N.C. DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES
DIVISION OF SOLID WASTE
HAZARDOUS WASTE SECTION

Circle one:
G, I, P, GW, C, E

FILE DOCKET

	DATE	ITEM
1	5-31-95	Sample Analysis Request
2	6-2-95	Chain of Custody record
3	6.7.95	GW inspection form
4	9-19-95	GW monitoring evaluation
5	12-6-95	Revised GW Sampling
6	12-11-95	GW monitoring System
7	1-28-96	Meeting Attendance record
8	2-14-96	Response to HWS correspondence
9	3-6-96	GW Sampling & Analysis report
10	6.2.95	Chain of Custody Record
11	8-4-98	PH meter Readings
12	8.18.00	Post Closure Care Sampling Modification Request Letter
13	~~9.22.00~~	~~Fee Letter~~
14	~~10.2.00~~	~~New contact Letter.~~
13	10.1.02	Transmittal of Documents Supporting CME
14	11.15.02	Transmittal of Monitoring Well Information
15	1.6.03	CME Report

HAZARDOUS WASTE SECTION (Review 8/93)

G- General, I- Inspections
P- Permits, GW- Ground Water
C- Closure E-Enforcement

North Carolina
Department of Environment and Natural Resources

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Director

NCDENR

(14)

November 15, 2002

Ms. Sharon Matthews
EPA Region 4
980 College Station Road
Athens, GA 30605

Re: Transmittal of Monitoring Well Information
City of Statesville--Third Creek Monofill
Statesville, NC
EPA ID # NCR 000 001 602

Dear Ms. Matthews:

Enclosed are copies of completion records and/or construction logs for monitoring wells and a deep soil boring located at the City of Statesville's Third Creek Monofill. As I mentioned in my earlier e-mail, I don't have similar information for monitoring well MW-9. I hope the data I am sending will be sufficient to meet your requirements.

Since we don't have extra copies of the enclosed documents, I am sending Xerox copies. There is no need to return these to the NC Hazardous Waste Section. If you have questions or require additional information, please feel free to call me at (919) 733-2178 extension 236. I can also be contacted through my e-mail address (Larry.Stanley@ncmail.net).

Sincerely,

Larry Stanley

Larry Stanley
Hydrogeologist
NC Hazardous Waste Section

cc: Narindar Kumar, EPA Region 4
Larry Fox
Larry Stanley

rc: Linda Culpepper LC for LC
Bob Glaser
Larry Stanley

Enclosures

S-Matthews-3rd Creek MW

1646 Mail Service Center, Raleigh, North Carolina 27699-1646
Phone: 919-733-4996 \ FAX: 919-715-3605 \ Internet: www.enr.state.nc.us

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Third Creek Monofill
Statesville
NCR 000 001 602

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION 4, SCIENCE and ECOSYSTEM SUPPORT DIVISION
ATHENS, GEORGIA 30605-2700

JAN 2003
Received
Hazardous Waste
Section

4SESD-EIB JANUARY 6,2003

MEMORANDUM

SUBJECT: SESD-ES Comprehensive Ground Water Monitoring Evaluation (CME) for the City of Statesville Third Creek Monofill, Statesville, NC.; EPA ID No. NCR 000 001 602; SESD Project No. 03-0129

15

FROM: S. E. Matthews, P.G.
Enforcement Section
SEM 1/6/03

TO: Kris Lippert
North Enforcement and Compliance Section
Enforcement and Compliance Branch
Waste Management Division

Larry Stanley
North Carolina Department of Environment and Natural Resources
DWM, HWS
1646 Mail Service center
Raleigh, NC 27699-1646

Attached is the CME report for the subject facility. A copy of this report has been requested by:

Jeff Carty
Third Creek WWTP Supervisor
City of Statesville
PO Box 1111
Statesville, NC 28677-1111

Thomas Haynes
Waters Edge Environmental, LLC
302 Pomona Drive, Suite L
Greensboro, NC 27407

If you have any questions about this document, please contact me at (706) 355-8608 or at email *matthews.sharon@epa.gov.*

COMPREHENSIVE GROUND WATER MONITORING EVALUATION
CITY OF STATESVILLE, NC THIRD CREEK MONOFILL
SESD Project No. 03-0129

INTRODUCTION

On December 3, 2002, a comprehensive ground water monitoring evaluation (CME) was conducted at the City of Statesville Third Creek Monofill in Statesville, NC. This CME was requested by the North Carolina Department of Environment and Natural Resources (NC DENR) and the US EPA RCRA Enforcement and Compliance Branch to determine compliance with the applicable ground water monitoring regulations and to evaluate quality assurance and quality control (QA/QC) of the ground water sample collection/handling procedures. The CME also determines if the monitoring well system will yield representative ground water samples, reliable hydrologic data and to identify any deficiencies in the present monitoring system.

The CME was performed by US EPA Science and Ecosystem Division (SESD) Enforcement Section (ES) personnel S.E. Matthews. The CME consisted of a review of the US EPA Region IV files, NCDENR files and a site visit. Mr. Jeff Carty represented the facility. Mr. Thomas Haynes of Waters Edge Environmental, LLC, Greensboro, NC conducted the ground water sampling.

SESD-ES personnel requested lab data packages for monitoring wells MW 2, MW 7 and MW 9 for laboratory QA/QC evaluation. The evaluation of the lab data packages will be reported in a separate memo prepared by the SESD Office of Quality Assurance.

Waters Edge Environmental personnel answered questions and conducted well purging and sample handling techniques in a knowledgeable and competent manner. Documents requested as part of the CME were made available for review during the inspection or were mailed at a later date. At the time of the CME, the ground water monitoring system was in compliance with the applicable ground water monitoring requirements. The US EPA CME checklist used during the evaluation is included in Appendix A.

SITE BACKGROUND

The City of Statesville operates a wastewater treatment system at the Third Creek facility located southeast of the city limits of Statesville, NC (Figure1). The facility 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 woodlands.

The facility operates under a NPDES permit (Permit No. 0020591) and a non-discharge permit (Permit No. WQ004040). Concerns of elevated cadmium concentrations 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 wastewater treatment system. Sludge from the facility was landfilled in eight trenches on property near the wastewater treatment plan. Sampling of the

landfilled sludge detected the presence of cadmium above the toxicity leaching procedure regulatory limit in seven of the eight trenches. The City of Statesville and the State of North Carolina entered into an Administrative Order on Consent in March 1995 to address this issue. The City contracted with Aquaterra to perform subsurface characterization activities to determine ground water flow direction and to install soil borings and ground water monitoring wells.

The Third Creek Monofill was closed in July 1996 by stabilizing and capping the trenches. The State accepted the closure certification in June 1998. The facility's ground water monitoring sampling is conducted annually. A request may be submitted in 2003 to reduce the present list of parameters by dropping the VOC/SVOC analyses.

SITE CHARACTERIZATION

Geology/Hydrology

The site is located in Iredell County, North Carolina, which lies within the Charlotte Belt of the Piedmont Physiographic Province. The Charlotte Belt is characterized by metamorphosed igneous and sedimentary bedrock such as granite, gneiss, schist, quartzite, slate, marble, and phyllite overlain by clay-rich saprolite. In site borings, granite and schist rock fragments were encountered, with auger refusal at about 86 feet below land surface (bls). The silty sands at surface graded into a highly weathered mica schist at about 25 to 30 feet bls.

The ground water is typical of shallow aquifers within the Piedmont region of North Carolina, with unconfined water table conditions existing across the site. Recharge to the water table occurs through precipitation infiltration. Because of the persistent drought in the Statesville area, the water table has dropped and wells MW 5 , MW 6 and MW 8 could not be sampled due to insufficient water. Recent potentiometric maps indicate the direction of ground water flow appears to be to the southwest with a horizontal gradient ranging from 0.014 ft/ft to 0.024 ft/ft.

COMPREHENSIVE GROUND WATER MONITORING EVALUATION

The following is an evaluation of the ground water monitoring program implemented at the facility and is based on field observations, discussions with State and consultant personnel and file reviews. A map of the well locations is given as Figure 2. The Technical Enforcement Guidance Document CME checklist used to determine compliance with 40 CFR Part 265 Subpart F was used as a reference with a copy of that checklist included as Appendix A. Well construction diagrams/lithologic logs are given in Appendix B. A summary of well construction details is included as Table 1 in Appendix C. Recent potentiometric maps are included as Appendix D.

40 CFR Part 265.90 - Applicable Requirements

The ground water monitoring system was designed to adhere to the 40 CFR 265 Subpart F (codified at 15A NCAC 13A. 0010) standards and requirements applicable to owner/operators of hazardous waste management facilities with interim status.

40 CFR Part 265.91 - Ground Water Monitoring System

Monitoring wells MW1 to MW 4 were installed in June 1987. These wells ranged from 30 to 70 feet below ground surface (bgs) and had 10-foot 0.010-slot 2-inch PVC screens placed in the bottom of the hole. A sand/gravel pack was placed around the screen, extending a foot or more above the screen. This was followed by a 1-foot bentonite seal. The well was then grouted to land surface for completion. MW 1 was abandoned in November 2000 and is no longer a part of the ground water monitoring system.

Monitoring wells MW-5 to MW-8 were installed in April 1995 by hollow stem auger methods. The wells ranged from 36 to 50 feet bgs and had 10-foot 0.010-slot 2-inch PVC screens placed in the bottom of the hole. A sand/gravel pack was placed around the screen, extending a foot or more above the screen. This was followed by a 2-foot bentonite seal. The well was then grouted to land surface for completion.

Monitoring well MW 9 was installed in August 1998. This well had a total depth of 43.5 feet bgs and had a 10-foot 0.010-slot 2-inch PVC screen placed in the bottom of the hole. A sand/gravel pack was placed around the screen, extending a foot or more above the screen. This was followed by a 2-foot bentonite seal. The well was then grouted to land surface for completion.

40 CFR Part 265.92 - Sampling and Analysis

The most recent Sampling and Analysis Plan (SAP) available for review was the December 2000 version prepared by Waters Edge Environmental, LLC. The SAP includes the procedures and techniques specified in the ground water monitoring regulations. Sample collection and handling techniques used by Waters Edge Environmental personnel in the field were adequate and appropriate to meet the regulatory requirements.

It was noted that all wells were locked prior to purging/sampling activities and that the wells appeared to be in good condition. It was noted that some of the older well pads, especially for wells MW 2 and MW 3, were cracked. Water levels were measured with a Solonist water level indicator to the nearest 0.01 foot prior to purging. This number is subtracted from the total depth and plugged into a formula for calculating the static volume to determine the well volume to be purged. Wells are purged for a minimum of three well volumes or to dryness and until the field parameter measurements for pH, temperature and specific conductivity stabilize. Field measurements were made with a rented YSI meter that was calibrated prior to field work. Purge water was collected into a 5 gallon bucket and then transferred to 55-gallon drum for later disposal at the WWTP.

The water level recorder was deconned between each well with DI water/ Liquinox, then rinsed again with DI water, rinsed with 5% nitric acid followed by a DI rinse, then isopropyl alcohol with a DI rinse and air dried between uses. Monitoring wells were purged and sampled with a disposable PVC bailer on new nylon cord.

The wells were sampled from least to most contaminated. Disposable gloves were worn for well purging/ sampling and changed between each well. Samples were collected directly into the appropriate sample containers, pre-cleaned by the lab, with labels affixed to each container documenting the sample location, time, analysis required, etc. Sample containers were pre-preserved. Trip blanks and field blanks were collected for QA/QC purposes. Samples were collected for volatile and semi-volatile organic compounds (VOC/SVOC), metals, total dissolved solids, total organic carbon, and nitrate/nitrogen. The most recent EPA SW-846 analytical methods were to be used for analysis.

Samples were labeled, bagged and iced for transport to Pace Analytical Services, Inc. in Huntersville, NC. Chain-of-Custody forms were completed for the samples. Field techniques for performing water level measurements, well purging/sampling procedures, sample preservation and handling, and QA/QC procedures were evaluated for adequacy and found to be in compliance with the current SAP. It is recommended that the pH of the metals sample be checked to insure the laboratory supplied enough nitric acid to lower the pH to less than 2.

40 CFR Part 265.93 - Preparation, Evaluation and Response

The present ground water monitoring system has been developed in accordance with 40 CFR 265 Subpart F.

40 CFR Part 265.94 - Record keeping and Reporting

The facility is in compliance with the reporting and record-keeping requirements of the applicable ground water monitoring regulation. Documents requested by the EPA inspector were made available for review or submitted at a later date.

