground Water Sampling and Analysis Plan* is to establish the standard operational procedure to monitor ground water conditions prior to and following closure of the HWMU (former sludge disposal area) and during further assessment activities. This SAP includes the procedures for sample collection, sample preservation, analytical procedures, and chain-of-custody control. The following are the six key components of the SAP:

- Ground Water Monitoring System
- Ground Water Sample Collection
- Sample Preservation and Handling
- Chain-of-Custody Control
- Analytical Procedures
- Sample Collection Schedule

1.3 Physical Setting

The Third Creek facility is located near the City of Statesville in Iredell County, North Carolina. The site is situated on a dirt road that intersects Third Creek Road southeast of Statesville. The site is bordered to the north by pasture land, to the south by Third Creek, to the east by residential property, and to the west by wooded land.

2 Ground Water Monitoring System

2.1 Hydrogeologic Setting

The site is located in the Piedmont physiographic province of North Carolina The surrounding topography consists of rolling land with broad ridges. The surficial geology consists of residual soils that have weathered in place from the underlying bedrock. A review of the Geologic Map of North Carolina (1985) indicates the site is located in the Charlotte Belt and is underlain by a fine grained biotite gneiss that is massive to strongly foliated with minor layers of amphibolite and muscovite schist.

2.2 Ground Water

The ground water underlying the Third Creek Monofill facility is typical of shallow aquifers within the Piedmont physiographic region of North Carolina. Unconfined water table conditions exist across the site. Under these conditions, the water table surface is in equilibrium with the atmosphere, with no confining units present between the water table and ground surface. Recharge to the water table occurs through direct infiltration of precipitation Discharge from the aquifer occurs at topographic and hydrogeologic lows where the water table and surface water bodies are in contact.

Aquaterra installed four shallow ground water monitoring wells (MW-5, MW-6, MW-7, MW-8) at the site to determine ground water flow direction, to characterize ground water impact, determine vertical and horizontal extent of impact, identify migration of hazardous substances, and assess adverse effects or risks, if any, associated with the presence of identified contaminants

at the site. In addition to these four monitoring wells, four other monitoring wells (MW-1, MW-2, MW-3, MW-4) were installed previously. Aquaterra has proposed the installation of two additional monitoring wells in the vicinity of MW-7 (see Figure 2). Aquaterra also proposed that monitoring well MW-2 be added to the detection monitoring program.

All monitoring wells installed by Aquaterra were constructed in accordance with the requirements of NCDEHNR, Division of Water Quality (DWQ). The top of the inner casing of each well has been surveyed to establish the vertical elevation relative to a fixed reference datum (see Table 1). Each well is provided with a protective outer casing and lock to prevent inadvertent entry into the well.

Based upon the data generated as part of the June 27, 1996, sampling effort, the direction of ground water flow appears to be to the southwest, responding to an average horizontal hydraulic gradient of approximately 0.022 foot per foot (see Figure 3)

In addition to the four ground water monitoring wells, Aquaterra installed one soil boring to auger refusal, which occurred at 86 feet below grade. Please refer to Aquaterra's *Phase I Subsurface Characterization Report* (GR5057), dated May 5, 1995.

3 Ground Water Sample Collection

3.1 Review of the Sampling Plan

This revised SAP will be reviewed by the sampling team and site manager prior to collecting ground water samples. The team and site manager will develop a schedule as to which monitoring wells will be sampled and which samples will be duplicated The correct number of sample containers will be secured and labeled prior to each field sampling event.

3.2 Ground Water Sample Collection Log Book

A ground water sample log book will be maintained by Aquaterra to document each sampling event. The following field observations will be documented in the log book for each well:

- well number
- sample date
- name(s) of the people present
- weather conditions
- unusual site conditions (e.g., damaged well casings, well cover missing)
- total well depth below the measuring point
- depth to the water level below the measuring point
- height of water column
- well diameter
- well volume
- amount of water removed during purging
- number of well volumes purged
- equipment used for purging
- sample collection time and date
- equipment used for sample collection
- field parameters (pH, specific conductance, temperature)

- types and numbers of sample containers filled at each well and any special handling procedures

3.3 Water Level Measurements

Prior to well purging or sampling of any well on-site, water level measurements to the nearest 0.01 foot will be recorded for all wells on-site. In addition, the total depth of each well will be measured to the nearest 0.01 foot. An electronic water level meter will be used to determine the depth from the measuring point (i.e., top of the casing) to the water level. Water level measurements will first be obtained from monitoring wells historically exhibiting the lowest concentrations and will proceed to those wells exhibiting increasing concentrations. Prior to measuring water levels, those wells equipped with air tight caps on the inner casing will have the caps removed in sufficient time to allow the equilibration of the water in the well.

The electric probe and first few feet of cable will be wiped with a phosphate-free, low-residue laboratory soap. The equipment will then be rinsed with distilled water and dried with a clean paper towel. This procedure will be implemented between each well when measuring water levels. All sampling personnel will wear protective/nonreactive vinyl gloves throughout the water level monitoring procedures. New gloves will be donned prior to measuring the water level at each monitoring well.

3.4 Well Purging

A dedicated Teflon bailer, new disposable bailer, or a submersible pump will be used to purge each monitoring well of a minimum of three well volumes, or to dryness, prior to sampling. Wells constructed in low hydraulic conductivity silts and clays will be gently purged so as not to disturb the silts and clays, which could produce a turbid ground water sample. When using a dedicated bailer for purging, the bailer will be lowered gently into the water column to purge the upper portion of the column. Once purging has been completed, pH, conductivity, and temperature will be measured and recorded.

The purging procedure will continue until indicator parameters (i.e., pH, specific conductance, temperature) have stabilized. Stabilization consists of three consecutive readings taken at approximately 5-minute intervals where the parameter values are within 10 percent of each other. Well water stabilization will be documented in the log book.

If laboratory analysis indicate impact to ground water, all water purged from the monitoring wells will be containerized in unlined 55-gallon drums on-site that will be labeled with the date, contents, and well number(s).

Disposal of the purge water will be based upon the analytical data obtained from the sampled wells. If the results reveal hazardous constituents, the material will be properly disposed of, or treated and disposed of, in an approved manner.

3.5 Decontamination of Sampling Equipment

Dedicated Teflon bailers used to purge and sample monitoring wells will be properly etched for identification, laboratory decontaminated, wrapped in aluminum foil, and sealed in a polyethylene bag at the laboratory. Therefore, field decontamination of dedicated bailers should not be necessary. Bailers will be laboratory decontaminated according to the following procedures:

- remove excess soil/sludge as necessary
- phosphate-free soap and tap water wash
- tap water rinse
- nitric acid rinse
- deionized water rinse
- isopropyl alcohol rinse
- organic-free water rinse (if not available, at least 24 hours will be allowed for equipment to dry fully)
- air dry
- wrap equipment with non-reactive material prior to transport into the field

New disposable bailers used for purging and sampling will be discarded following use.

Submersible pumps used for purging and sampling will be decontaminated between each well by inserting the pump in a tap water/laboratory grade soap mixture, pumping and recycling the mixture through the pump for a period of about 10-minutes, then inserting the pump in a deionized or distilled water rinse and allowing the pump to recycle the water for a period of about 5-minutes. The outside of the pump and tubing will be rinsed with deionized or distilled water as it is lowered into the well.

3.6 Well Sampling

The following sections discuss the required equipment and details of well sampling. Based on historical analytical results, sampling of wells will begin with the least contaminated and then proceed to the remaining wells in order of increasing contaminant concentration.

3.6.1 Required Equipment and Materials

The following equipment and materials will be used to sample the monitoring wells:

- safety glasses
- vinyl gloves
- Teflon bailers, disposable bailers, or submersible pump
- nylon cord
- field log book
- sample bottles
- temperature/pH/conductivity meter
- labels and permanent marking pen
- knife
- plastic sheeting

3.6.2 Procedure for Collection of Ground Water Samples

The following procedure will be used to collect ground water samples:

1. Plastic sheeting with a hole cut in the center will be placed over the well casing and lowered to ground surface to prevent the bailer cord and sampling equipment from contacting the ground during sampling.