CONCLUSIONS/RECOMMENDATIONS

Sampling personnel answered questions and conducted well purging and sample handling techniques in a competent manner. Documents requested as part of the overview were made available for review. At the time of the overview, sample collection and handling techniques were in accordance with the most recent Sampling and Analysis Plan. It is recommended that the pH of the metals sample be checked to insure the laboratory supplied enough nitric acid to lower the pH to less than 2.

REFERENCES

"Ground Water Sampling and Analysis Report, Third Creek Monofill" prepared for the City of Statesville, NC by Waters Edge Environmental, LLC, January 2002.

"Ground Water Sampling and Analysis Report, Third Creek Monofill" prepared for the City of Statesville, NC by Waters Edge Environmental, LLC, February 2001.

"Revised Ground Water Sampling and Analysis Plan", prepared for the City of Statesville, NC by Waters Edge Environmental, LLC, December 2000.

"RCRA Compliance Evaluation Inspection of the Water/Wastewater Treatment, City of Statesville, NC" prepared by the USEPA Region 4 Waste Management Division, October 1996.

"Post-Closure Care Plan, Third Creek Monofill" prepared for the City of Statesville, NC by Aquaterra, Inc., September 1996.

"Revised Ground Water Sampling and Analysis Plan", prepared for the City of Statesville, NC by Aquaterra, Inc., September 1996.

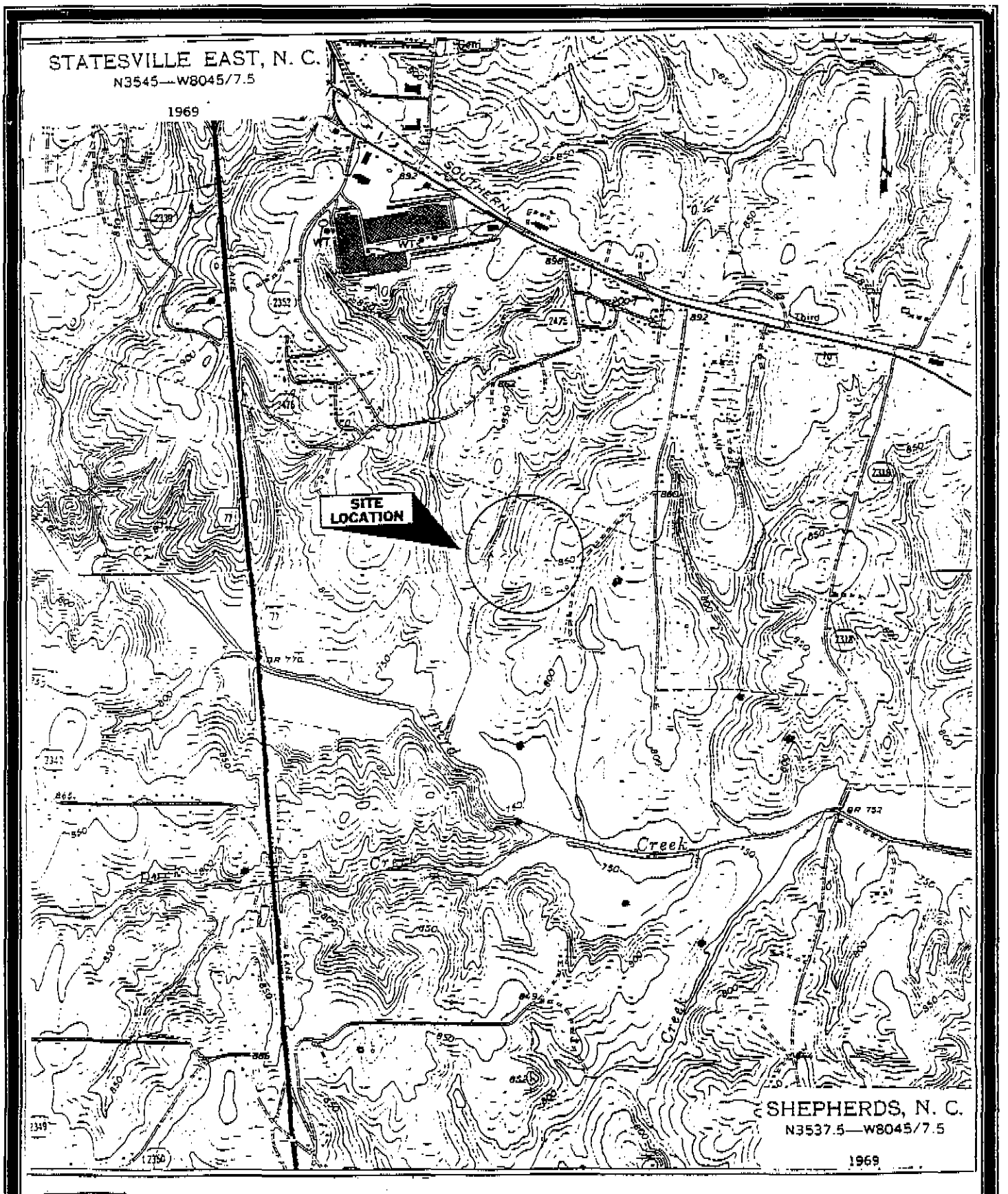
"Closure Care Plan, Third Creek Monofill" prepared for the City of Statesville, NC by Aquaterra, Inc., July 1996.

"Ground Water Sampling and Analysis Report, Third Creek Monofill" prepared for the City of Statesville, NC by Aquaterra, Inc., February 1996.

"Comprehensive Ground Water Monitoring Evaluation" of the City of Statesville Third Creek Wastewater Treatment Plant, prepared by the North Carolina Division of Solid Waste Management, June 1995.

"Administrative Order On Consent Docket # 94-191" to the City of Statesville Third Creek Wastewater Treatment Plant, prepared by the North Carolina Department of Environment, Health and Natural Resources, March 1995.

"Hazardous Waste Permit Application Part A", Third Creek Monofill, City of Statesville, NC., July 1995.



Scale
1" = 2,000'

FIGURE 1
FACILITY LOCATION MAP
THIRD CREEK MONOFILL, STATESVILLE, NC

After Waters Edge

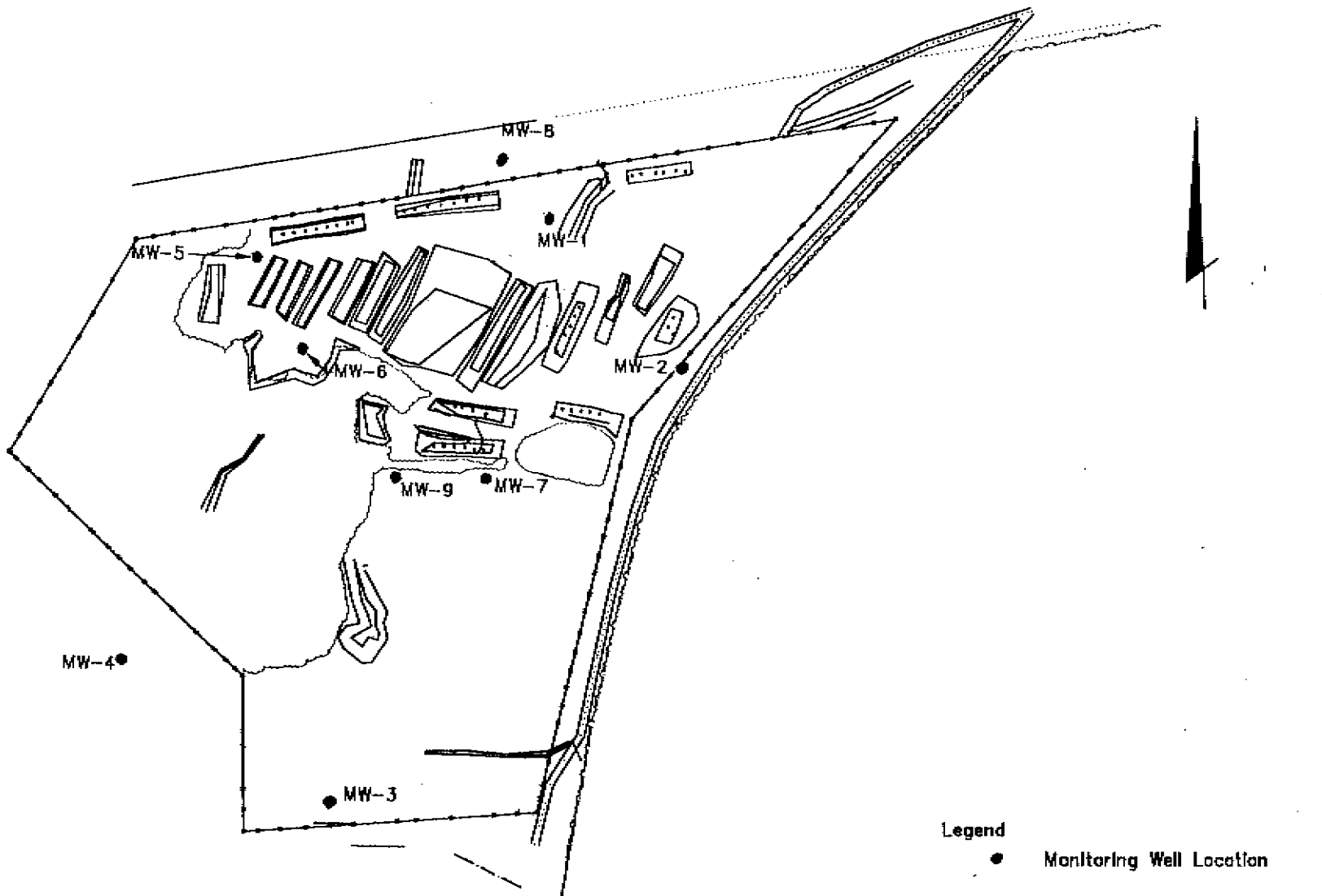


FIGURE 2
MONITORING WELL LOCATION MAP
THIRD CREEK MONOFILL, STATESVILLE, NC

After Waters Edge

APPENDIX A
COMPREHENSIVE GROUND WATER MONITORING CHECKLIST

CITY OF STATESVILLE, NC THIRD CREEK MONOFILL
SESD Project No. 03-0129

CHECKLIST
FOR
COMPREHENSIVE GROUND WATER
MONITORING EVALUATION (CME)
AT
RCRA FACILITIES

FACILITY NAME City of Statesville 3rd creek monofill
EPA ID# NCR 000 001 602
FACILITY ADDRESS Statesville, NC
FACILITY CONTACT/TITLE Jeff Carty 704 872-9621
INSPECTORS NAME J E Matthews
DATE 12/3/02
TYPE OF FACILITY (TSD) closed trenches
REGULATED UNIT(S):

facility is in post-closure monitoring

APPENDIX A

COMPREHENSIVE GROUND-WATER MONITORING EVALUATION WORKSHEET

The following worksheets have been designed to assist the enforcement officer/technical reviewer in evaluating the ground-water monitoring system an owner/operator uses to collect and analyze samples of ground water. The focus of the worksheets is technical adequacy as it relates to obtaining and analyzing representative samples of ground water. The basis of the worksheets is the final RCRA Ground Water Monitoring Technical Enforcement Guidance Document which describes in detail the aspects of ground-water monitoring which EPA deems essential to meet the goals of RCRA.

Appendix A is not a regulatory checklist. Specific technical deficiencies in the monitoring system can, however, be related to the regulations as illustrated in Figure 4.3 taken from the RCRA Ground-Water Monitoring Compliance Order Guide (COG) (included at the end of the appendix). The enforcement officer, in developing an enforcement order, should relate the technical assessment from the worksheets to the regulations using figure 4.3 from the COG as a guide.

I. Office Evaluation - Technical Evaluation of the Design of the Ground-water Monitoring System

A. Review of relevant documents:

1. What documents were obtained prior to conducting the inspection:

a. RCRA Part A permit application? (Y/N) ✓
b. RCRA Part B permit application? (Y/N) ___
c. Correspondence between the owner/operator and appropriate agencies or citizen's groups? (Y/N) ✓
d. Previously conducted facility inspection reports? (Y/N) ✓
e. Facility's contractor reports? (Y/N) ✓
f. Regional hydrogeologic, geologic, or soil reports? (Y/N) ___
g. The facility's Sampling and Analysis Plan? (Y/N) ✓
h. Ground-water Assessment Program Outline (or Plan, if the facility is in assessment monitoring)? (Y/N) ___
i. Other (specify) post-closure plans

B. Evaluation of the Owner/Operator's Hydrogeologic Assessment:

1. Did the owner/operator use the following direct techniques in the hydrogeologic assessment:

a. Logs of the soil borings/rock corings (documented by a professional geologist, soil scientist, or geotechnical engineer)? (Y/N) ✓
b. Materials tests (e.g., grain size analyses, standard penetration tests, etc.)? (Y/N) not noted in files
c. Piezometer installation for water level measurements at different depths? (Y/N) ↓
d. Slug tests? (Y/N) ↓

not noted in files

e. Pump tests? (Y/N) ___
f. Geochemical analyses of soil samples? (Y/N) ___
g. Other (specify) (e.g., hydrochemical diagrams and wash analysis) _____

2. Did the owner/operator use the following indirect techniques to supplement direct techniques data:

a. Geophysical well logs? (Y/N) ___
b. Tracer studies? (Y/N) ___
c. Resistivity and/or electromagnetic conductance? (Y/N) ___
d. Seismic Survey? (Y/N) ___
e. Hydraulic conductivity measurements of cores? (Y/N) ___
f. Aerial photography? (Y/N) ___
g. Ground penetrating radar? (Y/N) ___
h. Other (specify) _____

3. Did the owner/operator document and present the raw data from the site hydrogeologic assessment? (Y/N) ✓

4. Did the owner/operator document methods (criteria) used to correlate and analyze the information? (Y/N) ✓

5. Did the owner/operator prepare the following:

a. Narrative description of geology? (Y/N) ✓
b. Geologic cross sections? (Y/N) ___
c. Geologic and soil maps? (Y/N) ___
d. Boring/coring logs? (Y/N) ✓
e. Structure contour maps of the differing water bearing zones and confining layer? (Y/N) ___
f. Narrative description and calculation of ground-water flows? (Y/N) ✓
g. Water table/potentiometric map? (Y/N) ✓
h. Hydrologic cross sections? (Y/N) ___

6. Did the owner/operator obtain a regional map of the area and delineate the facility? (Y/N) ✓

If yes, does this map illustrate:

a. Surficial geology features? (Y/N) ✓
b. Streams, rivers, lakes, or wetlands near the facility? (Y/N) ✓
c. Discharging or recharging wells near the facility? (Y/N) ___

7. Did the owner/operator obtain a regional hydrogeologic map? (Y/N) not noted in files

   If yes, does this hydrogeologic map indicate:

   a. Major areas of recharge/discharge? (Y/N)
   b. Regional ground-water flow direction? (Y/N)
   c. Potentiometric contours which are consistent with observed water level elevations? (Y/N)

8. Did the owner/operator prepare a facility site map? (Y/N) ✓

   If yes, does the site map show:

   a. Regulated units of the facility (e.g., landfill areas, impoundments)? (Y/N) ✓
   b. Any seeps, springs, streams, ponds, or wetlands? (Y/N) ___
   c. Location of monitoring wells, soil borings, or test pits? (Y/N) ✓
   d. How many regulated units does the facility have? Several trenches
      If more than one regulated unit then,
      o Does the waste management area encompass all regulated units? (Y/N) ✓
        Or
      o Is a waste management area delineated for each regulated unit? (Y/N) ___

C. Characterization of Subsurface Geology of Site

1. Soil boring/test pit program:

   a. Were the soil borings/test pits performed under the supervision of a qualified professional? (Y/N) ✓
   b. Did the owner/operator provide documentation for selecting the spacing for borings? (Y/N) ___
   c. Were the borings drilled to the depth of the first confining unit below the uppermost zone of saturation or ten feet into bedrock? (Y/N) auger refusal
   d. Indicate the method(s) of drilling:
      o Auger (hollow or solid stem) ✓
      o Mud rotary ___
      o Reverse rotary ___
      o Cable tool ___
      o Jetting ___
      o Other (specify) ___
   e. Were continuous sample corings taken? (Y/N) N every 5 feet

f. How were the samples obtained (checked method[s])
- o Split spoon ✓
- o Shelby tube, or similar ___
- o Rock coring ___
- o Ditch sampling ___
- o Other (explain) ___

g. Were the continuous sample corings logged by a qualified professional in geology? (Y/N) ✓

h. Does the field boring log include the following information:
- o Hole name/number? (Y/N) ✓
- o Date started and finished? (Y/N) ✓
- o Driller's name? (Y/N) ✓
- o Hole location (i.e., map and elevation)? (Y/N) ✓
- o Drill rig type and bit/auger size? (Y/N) HSA
- o Gross petrography (e.g., rock type) of each geologic unit? (Y/N) ✓
- o Gross mineralogy of each geologic unit? (Y/N) ✓
- o Gross structural interpretation of each geologic unit and structural features (e.g., fractures, gouge material, solution channels, buried streams or valleys, identification of depositional material)? (Y/N) ✓
- o Development of soil zones and vertical extent and description of soil type? (Y/N) ✓
- o Depth of water bearing unit(s) and vertical extent of each? (Y/N) ✓ auger
- o Depth and reason for termination of borehole? (Y/N) refusal
- o Depth and location of any contaminant encountered in borehole? (Y/N) N/A
- o Sample location/number? (Y/N) N
- o Percent sample recovery? (Y/N) N
- o Narrative descriptions of:
  - -- Geologic observations? (Y/N) ✓
  - — Drilling observations? (Y/N) ✓

i. Were the following analytical tests performed on the core samples: not noted in files
- o Mineralogy (e.g., microscopic tests and x-ray diffraction)? (Y/N) ___
- o Petrographic analysis:
  - - degree of crystallinity and cementation of matrix? (Y/N) ___
  - - degree of sorting, size fraction (i.e., sieving), textural variations? (Y/N) ___

not noted in files

- rock type(s)? (Y/N)
- soil type? (Y/N)
- approximate bulk geochemistry? (Y/N)
- existence of microstructures that may effect or indicate fluid flow? (Y/N)

o Falling head tests? (Y/N)
o Static head tests? (Y/N)
o Settling measurements? (Y/N)
o Centrifuge tests? (Y/N)
o Column drawings? (Y/N)

D. Verification of subsurface geological data

1. Has the owner/operator used indirect geophysical methods to supplement geological conditions between borehole locations? (Y/N) N
2. Do the number of borings and analytical data indicate that the confining layer displays a low enough permeability to impede the migration of contaminants to any stratigraphically lower water-bearing units? (Y/N) NA
3. Is the confining layer laterally continuous across the entire site? (Y/N) NA
4. Did the owner/operator consider the chemical compatibility of the site-specific waste types and the geologic materials of the confining layer? (Y/N) NA
5. Did the geologic assessment address or provide means for resolution of any information gaps of geologic data? (Y/N) ✓
6. Do the laboratory data corroborate the field data for petrography? (Y/N) NA
7. Do the laboratory data corroborate the field data for mineralogy and subsurface geochemistry? (Y/N) NA

E. Presentation of geologic data

not noted in files

1. Did the owner/operator present geologic cross sections of the site? (Y/N)
2. Do cross sections:
   a. identify the types and characteristics of the geologic materials present? (Y/N)
   b. define the contact zones between different geologic materials?
   c. note the zones of high permeability or fracture? (Y/N)
   d. give detailed borehole information including:
      o location of borehole? (Y/N)
      o depth of termination? (Y/N)
      o location of screen (if applicable)? (Y/N)
      o depth of zone(s) of saturation? (Y/N)
      o backfill procedure?

3. Did the owner/operator provide a topographic map which was constructed by a licensed surveyor? (Y/N) USGS
4. Does the topographic map provide:
   a. contours at a maximum interval of two-feet? (Y/N) 10'
   b. locations and illustrations of man-made features (e.g., parking lots, factory buildings, drainage ditches, storm drains, pipelines, etc.)? (Y/N) ___
   c. descriptions of nearby water bodies? (Y/N) ✓
   d. descriptions of off-site wells? (Y/N) ___
   e. site boundaries? (Y/N) ✓
   f. individual RCRA units? - on site map (Y/N) ✓
   g. delineation of the waste management area(s)? (Y/N) ___
   h. well and boring locations? on site map (Y/N) ✓
5. Did the owner/operator provide an aerial photograph depicting the site and adjacent off-site features? (Y/N) N
6. Does the photograph clearly show surface water bodies, adjacent municipalities, and residences and are these clearly labelled? (Y/N) NA

F. Identification of Ground-Water Flowpaths

1. Ground-water flow direction

   a. Was the well casing height measured by a licensed surveyor to the nearest 0.01 feet? (Y/N) ✓
   b. Were the well water level measurements taken within a 24 hour period? (Y/N) ✓
   c. Were the well water level measurements taken to the nearest 0.01 feet? (Y/N) ✓
   d. Were the well water levels allowed to stabilize after construction and development for a minimum of 24 hours prior to measurements? (Y/N) ✓
   e. Was the water level information obtained from (check appropriate one):
      o multiple piezometers placed in single borehole? ___
      o vertically nested piezometers in closely spaced separate boreholes? ___
      o monitoring wells ✓

f. Did the owner/operator provide construction details for the ~~piezometers~~? wells (Y/N) ✓

g. How were the static water levels measured (check method(s).
   - o Electric water sounder — Solonist
   - o Wetted tape ____
   - o Air line ____
   - o Other (explain) ____

h. Was the well water level measured in wells with equivalent screened intervals at an equivalent depth below the saturated zone? screen depths vary (Y/N) ____

i. Has the owner/operator provided a site water table (potentiometric) contour map? If yes,
   - o Do the potentiometric contours appear logical and accurate based on topography and presented data? (Consult water level data) (Y/N) ✓
   - o Are ground-water flow-lines indicated? (Y/N) ✓
   - o Are static water levels shown? (Y/N) ✓
   - o Can hydraulic gradients be estimated? (Y/N) ✓

j. Did the owner/operator develop hydrologic cross sections of the vertical flow component across the site using measurements from all wells? (Y/N) N

k. Do the owner/operator's flow nets include:
   - o piezometer locations? (Y/N) ____
   - o depth of screening? (Y/N) ____
   - o width of screening? (Y/N) ____
   - o measurements of water levels from all wells and piezometers? (Y/N) ____

2. Seasonal and temporal fluctuations in ground-water level

   a. Do fluctuations in static water levels occur? (Y/N) seasonal
      - o If yes, are the fluctuations caused by any of the following:
      - -- Off-site well pumping (Y/N) ____
      - -- Tidal processes or other intermittent natural variations (e.g., river stage, etc.) (Y/N) ____
      - -- On-site well pumping (Y/N) ____
      - -- Off-site, on-site construction or changing land use patterns (Y/N) ____
      - -- Deep well injection (Y/N) ____
      - -- Seasonal variations — drought ~~(Y/N)~~ ✓
      - -- Other (specify) ____

b. Has the owner/operator documented sources and patterns that contribute to or affect the ground-water patterns below the waste management? (Y/N) drought

c. Do water level fluctuations alter the general ground-water gradients and flow directions? (Y/N) N

d. Based on water level data, do any head differentials occur that may indicate a vertical flow component in the saturated zone? (Y/N) N

e. Did the owner/operator implement means for gauging long term effects on water movement that may result from on-site or off-site construction or changes in land-use patterns? (Y/N) N

3. Hydraulic conductivity

not noted in files

a. How were hydraulic conductivities of the subsurface materials determined?
   - o Single-well tests (slug tests)? (Y/N) ___
   - o Multiple-well tests (pump tests) (Y/N) ___
   - o Other (specify)

b. If single-well tests were conducted, was it done by:
   - o Adding or removing a known volume of water, or (Y/N) ___
   - o Pressurizing well casing (Y/N) ___

c. If single well tests were conducted in a highly permeable formation, were pressure transducers and high-speed recording equipment used to record the rapidly changing water levels? (Y/N) ___

d. Since single well tests only measure hydraulic conductivity in a limited area, were enough tests run to ensure a representative measure of conductivity in each hydrogeologic unit? (Y/N) ___

e. Is the owner/operator's slug test data (if applicable) consistent with existing geologic information (e.g., boring logs)? (Y/N) ___

f. Were other hydraulic conductivity properties determined? (Y/N) Y

g. If yes, provide any of the following data, if available:
   - o Transmissivity ___
   - o Storage coefficient ___
   - o Leakage ___
   - o Permeability ___
   - o Porosity ___
   - o Specific capacity ___
   - o Other (specify) ___

horizontal gradient ranges from 0.014 to 0.024 ft/ft

4. Identification of the uppermost aquifer

shallow unconfined aquifer

a. Has the extent of the uppermost saturated zone (aquifer) in the facility area been defined? If yes, (Y/N) ___
   o Are soil boring/test pit logs included? (Y/N) ___
   o Are geologic cross-sections included? (Y/N) ___
b. Is there evidence of confining (competent, unfractured, continuous, and low permeability) layers beneath the site? (Y/N) ___
   o If yes, how was continuity demonstrated?