2. Closed top Teflon bailers, or new disposable bailers, with new nylon cord will be used to sample the shallow wells. Bailers will be lowered slowly into the well so as not to cause excessive aeration. Protective/nonreactive vinyl gloves or equivalent will be worn when sampling the well. Sample parameters listed in their order of collection are listed below in Section 3.6.3.

   In those wells sampled with a submersible pump, a 2-inch Grundfos Rediflow-2 brand pump will be used. This pump has controls to vary the flow and is capable of pumping at the low flow rates required by EPA for ground water sampling. The pump will be gently lowered into the well to approximately the mid-point of the well screen and allowed to pump at approximately 0.25 or less gallons per minute for sampling purposes, with the exception of VOCs, which will be collected at a flow rate of 100 mls/min or less.

3. Samples collected for volatile organic compound (VOC) analysis will be collected in glass vials with a Teflon covered septum top. The samples will be collected with no headspace in order to prevent volatilization. If no preservative is used, the samples for VOC analysis will be analyzed within 1 week of collection. Samples collected for VOCs and metals will not be filtered.

3.6.3 Order of Sample Collection

Samples should be collected in the order of volatilization sensitivity. The recommended order of sample collection for common parameters is as follows:

- VOCs
- total organic halogens (TOX)
- total organic carbon (TOC)
- semi-volatile organic compounds (SVOCs)
- herbicides/pesticides
- total metals
- field parameters (pH, temperature, specific conductance)

3.6.4 Well Sampling Data

The following will be recorded for each well in the sample collection log book:

- sample time and date
- equipment used to sample
- field parameters (e.g., pH, specific conductance, temperature)
- analytical method, order of sample collection, type of container, and preservative (if any)

4 Sample Preservation and Handling

4.1 Sample Containers

The sample containers used for each analysis are outlined in Table 2. Metals will be collected in polyethylene containers with polypropylene caps, or in glass. Organics will be collected in glass bottles with fluorocarbon resin-lined caps. The containers will be cleaned by the laboratory based on the analyte of interest. Sample containers for metals will be cleaned as follows: thoroughly

washed with nonphosphate detergent and tap water, and rinsed with (1:1) nitric acid, tap water, (1:1) hydrochloric acid, tap water, and, finally, distilled water. The cleaning procedure for organic bottles is as follows: washing with nonphosphate detergent in hot water, rinsing with tap water, distilled water, acetone, and, finally, with pesticide grade hexane. Glass bottles may be baked in a muffle furnace at 400°C for 15 to 30 minutes to remove organic deposits. Glassware will be sealed and stored in a clean environment immediately after drying or cooling to prevent any accumulation of dust or other contaminants.

4.2 Sample Preservation

Preservatives are added to a sample container to retard biological action, to retard hydrolysis, and to reduce sorption effects. Preservation techniques are limited to pH control, chemical addition, refrigeration, and protection from light. The preservation methods are outlined in Table 2.

4.3 Special Handling Considerations

Samples will not be filtered in the field before addition of preservatives. Samples will be transferred from the bailer or pump directly to the laboratory containers. Field logs and laboratory analysis reports will denote the presence of headspace in the sample containers at the time of receipt by the laboratory as well as the time the sample was first transferred to the sample container from the bailer. Bottles for VOCs will contain no headspace after filling.

5 Chain-of-Custody Control

5.1 Sample Labels

Field personnel will affix legible labels to each sample container before the ground water sampling event. The labels will be sufficiently durable to remain legible even when wet and will contain the following information:

- place of collection
- sample identification
- date and time of collection
- parameter(s) for which the container is required
- type of preservative
- name of collector

5.2 Chain-of-Custody Record

A chain-of-custody form will be completed to establish the documentation necessary to trace sample possession from the time of collection to the completed analysis (see Appendix A). A chain-of-custody record will be generated for each sampling event and for each analytical laboratory, if samples are delivered to more than one. The following information will be entered on the chain-of-custody:

- sample and well identification
- date and time of sample collection
- signature of sample collector, transporter, and laboratory person receiving sample
- inclusive dates of possession
- number of containers

- parameters requested for analysis
- field observations
- laboratory number
- special requests

5.3 *Transportation to Analytical Laboratory*

After each well location has been sampled, the samples will be transferred in a cooler. The samples will be chilled to approximately 4°C by placing crushed ice on the samples. The samples will be transported to the analytical laboratory after the completion of the sampling event. In accordance with EPA protocols, the samples will be relinquished to laboratory personnel with the time, date, and signature recorded on the chain-of-custody form. A copy of the form is shown in Appendix A. If the samples are shipped to the laboratory by common carrier, custody seals will be placed on each of the sample containers to ensure that the samples have not been tampered with.

6 Analytical Procedures

6.1 *Analytical Methods*

At the laboratory, all samples will be analyzed to EPA methods specified in *Test Methods for Evaluating Solid Wastes*, SW-846, 3rd Edition. The laboratory will clearly state if a deviation from the specified method occurred and the reasons for the deviation. Table 2 lists the methods to be used for analysis.

6.2 *Records*

Records of ground water analysis will include the methods employed, extraction date, digestion date, date of actual analysis, the concentration detected, the units of concentration, and the detection limits. Data from samples that are not analyzed within recommended holding times will be considered suspect. New samples will be collected from the source that corresponds with the suspect data to confirm the concentration of the original analysis. Any deviation from the listed methodologies will be explained and supported with sufficient information to ensure that the quality of the results meets the performance specifications of the referenced method.

6.3 *Quality Assurance Program*

The Quality Assurance (QA) programs used for ground water will consist of different travel blanks, duplicate samples, field blanks, and split samples as required by DSWM. The definition of each of these terms follows.

Travel blanks are defined as distilled and deionized, analyte-free water that is supplied by the laboratory in the appropriate sample container, treated (if preservatives are used), and handled in the same manner as the samples. The travel blanks can be indicators of any contamination that may have occurred in transport or in the laboratory.

Duplicate samples are defined as multiple samples that are identical. These samples must be collected at the same time, from exactly the same location, using the same sampling apparatus.

Also, these samples should be collected in identical containers that have been similarly prepared and filled to the same volume. Duplicate samples are preserved and handled in identical fashion.

Field blanks are defined as distilled and deionized, analyte-free water that is collected in the field, containerized, treated (if preservatives are used), and handled in the same manner as other samples. The field blanks can be indicators of any atmospheric or sampling equipment contamination that may be present.

Finally, split samples are not planned for the program unless requested by DSWM, the analytical laboratory results become suspect, or unexpected contaminants are detected. A split sample is an aliquot of a collected sample that will be analyzed by a different method or another qualified laboratory to verify the original data.

7 Schedule for Sample Reporting

7.1 Dates

Samples will be collected from the listed monitoring wells at the Third Creek Monofill facility on a quarterly basis (March, June, September, December).

If necessary, ground water sampling conducted as part of on-going ground water assessment activities will be performed periodically during each successive phase of ground water assessment.

7.2 Sampling Locations

The sampling locations for the ground water monitoring program will include wells MW-2 through MW-8, with ground water elevations collected from wells MW-1 through MW-8. If additional ground water monitoring wells are required or if wells have been properly abandoned, then this SAP will be amended to reflect the changes.

7.3 Analytical Parameters

Monitoring wells MW-5, MW-6, and MW-7 will be analyzed for the parameters listed below. Monitoring well MW-2 and any additional wells installed or added to the detection monitoring program will be analyzed for the parameters listed below as well as herbicides and phenols. Subsequent to the installation of the two proposed monitoring wells adjacent to MW-7, MW-7 will no longer be sampled. Monitoring well MW-8 will be analyzed for the parameters below, with the exception of VOCs, SVOCs, and pesticides. Modifications to the list of parameters are subject to the approval of DSWM.