   _____

   _____

c. What is hydraulic conductivity of the confining unit (if present)? N/A cm/sec
   How was it determined? _____
d. Does potential for other hydraulic communication exist (e.g., lateral incontinuity between geologic units, facies changes, fracture zones, cross cutting structures, or chemical corrosion/alteration of geologic units by leachage? (Y/N) ___
   If yes or no what is the rationale? possible fractured bedrock

G. Office Evaluation of the Facility's Ground-Water Monitoring System

Monitoring Well Design and Construction:
These questions should be answered for each different well design present at the facility.

1. Drilling Methods

a. What drilling method was used for the well?
   o Hollow-stem auger ✓
   o Solid-stem auger ___
   o Mud rotary ___
   o Air rotary ___
   o Reverse rotary ___
   o Cable tool ___
   o Jetting ___
   o Air drill with casing hammer ___
   o Other (specify) _____
b. Were any cutting fluids (including water) or additives used during drilling? (Y/N) N
   If yes, specify
   Type of drilling fluid _____
   Source of water used _____
   Foam _____
   Polymers _____
   Other _____

c. Was the cutting fluid, or additive, identified? (Y/N) NA
d. Was the drilling equipment steam-cleaned prior to drilling the well? (Y/N) ✓
Other methods _____

e. Was compressed air used during drilling? (Y/N) NA
o If yes, was the air filtered to remove oil? (Y/N) NA
f. Did the owner/operator document procedure for establishing the potentiometric surface? (Y/N) ✓
o If yes, how was the location established?
monitoring wells

g. Formation samples
o Were formation samples collected initially during drilling? (Y/N) ✓
o Were any cores taken continuous? (Y/N) N
If not, at what interval were samples taken? 5 foot

o How were the samples obtained?
- Split spoon ✓
- Shelby tube
- Core drill
- Other (specify)
o Identify if any physical and/or chemical tests were performed on the formation samples (specify) _____

2. Monitoring Well Construction Materials

a. Identify construction materials (by number) and diameters (ID/OD)

	Material	Diameter (ID/OD)
o Primary Casing	PVC	2"
o Secondary or outside casing (double construction)	steel	4 to 6"
o Screen	PVC	2"

b. How are the sections of casing and screen connected?
o Pipe sections threaded ✓
o Couplings (friction) with adhesive or solvent
o Couplings (friction) with retainer screws
o Other (specify) _____

c. Were the materials steam-cleaned prior to installation? (Y/N) ✓
If no, how were the materials cleaned? _____

3. Well Intake Design and Well Development

a. Was a well intake screen installed? (Y/N) ✓
o What is the length of the screen for the well? 10 foot
o Is the screen manufactured? (Y/N) ✓

b. Was a filter pack installed? (Y/N) ✓
o What kind of filter pack was employed? sand/gravel
o Is the filter pack compatible with formation materials? (Y/N) ✓
o How was the filter pack installed? tremie
o What are the dimensions of the filter pack? 1 to 2 feet above screen
o Has a turbidity measurement of the well water ever been made? (Y/N) N
o Have the filter pack and screen been designed for the in situ materials? (Y/N) ✓

c. Well development
Was the well developed? (Y/N) ✓
o What technique was used for well development?
- Surge block
- Bailer ✓
- Air surging
- Water pumping
- Other (specify) _____

4. Annular Space Seals

a. What is the annular space in the saturated zone directly above the filter pack filled with?
- Sodium bentonite (specify type and grit) bentonite chips
- Cement (specify neat or concrete) _____
- Other (specify) _____
o Was the seal installed by? unknown
- Dropping material down the hole and tamping
- Dropping material down the inside of hollow-stem auger
- Tremie pipe method
- Other (specify)

b. Was a different seal used in the unsaturated zone? (Y/N) ✗
If yes,
o Was this seal made with?
- Sodium bentonite (specify type and grit) _____
- Cement (specify neat or concrete) _____
- Other (specify) Portland/bentonite slurry or Type I Portland

o Was this seal installed by? unknown
- Dropping material down the hole and tamping
- Dropping material down the inside of hollow stem auger
- Other (specify) _____

c. Is the upper portion of the borehole sealed with a concrete cap to prevent infiltration from the surface? (Y/N) ✓

d. Is the well fitted with an above-ground protective device and ~~bumper-guards?~~ (Y/N) ✓

e. Has the protective cover been installed with locks to prevent tampering (Y/N) ✓

H. Evaluation of the Facility's Detection Monitoring Program

facility is in post-closure monitoring

1. Placement of Downgradient Detection Monitoring Wells

a. Are the ground-water monitoring wells or clusters located immediately adjacent to the waste management area? (Y/N)

b. How far apart are the detection monitoring wells?

_____

c. Does the owner/operator provide a rationale for the location of each monitoring well or cluster? (Y/N)

d. Has the owner/operator identified the well screen lengths of each monitoring well or clusters? (Y/N)

e. Does the owner/operator provide an explanation for the well screen lengths of each monitoring well or cluster? (Y/N)

f. Do the actual locations of monitoring wells or clusters correspond to those identified by the owner/operator? (Y/N)

2. Placement of Upgradient Monitoring Wells

a. Has the owner/operator documented the location of each upgradient monitoring well or cluster? (Y/N)

b. Does the owner/operator provide an explanation for the location(s) of the upgradient monitoring wells? (Y/N)

c. What length screen has the owner/operator employed in the background monitoring well(s)?

_____

d. Does the owner/operator provide an explanation for the screen length(s) chosen? (Y/N)

e. Does the actual location of each background monitoring well or cluster correspond to that identified by the owner/operator? (Y/N)

facility is in post-closure monitoring

I. Office Evaluation of the Facility's Assessment Monitoring Program

1. Does the assessment plan specify:
   a. The number, location, and depth of wells? (Y/N) ___
   b. The rationale for their placement and identify the basis that will be used to select subsequent sampling locations and depths in later assessment phases? (Y/N) ___
2. Does the list of monitoring parameters include all hazardous waste constituents from the facility? (Y/N) ___
   a. Does the water quality parameter list include other important indicators not classified as hazardous waste constituents? (Y/N) ___
   b. Does the owner/operator provide documentation for the listed wastes which are not included? (Y/N) ___
3. Does the owner/operator's assessment plan specify the procedures to be used to determine the rate of constituent migration in the ground-water? (Y/N) ___
4. Has the owner/operator specified a schedule of implementation in the assessment plan? (Y/N) ___
5. Have the assessment monitoring objectives been clearly defined in the assessment plan? (Y/N) ___
   a. Does the plan include analysis and/or re-evaluation to determine if significant contamination has occurred in any of the detection monitoring wells? (Y/N) ___
   b. Does the plan provide for a comprehensive program of investigation to fully characterize the rate and extent of contaminant migration from the facility? (Y/N) ___
   c. Does the plan call for determining the concentrations of hazardous wastes and hazardous waste constituents in the ground water? (Y/N) ___
   d. Does the plan employ a quarterly monitoring program? (Y/N) ___
6. Does the assessment plan identify the investigatory methods that will be used in the assessment phase? (Y/N) ___
   a. Is the role of each method in the evaluation fully described? (Y/N) ___
   b. Does the plan provide sufficient descriptions of the direct methods to be used? (Y/N) ___
   c. Does the plan provide sufficient descriptions of the indirect methods to be used? (Y/N) ___
   d. Will the method contribute to the further characterization of the contaminant movement? (Y/N) ___
7. Are the investigatory techniques utilized in the assessment program based on direct methods? (Y/N) ___
   a. Does the assessment approach incorporate indirect methods to further support direct methods? (Y/N) ___
   b. Will the planned methods called for in the assessment approach ultimately meet performance standards for assessment monitoring? (Y/N) ___

facility is in post-closure monitoring

c. Are the procedures well defined? (Y/N) ___
d. Does the approach provide for monitoring wells similar in design and construction as the detection monitoring wells? (Y/N) ___
e. Does the approach employ taking samples during drilling or collecting core samples for further analysis? (Y/N) ___

8. Are the indirect methods to be used based on reliable and accepted geophysical techniques? (Y/N) ___
   a. Are they capable of detecting subsurface changes resulting from contaminant migration at the site? (Y/N) ___
   b. Is the measurement at an appropriate level of sensitivity to detect ground-water quality changes at the site? (Y/N) ___
   d. Is the method appropriate considering the nature of the subsurface materials? (Y/N) ___
   e. Does the approach consider the limitations of these methods? (Y/N) ___
   f. Will the extent of contamination and constituent concentration be based on direct methods and sound engineering judgment? (Using indirect methods to further substantiate the findings) (Y/N) ___

9. Does the assessment approach incorporate any mathematical modeling to predict contaminant movement? (Y/N) ___
   a. Will site specific measurements be utilized to accurately portray the subsurface? (Y/N) ___
   b. Will the derived data be reliable? (Y/N) ___
   c. Have the assumptions been identified? (Y/N) ___
   d. Have the physical and chemical properties of the site-specific wastes and hazardous waste constituents been identified? (Y/N) ___

J. Conclusions

1. Subsurface geology

   a. Has sufficient data been collected to adequately define petrography and petrographic variation? (Y/N) ✓
   b. Has the subsurface geochemistry been adequately defined? (Y/N) ✓
   c. Was the boring/coring program adequate to define subsurface geologic variation? (Y/N) ✓
   d. Was the owner/operator's narrative description complete and accurate in its interpretation of the data? (Y/N) ✓
   e. Does the geologic assessment address or provide means to resolve any information gaps? (Y/N) ✓

2. Ground-water flowpaths

a. Did the owner/operator adequately establish the horizontal ~~and vertical~~ components of ground-water flow? (Y/N) horz.
b. Were appropriate methods used to establish ground-water flowpaths? (Y/N) ✓
c. Did the owner/operator provide accurate documentation? (Y/N) ✓
d. Are the potentiometric surface measurements valid? (Y/N) ✓
e. Did the owner/operator adequately consider the seasonal and temporal effects on the ground-water? (Y/N) ✓
f. Were sufficient hydraulic conductivity tests performed to document lateral and vertical variation in hydraulic conductivity in the entire hydrogeologic subsurface below the site? (Y/N) NA

3. Uppermost aquifer

a. Did the owner/operator adequately define the uppermost aquifer? (Y/N) ✓

4. Monitoring Well Construction and Design

a. Do the design and construction of the owner/operator's ground-water monitoring wells permit depth discrete ground-water samples to be taken? (Y/N) ✓
b. Are the samples representative of ground-water quality? (Y/N) ✓
c. Are the ground-water monitoring wells structurally stable? (Y/N) ✓
d. Does the ground-water monitoring well's design and construction permit an accurate assessment of aquifer characteristics? (Y/N) ✓

5. Detection Monitoring facility is in post-Closure monitoring

a. Downgradient Wells
Do the location, and screen lengths of the ground-water monitoring wells or clusters in the detection monitoring system allow the immediate detection of a release of hazardous waste or constituents from the hazardous waste management area to the uppermost aquifer? (Y/N) ___

b. Upgradient Wells
Do the location and screen lengths of the upgradient (background) ground-water monitoring wells ensure the capability of collecting ground-water samples representative of upgradient (background) ground-water quality including any ambient heterogenous chemical characteristics? (Y/N) ___

facility is in post-closure monitoring

6. Assessment Monitoring

a. Has the owner/operator adequately characterized site hydrogeology to determine contaminant migration? (Y/N)
b. Is the detection monitoring system adequately designed and constructed to immediately detect any contaminant release? (Y/N)
c. Are the procedures used to make a first determination of contamination adequate? (Y/N)
d. Is the assessment plan adequate to detect, characterize, and track contaminant migration? (Y/N)
e. Will the assessment monitoring wells, given site hydrogeologic conditions, define the extent and concentration of contamination in the horizontal and vertical planes? (Y/N)
f. Are the assessment monitoring wells adequately designed and constructed? (Y/N)
g. Are the sampling and analysis procedures adequate to provide true measures of contamination? (Y/N)
h. Do the procedures used for evaluation of assessment monitoring data result in determinations of the rate of migration, extent of migration, and hazardous constituent composition of the contaminant plume? (Y/N)
i. Are the data collected at sufficient frequency and duration to adequately determine the rate of migration? (Y/N)
j. Is the schedule of implementation adequate? (Y/N)
k. Is the owner/operator's assessment monitoring plan adequate? (Y/N)
   o If the owner/operator had to implement his assessment monitoring plan, was it implemented satisfactorily? (Y/N)

II. Field Evaluation

A. Ground-water monitoring system:
Are the numbers, depths, and locations of monitoring wells in agreement with those reported in the facility's monitoring plan? (See Section 3.2.3) (Y/N) ✓

B. Monitoring well construction:
1. Identify construction material

	Material	Diameter
a. Primary Casing	PVC	2"
b. Secondary or outside casing	steel	4" to 6"

2. Is the upper portion of the borehole sealed with concrete to prevent infiltration from the surface? (Y/N) Y

3. Is the well fitted with an above-ground protective device? (Y/N) Y

4. Is the protective cover fitted with locks to prevent tampering? (Y/N) Y

If a facility utilizes more than a single well design, answer the above questions for each well design.

III. Review of Sample Collection Procedures

A. Measurement of well depths elevation:

1. Are measurements of both depth to standing water and depth to the bottom of the well made? (Y/N) Y

2. Are measurements taken to the 0.01 feet? (Y/N) Y

3. What device is used?
Solonist WL recorder

4. Is there a reference point established by a licensed surveyor? (Y/N) Y

5. Is the measuring equipment properly cleaned between well locations to prevent cross contamination? (Y/N) Y

B. Detection of immiscible layers:

1. Are procedures used which will detect light phase immiscible layers? (Y/N) N/A

2. Are procedures used which will detect heavy phase immiscible layers? (Y/N) —

C. Sampling of immiscible layers:

1. Are the immiscible layers sampled separately prior to well evacuation? (Y/N) —

2. Do the procedures used minimize mixing with water soluble phases? (Y/N) —

D. Well evacuation:

1. Are low yielding wells evacuated to dryness? (Y/N) Y

2. Are high yielding wells evacuated so that at least three casing volumes are removed? (Y/N) Y

3. What device is used to evacuate the wells?
   disposable PVC bailer

4. If any problems are encountered (e.g., equipment malfunction) are they noted in a field logbook? (Y/N) Y

E. Sample withdrawal:

1. For low yielding wells, are samples for volatiles, pH, and oxidation/reduction potential drawn first after the well recovers? VOC's first (Y/N) Y

2. Are samples withdrawn with either flurocarbon/resins or stainless steel (316, 304 or 2205) sampling devices? (Y/N) PVC

3. Are sampling devices either bottom valve bailers or positive gas displacement bladder pumps? (Y/N) Y

4. If bailers are used, is fluorocarbon/resin coated wire, single strand stainless steel wire, or monofilament used to raise and lower the bailer? new nylon cord (Y/N) N

5. If bladder pumps are used, are they operated in a continuous manner to prevent aeration of the sample? (Y/N) NA

6. If bailers are used, are they lowered slowly to prevent degassing of the water? (Y/N) Y

7. If bailers are used, are the contents transferred to the sample container in a way that minimizes agitation and aeration? (Y/N) Y

8. Is care taken to avoid placing clean sampling equipment on the ground or other contaminated surfaces prior to insertion into the well? plastic around wells (Y/N) Y

9. If dedicated sampling equipment is not used, is equipment disassembled and thoroughly cleaned between samples? (Y/N) NA

10. If samples are for inorganic analysis, does the cleaning procedure include the following sequential steps: for WL recorder
    a. Dilute acid rinse (HNO_3 or HCl)? (Y/N) Y

11. If samples are for organic analysis, does the cleaning procedure include the following sequential steps:
    a. Nonphosphate detergent wash? (Y/N) ✓
    b. Tap water rinse? (Y/N) ✓

c. Distilled/deionized water rinse? (Y/N) ✓
d. Acetone rinse? (Y/N) N
e. Pesticide-grade hexane rinse? (Y/N) N

12. Is sampling equipment thoroughly dry before use? (Y/N) Y

13. Are equipment blanks taken to ensure that sample cross-contamination has not occurred? trip equipment (Y/N) Y

14. If volatile samples are taken with a positive gas displacement bladder pump, are pumping rates below 100 ml/min? (Y/N) NA

F. In-situ or field analyses:

1. Are the following labile (chemically unstable) parameters determined in the field:
   a. pH? (Y/N) ✓
   b. Temperature? (Y/N) ✓
   c. Specific conductivity? (Y/N) ✓
   d. Redox potential? (Y/N) NA
   e. Chlorine? (Y/N) —
   f. Dissolved oxygen? (Y/N) —
   g. Turbidity? (Y/N) —
   h. Other (specify) _____

YSI 63 meter

2. For in-situ determinations, are they made after well evacuation and sample removal? (Y/N) during purging

3. If sample is withdrawn from the well, is parameter measured from a split portion? (Y/N) N

4. Is monitoring equipment calibrated according to manufacturers' specifications and consistent with SW-846? rented & calibrated by manufacturer (Y/N) Y

5. Is the date, procedure, and maintenance for equipment calibration documented in the field logbook? (Y/N) Y

IV. Review of Sample Preservation and Handling Procedures

A. Sample containers:

1. Are samples transferred from the sampling device directly to their compatible containers? (Y/N) Y

2. Are sample containers for metals (inorganics) analyses polyethylene with polypropylene caps? (Y/N) Y

3. Are sample containers for organics analysis glass bottles with fluorocarbonresin-lined caps? (Y/N) Y

MW4 - got 1 volume then to dryness

4. If glass bottles are used for metals samples are the caps fluorocarbonresin-lined? (Y/N) NA

5. Are the sample containers for metal analyses cleaned using these sequential steps? Bottles come pre-cleaned from lab
   a. Nonphosphate detergent wash? (Y/N)
   b. 1:1 nitric acid rinse? (Y/N)
   c. Tap water rinse? (Y/N)
   d. 1:1 hydrochloric acid rinse? (Y/N)
   e. Tap water rinse? (Y/N)
   f. Distilled/deionized water rinse? (Y/N)

6. Are the sample containers for organic analyses cleaned using these sequential steps?
   a. Nonphosphate detergent/hot water wash? (Y/N)
   b. Tap water rinse? (Y/N)
   c. Distilled/deionized water rinse? (Y/N)
   d. Acetone rinse? (Y/N)
   e. Pesticide-grade hexane rinse? (Y/N)

7. Are trip blanks used for each sample container type to verify cleanliness? (Y/N)

B. Sample preservation procedures:

1. Are samples for the following analyses cooled to 4°C:
   a. TOC? (Y/N) ✓
   b. TOX? (Y/N) ✓
   c. Chloride? (Y/N) NA
   d. Phenols? (Y/N) NA
   e. Sulfate? (Y/N) NA
   f. Nitrate? (Y/N) ✓
   g. Coliform bacteria? (Y/N) NA
   h. Cyanide? (Y/N) NA
   i. Oil and grease? (Y/N) NA
   j. Hazardous constituents (§261, Appendix VIII)? (Y/N) NA

2. Are samples for the following analyses field acidified to pH <2 with HNO_3:
   a. Iron? (Y/N)
   b. Manganese? (Y/N)
   c. Sodium? (Y/N)
   d. Total metals? (Y/N)
   e. Dissolved metals? (Y/N)
   f. Fluoride? (Y/N)
   g. Endrin? (Y/N)
   h. Lindane? (Y/N)
   i. Methoxychlor? (Y/N)
   j. Toxaphene? (Y/N)

metals only

k. 2,4, D? (Y/N) NA
l. 2,4,5, TP Silvex? (Y/N)
m. Radium? (Y/N)
n. Gross alpha? (Y/N)
o. Gross beta? (Y/N)

3. Are samples for the following analyses field acidified to pH <2 with H_2SO_4: (Y/N) NA
   a. Phenols? (Y/N)
   b. Oil and grease? (Y/N)

4. Is the sample for TOC analyses field acidified to pH <2 with HCl? (Y/N) ✓

5. Is the sample for TOX analysis preserved with 1 ml of 1.1 M sodium sulfite? (Y/N) ✓

6. Is the sample for cyanide analysis preserved with NaOH to pH >12? (Y/N) NA

C. Special handling considerations:
   1. Are organic samples handled without filtering? (Y/N) Y

   2. Are samples for volatile organics transferred to the appropriate vials to eliminate headspace over the sample? (Y/N) Y

   3. Are samples for metal analysis split into two portions? (Y/N) N

   4. Is the sample for dissolved metals filtered through a 0.45 micron filter? (Y/N) NA

   5. Is the second portion not filtered and analyzed for total metals? (Y/N) NA

   6. Is one equipment blank prepared each day of ground-water sampling? (Y/N) Y

V. Review of Chain-of-Custody Prodecures

A. Sample labels
   1. Are sample labels used? (Y/N) Y

   2. Do they provide the following information:
      a. Sample identification number? (Y/N) ✓
      b. Name of collector? (Y/N) ✓
      c. Date and time of collection? (Y/N) ✓
      d. Place of collection? (Y/N) ✓
      e. Parameter(s) requested and preservatives used? (Y/N) ✓

3. Do they remain legible even if wet? (Y/N) ✓

B. Sample seals:
1. Are sample seals placed on those containers to ensure the samples are not altered? (Y/N) N

hand carry to PACE lab

C. Field logbook:
1. Is a field logbook maintained? field data sheets (Y/N) ✓

2. Does it document the following:
a. Purpose of sampling (e.g., detection or assessment)? post-closure monitoring (Y/N) ✓
b. Location of well(s)? (Y/N) ✓
c. Total depth of each well? (Y/N) ✓
d. Static water level depth and measurement technique? (Y/N) ✓
e. Presence of immiscible layers and detection method? (Y/N) NA
f. Collection method for immiscible layers and sample identification numbers? (Y/N) NA
g. Well evacuation procedures? (Y/N) bailer
h. Sample withdrawal procedure? (Y/N) ✓
i. Date and time of collection? (Y/N) ✓
j. Well sampling sequence? (Y/N) ✓
k. Types of sample containers and sample identification number(s)? (Y/N) ✓
l. Preservative(s) used? (Y/N) ✓
m. Parameters requested? (Y/N) ✓
n. Field analysis data and method(s)? (Y/N) ✓
o. Sample distribution and transporter? (Y/N) ✓
p. Field observations? (Y/N) ✓
- o Unusual well recharge rates? (Y/N) ✓
- o Equipment malfunction(s)? (Y/N) ✓
- o Possible sample contamination? (Y/N) ✓
- o Sampling rate? (Y/N) ✓

D. Chain-of-custody record:
1. Is a chain-of-custody record included with each sample? (Y/N) ✓
2. Does it document the following:
a. Sample number? (Y/N) ✓
b. Signature of collector? (Y/N) ✓
c. Date and time of collection? (Y/N) ✓
d. Sample type? (Y/N) ✓
e. Station location? (Y/N) ✓
f. Number of containers? (Y/N) ✓
g. Parameters requested? (Y/N) ✓
h. Signatures of persons involved in the chain-of-possession? (Y/N) ✓
i. Inclusive dates of possession? (Y/N) ✓

E. Sample analysis request sheet: NA

1. Does a sample analysis request sheet accompany each sample? (Y/N)

2. Does the request sheet document the following:
   a. Name of person receiving the sample? (Y/N)
   b. Date of sample receipt? (Y/N)
   c. Laboratory sample number (if different than field number)? (Y/N)
   d. Analyses to be performed? (Y/N)

VI. Review of Quality Assurance/Quality Control

A. Is the validity and reliability of the laboratory and field generated data ensured by a QA/QC program? (Y/N) PACE

B. Does the QA/QC program include:

1. Documentation of any deviations from approved procedures? (Y/N) ✓

2. Documentation of analytical results for:
   a. Blanks? (Y/N) ✓
   b. Standards? (Y/N) ✓
   c. Duplicates? (Y/N) ✓
   d. Spiked samples? (Y/N) ✓
   e. Detectable limits for each parameter being analyzed? (Y/N) ✓

C. Are approved statistical methods used? (Y/N) ✓

D. Are QC samples used to correct data? (Y/N) ✓

E. Are all data critically examined to ensure it has been properly calculated and reported? (Y/N) ✓

VII. Surficial Well Inspection and Field Observation

A. Are the wells adequately maintained? Some well pads cracked (Y/N)

B. Are the monitoring wells protected and secure? (Y/N) ✓

C. Do the wells have surveyed casing elevations? (Y/N) ✓

D. Are the ground-water samples turbid? (Y/N) Some

E. Have all physical characteristics of the site been noted in the inspector's field notes (i.e., surface waters, topography, surface features)? (Y/N) ✓

F. Has a site sketch been prepared by the field inspector with a scale, north arrow, location(s) of buildings, location(s) of regulated units, location of monitoring wells, and a rough depiction of the site drainage pattern? (Y/N) ✓

VIII. Conclusions

A. Is the facility currently operating under the correct monitoring program according to the statistical analyses performed by the current operator? (Y/N) ✓

B. Does the ground-water monitoring system, as designed and operated, allow for detection or assessment of any possible ground-water contamination caused by the facility? (Y/N) ✓

C. Does the sampling and analysis procedures permit the owner/operator to detect and, where possible, assess the nature and extent of a release of hazardous constituents to ground water from the monitored hazardous waste management facility? (Y/N) ✓

APPENDIX B
WELL CONSTRUCTION DIAGRAMS/LITHO LOGS

CITY OF STATESVILLE, NC THIRD CREEK MONOFILL
SESD Project No. 03-0129

WELL COMPLETION RECORD

PLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE
ARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRAN
, BOX 2091, RALEIGH, N.C. 27602

AME OF SITE: City of Statesville - Third Creek Landfill

PERMIT NO.:

ADDRESS: Well #1

OWNER (print): Vaughn Brown & Assoc.