RCRA Primary Metals	**Organics**
Arsenic	Volatile Organic Compounds (VOCs)
Barium	Total Organic Halogens (TOX)
Cadmium	Total Organic Carbon (TOC)
Chromium	Semi-volatile Organic Compounds (SVOCs)
Lead	

Silver
Mercury
Selenium

Field Parameters

pH
Specific Conductance
Temperature

Other Metals

Iron
Manganese
Sodium

Pesticides

2,4-D
2,4,5-TP Silvex

Other Parameters

Fluoride
Nitrate
Sulfate
Chloride
Radium
Gross Alpha
Gross Beta

In addition, the pH, specific conductance, TOC, and TOX will be analyzed in the background well (MW-8) in 4 replicates during the first 4 sampling events. After the first year, these 4 constituents will be analyzed in 4 replicates in each well during each sampling event.

Monitoring wells sampled as part of on-going ground water assessment activities will be established in the appropriate ground water assessment plan that will typically include sampling for VOCs, SVOCs, metals, and field parameters only, unless otherwise requested by DSWM.

7.4 Submission of Reports

Reports of each quarterly sampling event will be submitted to DSWM within 30 days of the completion of the laboratory analysis. Each report will contain the field parameters, static water level measurements, water level elevations, sampling descriptions, analytical results, and conclusions and recommendations.

Ground water assessment reports will be submitted according to the schedule included in the respective ground water assessment work plan.

Table 1. Monitoring Well Elevations, Third Creek Monofill, Statesville, North Carolina.

Well No.	Elevations of Screened Interval Top	Elevations of Screened Interval Bottom	Measuring Point Elevation (Top of Casing)
MW-1	800.80	790.80	860.08
MW-2	818.50	808.50	847.94
MW-3	800.70	790.70	823.85
MW-4	794.80	784.80	814.68
MW-5	818.80	808.80	847.16
MW-6	817.70	807.70	850.21
MW-7	812.10	802.10	847.70
MW-8	819.00	809.00	861.44

All elevations referenced to mean sea level.

Aquaterra Job No. 5302100

Table 2. Sample Containers, Preservatives, and Analytical Methods, Third Creek Monofill, Statesville, North Carolina.

Parameter	Sample Containers	Preservatives	Analytical Methods[a]
Arsenic	1000 ml P or G	HNO_3 to pH<2	7060
Barium	1000 ml P or G	HNO_3 to pH<2	6010,7080
Cadmium	1000 ml P or G	HNO_3 to pH<2	6010,7130
Chromium	1000 ml P or G	HNO_3 to pH<2	6010,7190
Iron	1000 ml P or G	HNO_3 to pH<2	6010
Lead	1000 ml P or G	HNO_3 to pH<2	7421
Manganese	1000 ml P or G	HNO_3 to pH<2	6010
Mercury	1000 ml P or G	HNO_3 to pH<2	7470
Selenium	1000 ml P or G	HNO_3 to pH<2	7740
Silver	1000 ml P or G	HNO_3 to pH<2	6010
Sodium	1000 ml P or G	HNO_3 to pH<2	6010
Volatile Organics (VOCs)	3-40 ml VOAs	HCL to pH<2	8240
Semi-volatile Organics (SVOCs)	1000 ml Amber Glass	Refrigeration	8270
Total Organic Carbon (TOC)	100 ml P or G w/Teflon lined cap	Refrig/H_2SO_4 or HCl to pH<2	9060
Total Organic Halogens (TOX)	500 ml Amber Glass	Refrigeration	9020/9021
Herbicides/Pesticides	1000 ml Amber Glass	Refrigeration	8080/8150
Chloride	100 ml P or G	Refrigeration	9251/9252
Sulfate	100 ml P or G	Refrigeration	9036/9038
Nitrate	100 ml P or G	Refrigeration	9200
Phenols	1000 ml Amber Glass	Refrigeration	8040
Radium	1 gallon P or G	HNO_3 to pH<2	903.1
Gross Alpha	1 gallon P or G	HNO_3 to pH<2	900.0
Gross Beta	1 gallon P or G	HNO_3 to pH<2	900.0

[a] *Test Methods for Evaluating Solid Wastes, SW-846, 3rd Edition*

P = Plastic
G = Glass

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