DrillingCONTRACTOR: Yadkin Well Co. Inc.

REGISTRATION NO.: 424

Casing Type: PVC dia. 2 in. Grout Depth: from 0 to 56 ft. - dia. 6
Casing Depth: from 0 to 58 ft. - dia. 2 in. Bentonite Seal: from 56 to 57 ft. - dia. 6
Screen Type: 101 Slot dia. 2 in. Sand/Gravel PK: from 57 to 70 ft. - dia. 6
Screen Depth: from 58 to 68 ft. - dia. 2 in. Total Well Depth: from ____ to 70 ft. - dia. 6

Water Level: 43 feet from top of casing Date Measured 6 / 3 6

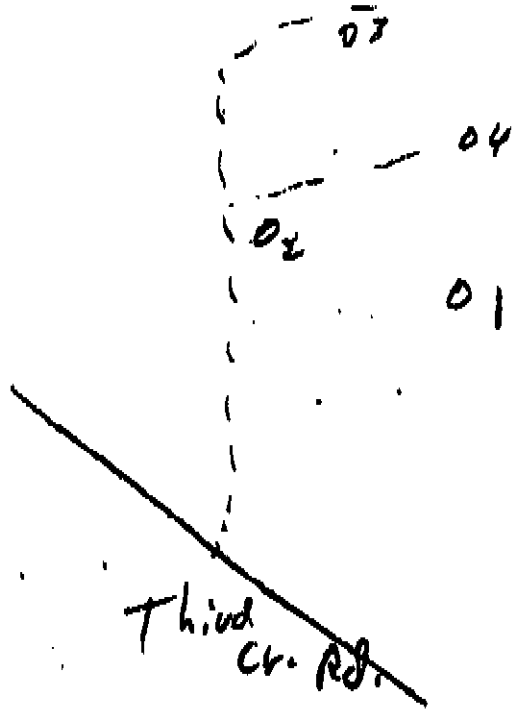
Yield (gpm): ____ Method of Testing: ____ Casing is 1 feet above land

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION

LOCATION SKETCH

(show distance to numbered roads, or other map reference p



REMARKS:

WELL COMPLETION RECORD

IPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE
ARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRA
BOX 2091, RALEIGH, N.C. 27602

NE OF SITE: City of Statesville - Third Creek Landfill

PERMIT NO.:

Well #2

ADDRESS:

OWNER (print):

Drilling CONTRACTOR: Hadkin Well Co. Inc.

REGISTRATION NO.: 474

Casing Type: PVC dia. 2 in. Grout Depth: from 0 to 26 ft. - dia. 6
Casing Depth: from 0 to 28 ft. - dia. 2 in. Bentonite Seal: from 26 to 27 ft. - dia. 6
Screen Type: plastic dia. 2 in. Sand/Gravel PK: from 27 to 40 ft. - dia. 6
Screen Depth: from 28 to 38 ft. - dia. 2 in. Total Well Depth: from ____ to 40 ft. - dia. 6

Water Level: 32 feet from top of casing Date Measured: 6/3/8

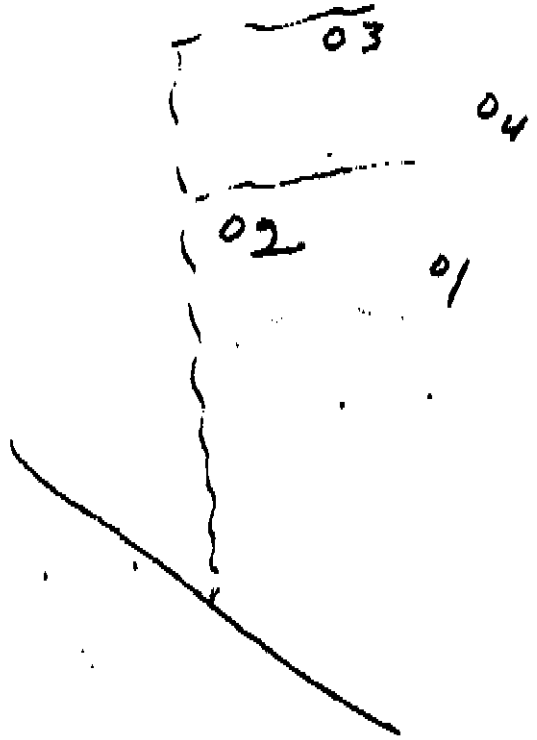
(gpm): ____ Method of Testing: ____ Casing is 2 feet above Lan

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION

LOCATION SKETCH

(show distance to numbered roads, or other map referenc



REMARKS:

WELL COMPLETION RECORD

MPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE
PARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRAN
. BOX 2091, RALEIGH, N.C. 27602

AME OF SITE: City of Statesville - Third Creek Landfill

PERMIT NO.:

ADDRESS: Well # 3

OWNER (print):

Drilling CONTRACTOR: Yadkin Well Co. Inc

REGISTRATION NO.: 474

Casing Type: PVC dia. 2 in. Grout Depth: from 0 to 20 ft. - dia. 6
Casing Depth: from 0 to 22 ft. - dia. 2 in. Bentonite Seal: from 20 to 21 ft. - dia. 6
Screen Type: 010 slot dia. 2 in. Sand/Gravel PK: from 21 to 34 ft. - dia. 6
Screen Depth: from 22 to 32 ft. - dia. 2 in. Total Well Depth: from ____ to 34 ft. - dia. 6

Water Level: 18 feet from top of casing Date Measured 6/17/

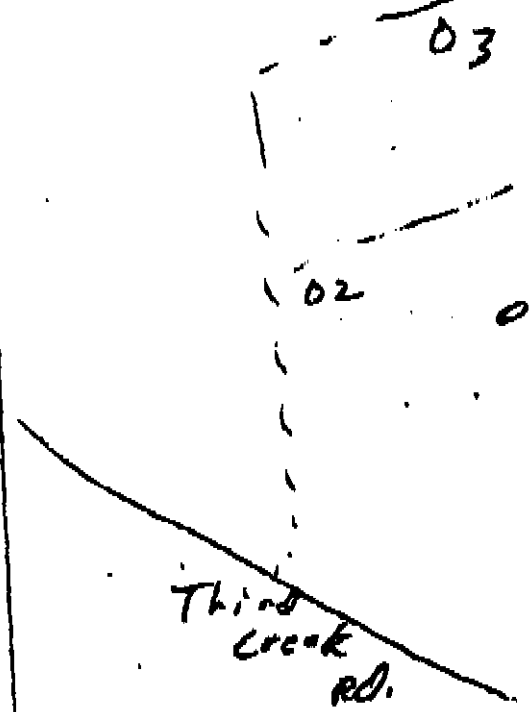
Yield (gpm): ____ Method of Testing: ____ Casing is 1 feet above Land

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION

LOCATION SKETCH

(show distance to numbered roads, or other map reference



REMARKS:

FROM : PHONE NO. : P05

WELL COMPLETION RECORD

MAY 3 1995

MPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N.C. ARTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANCH, OX 2091, RALEIGH, N.C. 27602

ME OF SITE: City of Waterville - Third Creek Landfill	PERMIT NO.:
ADDRESS: Well #4	OWNER (print):
Drilling CONTRACTOR: Hankin Well Co. Inc.	REGISTRATION NO.: 474

Casing Type: PVC dia. 2 in.		Grout Depth:	from 0 to 17 ft. - dia. 6 in.		
Casing Depth: from 0 to 18 ft. - dia. 2 in.		Bentonite Seal:	from 16 to 17 ft. - dia. 6 in.		
Screen Type: 010 Slot dia. 2 in.		Sand/Gravel PK:	from 17 to 30 ft. - dia. 6 in.		
Screen Depth: from 18 to 28 ft. - dia. ___ in.		Total Well Depth:	from ___ to 30 ft. - dia. 6 in.		

Static Water Level: 15 feet from top of casing Date Measured 4/18/92

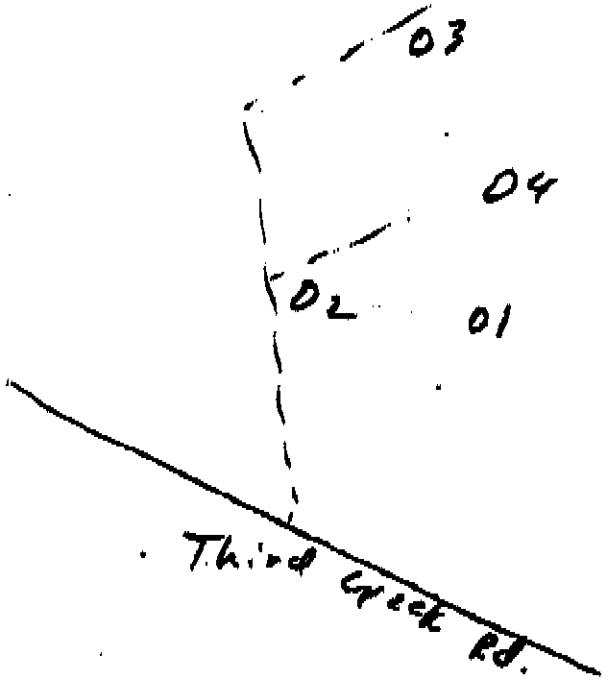
Yield (gpm): ___ Method of Testing: ___ Casing is 1 feet above land surface

DRILLING LOG

DEPTH FROM	TO	FORMATION DESCRIPTION

LOCATION SKETCH

(show distance to numbered roads, or other map reference points)



REMARKS: ___

Boring /Well Construction Log

Well Construction Permit Number NA

Aquaterra, Inc.

I. D. Number	MW-5	Purpose	Monitoring Well
Project Name	City of Statesville, 3rd Creek	Contractor	Geologic Exp.
Project No.	5302100	Registration No.	
Geologist	Susan Kite	Driller	Mark & Kevin
Start Date	04/18/95 Complete Date	Equipment	Mobile B-57, Hollow Stem Augers

Drilling Method	Hollow Stem Augers 4 1/2, 8 1/4 ID/OD
Comments	Just West of Trench C
	GW + 32' in boring below ground surface
	2.5' stick up

Well Construction Information		Depth From - To	Blow Count 6"	6"	6"	6"	Soil / Rock Description / Comments	FID /PID (ppm) @ Depth (ft.)
Borehole Dia.	8.25"	0-2.0					Red-brown silty micaceous clay, moist	
Riser Type	2" PVC	2.0-10					(Residual)	
Diameter	Sched 40	4-5.5	4	6	7		Red-brown silty fine sand, moist	
Screen Type	Sched 40							
Diameter	2" PVC	9-10.5	3	4	5		Tan micaceous silty sand, (saprolite) moist	
Riser interval	2.8-+2.5'							
Screen interval	38-26						Biotite layering, quartz vien	
Slot Size	.010							
Grout Type	Neat Grout	14-15.5	3	4	6		Red-brown clay silty f. sand	
Interval	0-22						micaceous layering (saprolite)	
Bentonite Type	Chips							
Interval	24-22	19-20.5	4	4	6		Red-brown silty sand	
Filter Pack	38-24'						Quartz layer (saprolite) moist	
Interval	1a Sand						micaceous	
Total Depth	38 bgs							
R.P.Elevation		24-25.5	4	5	6		Tan-white silty sand	
Datum							Quartz layer (saprolite) micaceous	
Water Level Information								
Date	W. L. Below R. P.	29-30.5	3	4	5		Same as above	
4/18/95	35.5 TOC							
		36'					Rock-Auger Refusal - Boring Terminated	

R.P. = Reference Point W.L. = Water Level TBM = Temporary Benchmark MSL = Mean Sea Level

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent.

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

DRILLER REGISTRATION NUMBER: 1175

STATE WELL CONSTRUCTION PERMIT NUMBER:

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Statesville County: Iredell
Third Creek Road
(Road, Community, or Subdivision and Lot No.)

2. OWNER City of Statesville Water & Waste Treatment
ADDRESS P.O. Box 1111
(Street or Route No.)
Statesville NC 28677
City or Town State Zip Code

3. DATE DRILLED 4-19-95 USE OF WELL monitor
4. TOTAL DEPTH 36.0 ft
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: _____ FT.
(Use "+" If Above Top of Casing)
8. TOP OF CASING IS 3.0 FT. Above Land Surface*
* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): NA METHOD OF TEST NA
10. WATER ZONES (depth): NA
11. CHLORINATION: Type NA Amount NA

DEPTH From	To	DRILLING LOG Formation Description
0.0'	10.0'	orange clay
10.0'	36.0'	tan black clay with manganese stains

If additional space is needed use back of form

12. CASING:

	Depth		Diameter	Wall Thickness or Weight/Ft.	Material
From 0.0	To 26.0	Ft.	2 inch	Sch.40	PVC
From	To	Ft.			
From	To	Ft.			

13. GROUT:

	Depth		Material	Method
From 0.0	To 22.0	Ft.	Portland Bentonite Slurry	
From	To	Ft.		

14. SCREEN:

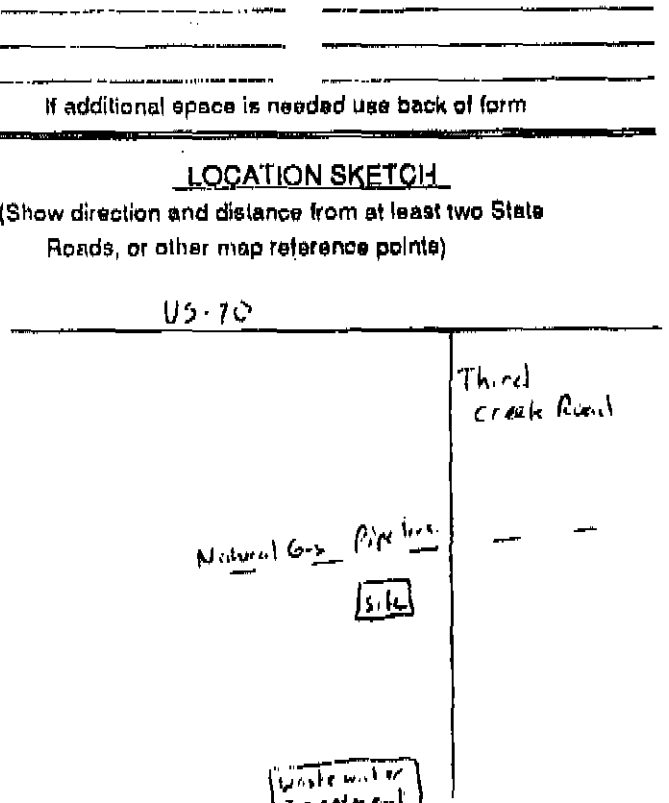
	Depth		Diameter	Slot Size	Material
From 26.0	To 36.0	Ft	2 in.	.010 in.	PVC
From	To	Ft.	in.	in.	
From	To	Ft.	in.	in.	

15. SAND/GRAVEL PACK:

	Depth		Size	Material
From 24.0	To 36.0	Ft.	20-40	Fine Silica sand
From	To	Ft.		

16. REMARKS: MW-5 Bentonite Seal from 22.0 to 24.0 feet

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Steph [signature] 4-26-95
SIGNATURE OF CONTRACTOR OR AGENT DATE

Submit to Division of Environmental Management and copy to well owner.

Boring /Well Construction Log

Well Construction Permit Number NA

Aquaterra, Inc.

I. D. Number	MW-6			Purpose	Monitoring Well
Project Name	City of Statesville, 3rd Creek			Contractor	Geologic Exploration
Project No.	5302100			Registration No.	
Geologist	Susan Kite			Driller	Mark, Kevin
Start Date	04/18/95	Complete Date	04/18/95	Equipment	Mobile B-57, Truck Mount

Drilling Method	Hollow-Stem Augers
Comments	Well located near treeline, +/- south of trench 9/10
	4 1/2 ID, 8 1/4 OD HSA

Well Construction Information		Depth From - To	Blow Count 6"	6"	6"	6"	Soil / Rock Description / Comments	FID /PID (ppm) @ Depth (ft.)
Borehole Dia.	8.25"	0.0-4.5					Red brown silty clay micaceous	
Riser Type	PVC Sched 40	4.0-5.5	2	2	3		Tan & black silty fine sand	
Diameter	2"						(residual)	
Screen Type	2" PVC							
Diameter	Sched 40	9.0-10.5	3	4	5		Red brown highly micaceous	
Riser interval	30 - T						silty fine sand (residual)	
Screen interval	30-40							
Slot Size	.010	14.0-15.5	4	4	5		Tant Black highly micaceous	
Grout Type	Neat Grout						silty fine sand (residual)	
Interval	28-0							
Bentonite Type	Chips	19-20.5	4	5	5		Tan & black sli micaceous	
Interval	28-26						F. Sandy silt (residual) moist	
Filter Pack	Sand						MnOxide present	
Interval	40-28							
Total Depth	40	24-25.5	3	4	5		Tan & black highly micaceous	
R.P.Elevation							Silty f. sand (residual) moist	
Datum								
Water Level Information		29-30.5	3	4	5		Same as above	
Date	W. L. Below R. P.						strongly foliated	
							Boring terminated @ 40.0	

R.P. = Reference Point W.L. = Water Level TBM = Temporary Benchmark MSL = Mean Sea Level

Boring /Well Construction Log

Well Construction Permit Number _____

Aquaterra, Inc.

I. D. Number	MW-7	Purpose	Downgradient Monitoring Well
Project Name	City of Statesville WWTP	Contractor	Geo. Expl.
Project No.	5302100	Registration No.	1105
Geologist	Tom Haynes	Driller	Mark
Start Date	04/19/95 Complete Date	Equipment	Mobile B-57 HSA

Drilling Method	Hollow Stem Auger
Comments	Well located behind Trench H. Bore to 43' and set well.

Well Construction Information		Depth From - To	Blow Count 6"	6"	6"	6"	Soil / Rock Description / Comments	FID / PID (ppm) @ Depth (ft.)
Borehole Dia.	6 1/4" OD	0-3"					Grass Topsoil	
Riser Type	PVC Sched 40	3"-4.5'					Red, brown, micaceous, sandy silt	
Diameter	2"	4.5-6'	3	3	5		Red, brown, micaceous, sandy silt (dry)	
Screen Type	PVC Sched 40							
Diameter	2"	9.5-11'	4	4	4		Orange, brown, tan micaceous silty sand (dry)	
Riser interval	33-0							
Screen interval	43-33'							
Slot Size	0.010"	14.5-16'	4	4	7		Tan, white, micaceous, slightly silty sand. (dry)	
Grout Type	Type I Portland							
Interval	28' to 0'							
Bentonite Type	3/8" Pellets	19.5-21'	3	4	7		Brown, yellow, tan highly micaceous,	
Interval	31 to 28'						slightly sandy silt. (moist)	
Filter Pack	Fine Quartz Sand #1							
Interval	43-31'	24.5-26'	4	4	4		Orange, brown, tan highly micaceous, slightly sandy	
Total Depth	43'						silt. (moist)	
R.P.Elevation								
Datum		29.5-31'	4	4	6		Dark brown, orange, white highly micaceous,	
Water Level Information							slightly sandy silt. (moist)	
Date	W.L. Below R.P.							
		34.5-36'	4	5	6		Orange, brown, tan, white highly, micaceous,	
							sandy silt. (wet) Ground water at 35'.	

R.P. = Reference Point W.L. = Water Level TBM = Temporary Benchmark MSL = Mean Sea Level

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent.

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

DRILLER REGISTRATION NUMBER: 1175

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Statesville County: Iredell
Third Creek Road
(Road, Community, or Subdivision and Lot No.)

2. OWNER City of Statesville Water & Waste Treatment
ADDRESS P.O. Box 1111
(Street or Route No.)
Statesville NC 28677
City or Town State Zip Code

3. DATE DRILLED 4-20-95 USE OF WELL monitor
4. TOTAL DEPTH 43.0 ft
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: _____ FT.
(Use "+" If Above Top of Casing)
8. TOP OF CASING IS 3.0 FT. Above Land Surface*

* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118

9. YIELD (gpm): NA METHOD OF TEST NA
10. WATER ZONES (depth): NA
11. CHLORINATION: Type NA Amount NA

DEPTH From	DEPTH To	DRILLING LOG Formation Description
0.0'	5.0'	tan orange clay
5.0'	10.0'	orange sand
10.0'	15.0'	tan sandy silt
15.0'	43.0'	brown sandy silt

If additional space is needed use back of form

12. CASING:

From	To	Diameter	Wall Thickness or Weight/Ft.	Material
0.0	33.0	2 inch	Sch.40	PVC

13. GROUT:

From	To	Material	Method
0.0	29.0	Portland	Bentonite slurry

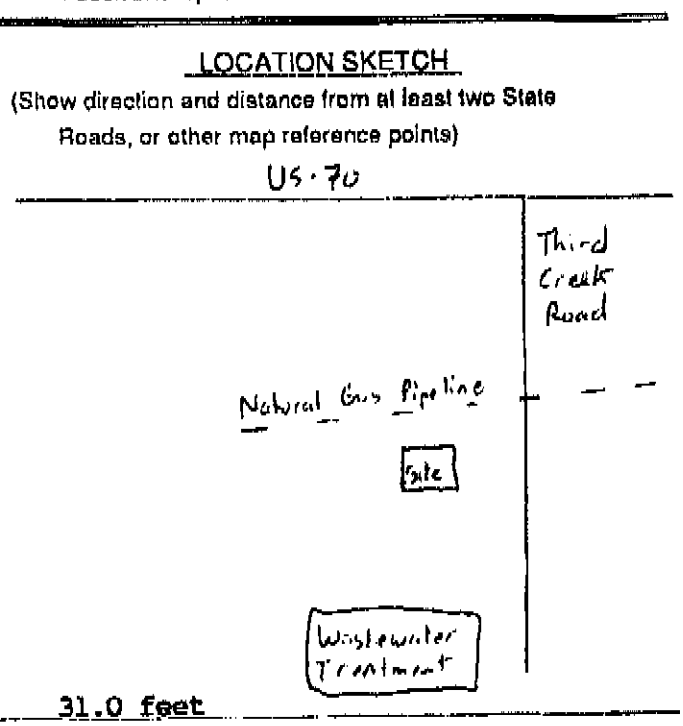
14. SCREEN:

From	To	Diameter	Slot Size	Material
33.0	43.0	2 in.	.010 in.	PVC

15. SAND/GRAVEL PACK:

From	To	Size	Material
31.0	43.0	20-40	Fine Silica Sand

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)



16. REMARKS: MW-7 Bentonite seal from 29.0 to 31.0 feet

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Stephen [signature] 4-26-95
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 (REV. 8/7/ Submit to Division of Environmental Management and copy to well owner

Boring /Well Construction Log

Well Construction Permit Number _____

Aquaterra, Inc.

I. D. Number	MW-8	Purpose	Upgradient Monitoring Well
Project Name	City of Statesville WWTP	Contractor	Geo. Expl.
Project No.	5302100	Registration No.	1105
Geologist	Tom Haynes	Driller	Mike McConahey
Start Date	04/18/95 Complete Date 04/18/95	Equipment	Mobile B-61 HSA

Drilling Method	HSA
Comments	Boring terminated @50'.

Well Construction Information		Depth From - To	Blow Count 6"	6"	6"	6"	Soil / Rock Description / Comments	FID / PID (ppm) @ Depth (ft.)
Borehole Dia.	8 1/2 O.D	0-4.5					0-3" Grass/topsoil	
Riser Type	PVC Sched 40						3"-4.5' - Red brown slightly micaceous	
Diameter	2"						sandy silt w/trace clay.	
Screen Type	PVC Sched 40	4.5-6'	5	5	7		Orange, tan, brown slightly micaceous	
Diameter	2"						sandy silt (damp)	
Riser interval	40-0							
Screen interval	50-40'	9.5-11'	6	5	5		Yellow, brown, tan, slighty micaceous	
Slot Size	0.010						silty sand. (damp)	
Grout Type	Type I Portland							
Interval	36'-0'	14.5-16'	5	6	7		Yellow, tan, brown micaceous fine	
Bentonite Type	3/8" Pellets						silty sand. (Damp)	
Interval	38-36'							
Filter Pack	Fine #1 Quartz sand	19.5-21'	5	9	12		Tan, brown, yellow, silty fine sand.	
Interval	50-38'						(damp). Highly weathered rock.	
Total Depth	50'							
R.P.Elevation		24.5-26'	9	13	17		Tan, brown, yellow, silty course grain sand	
Datum							w/quartz pieces interspersed. (damp)	
Water Level Information							Highly weathered rock.	
Date	W. L. Below R. P.	29.5-31'	10	12	15		Brown, tan, yellow, micaceous, silty coarse	
							grain sand. Highly weathered rock. (damp)	

R.P. = Reference Point W.L. = Water Level TBM = Temporary Benchmark MSL = Mean Sea Level

Boring /Well Construction Log

Well Construction Permit Number _____

Aquaterra, Inc.

I. D. Number	MW-8	Purpose	Upgradient Monitoring Well
Project Name	City of Statesville WWTP	Contractor	Geo. Expl.
Project No.	5302100	Registration No.	1105
Geologist	Tom Haynes	Driller	Mike McConahey
Start Date	04/18/95 Complete Date 04/18/95	Equipment	Mobile B-61 HSA

Drilling Method	HSA
Comments	33' very hard material

Well Construction Information	Depth From - To	Blow Count 6"	6"	6"	6"	Soil / Rock Description / Comments	FID / PID (ppm) @ Depth (ft.)
Borehole Dia.	34.5-36'	12	19	25		Brown, tan, black, yellow highly micaceous,	
Riser Type						slightly silty sand. Weathered rock (damp)	
Diameter							
Screen Type							
Diameter	39.5-41'	7	9	12		39.5-40.0 = Brown, tan, black highly micaceous silt	
Riser interval						sand. Weathered rock. 40.0' = yellow tan slightly	
Screen interval						micaceous, slightly silty fine sand. Very moist	
Slot Size						Groundwater @40.5'	
Grout Type							
Interval							
Bentonite Type						Terminate S.Spn sampling at this point due to 2	
Interval						location of ground water, however advance boring to	
Filter Pack						50' for monitoring well completion.	
Interval							
Total Depth							
R.P.Elevation							
Datum							
Water Level Information							
Date	W. L. Below R. P.						

R.P. = Reference Point W.L. = Water Level TBM = Temporary Benchmark MSL = Mean Sea Level

APPENDIX C
SUMMARY OF WELL CONSTRUCTION DETAILS

CITY OF STATESVILLE, NC THIRD CREEK MONOFILL
SESD Project No. 03-0129

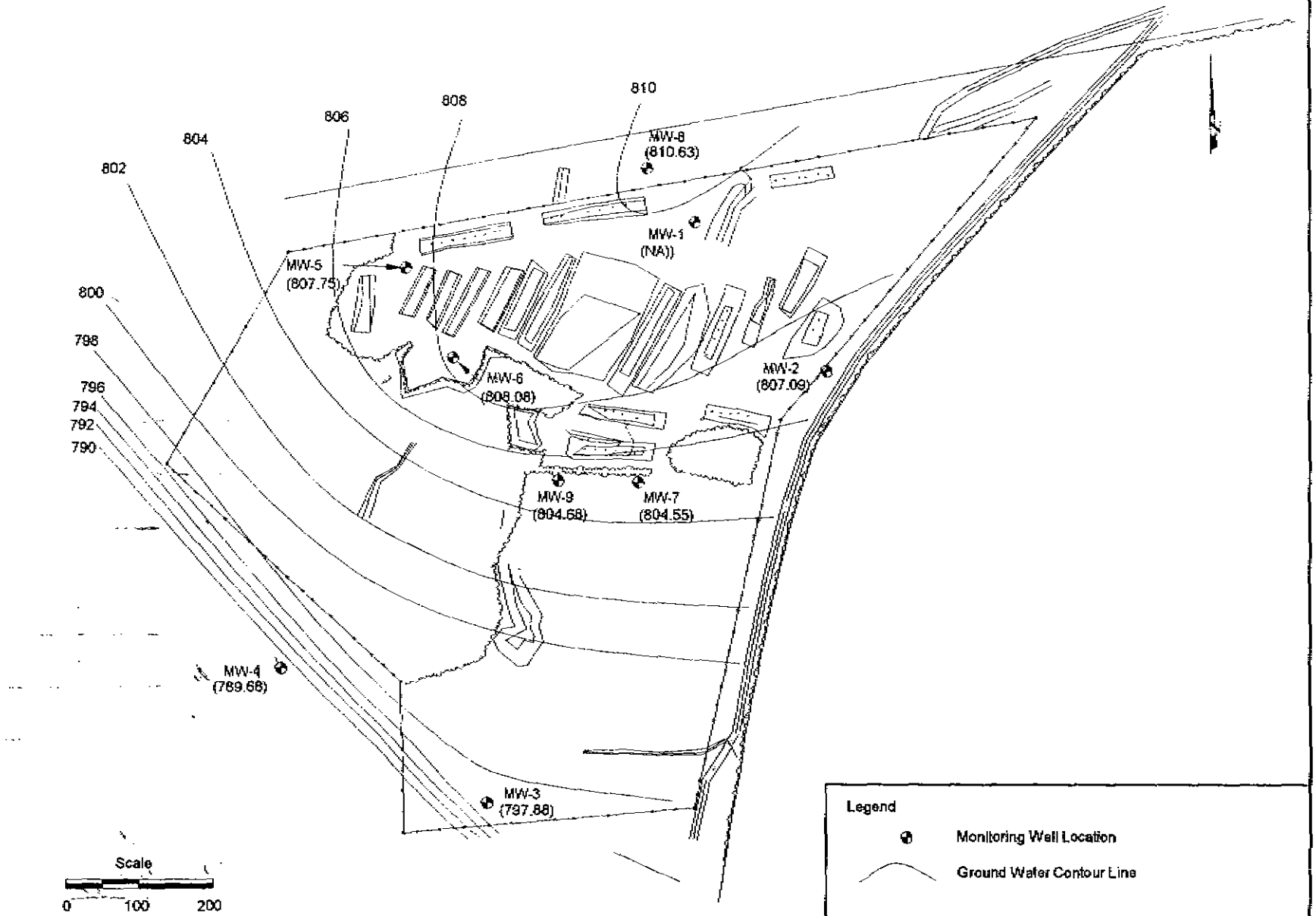
TABLE 1
MONITORING WELL CONSTRUCTION DETAILS
CITY OF STATESVILLE, NC THIRD CREEK MONOFILL

Well Number	Total Well Depth (in ft bgs)	Top of Csg (relative to msl)	Screen Interval (in ft bgs)	Diameter/ Csg/Screen Material	Bentonite Interval (in ft bgs)	Filter Sand/ Gravel Pack (in ft bgs)	Date Drilled
MW-1*	70	860.08	58-68	2 inch PVC	56-57	57-70	6/87
MW-2	40	847.94	28-38	2 inch PVC	26-27	27-40	6/87
MW-3	34	823.85	22-32	2 inch PVC	20-21	21-34	6/87
MW-4	30	814.68	18-28	2 inch PVC	16-17	17-30	6/87
MW-5	36	847.16	26-36	2 inch PVC	22-24	24-36	4/95
MW-6	40	850.21	30-40	2 inch PVC	26-28	28-40	4/95
MW-7	43	847.70	33-43	2 inch PVC	28-31	31-43	4/95
MW-8	50	861.44	40-50	2 inch PVC	36-38	38-50	4/95
MW-9	43.5	846.48	28.5-43.5	2 inch PVC	21-26	26-43.5	8/98

* = this well was abandoned 11/00
bgs = below ground surface
csg = casing
msl = mean sea level

APPENDIX D
RECENT POTENTIOMETRIC MAPS

CITY OF STATESVILLE, NC THIRD CREEK MONOFILL
SESD Project No. 03-0129

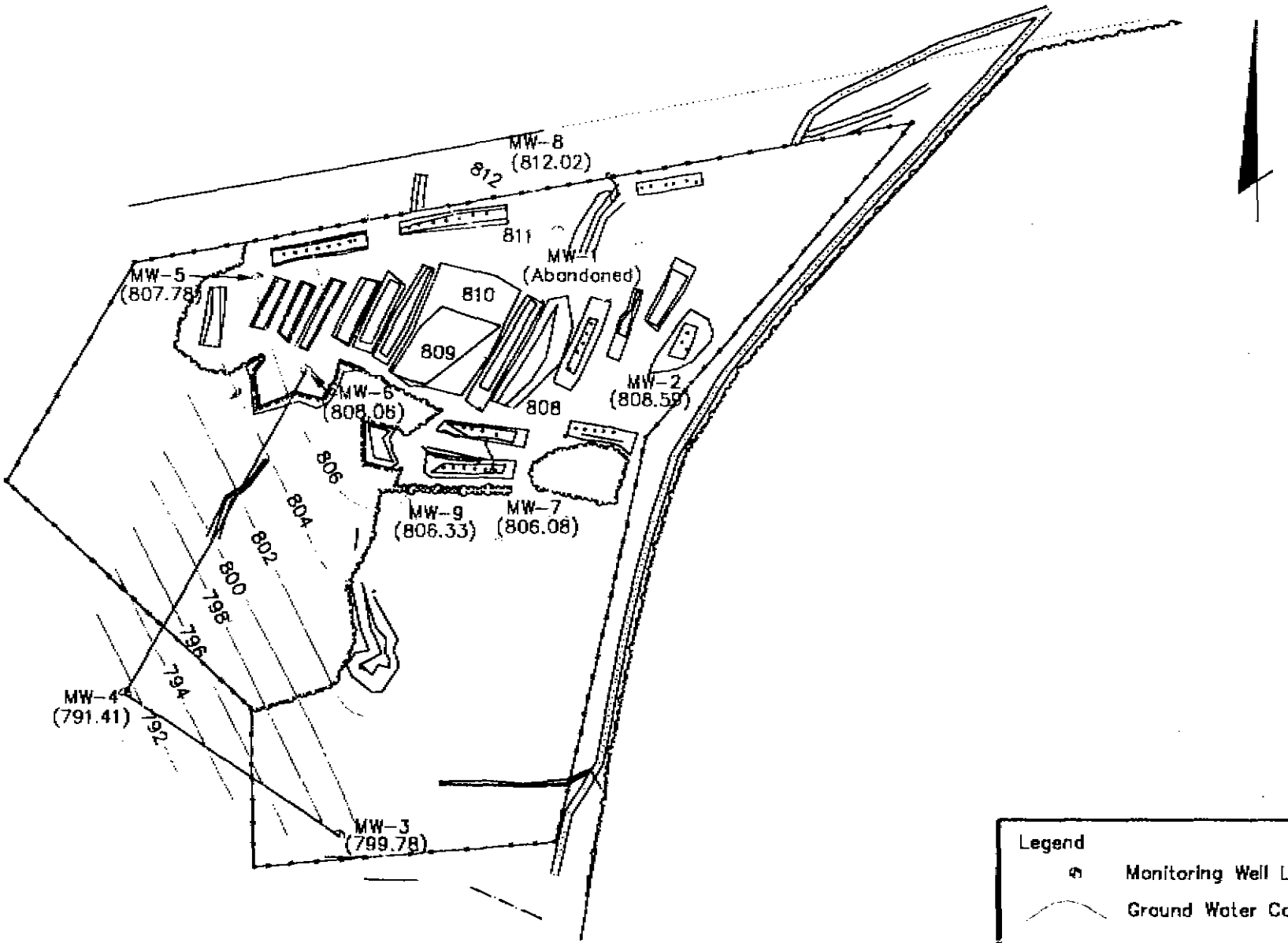


Legend

Monitoring Well Location

Ground Water Contour Line

Waters Edge Environmental, LLC	Author	Drawing	Layers	Date	Title
	JLP	G1-01	0,1,16	3-28-95	Ground Water Contour Map (December 13, 2001 Data)
	Job No.	Revision	Figure	Scale	Project
	G1-01	1-24-02	3	1" = 200'	Third Creek Monofill Facility Statesville, North Carolina



Legend

Monitoring Well Location

Ground Water Contour Line

	Author	Drawing	Layers	Date	Title
	mbb	G1-01	0	6-19-90	Ground Water Contour Map (Data Collected December 19, 2000)
	Job No.	Revision	Figure	Scale	Project
	G1-01	02-02-01	3	1"=200'	Third Creek Monofill Facility Statesville, North Carolina