DSWM
NEAC

SNL 221020065

CLOSURE/POST CLOSURE PLAN

DICKSON COUNTY LANDFILL/BALEFILL DICKSON COUNTY, TENNESSEE

June, 1996
Revised February, 1997

Prepared by

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File Number 143-11

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DICKSON COUNTY LANDFILL/BALEFILL
DICKSON COUNTY , TENNESSEE

1. INTRODUCTION

1.1. FACILITY DESCRIPTION

The landfill/balefill (Landfill) owned and operated by Dickson County has registration number SNL 22-102-0065 EXT (1988). It is located immediately west and adjacent to a closed landfill that was operated and is still owned by Dickson County. The entire landfill site includes 85 to 95 acres. The current landfill operations are located on the western part of the site, and include a Class I Balefill and a Class IV Landfill. Figure 1-1 presents the location of the site on the U.S.G.S. 7.5 minute Dickson, Tennessee quadrangle map.

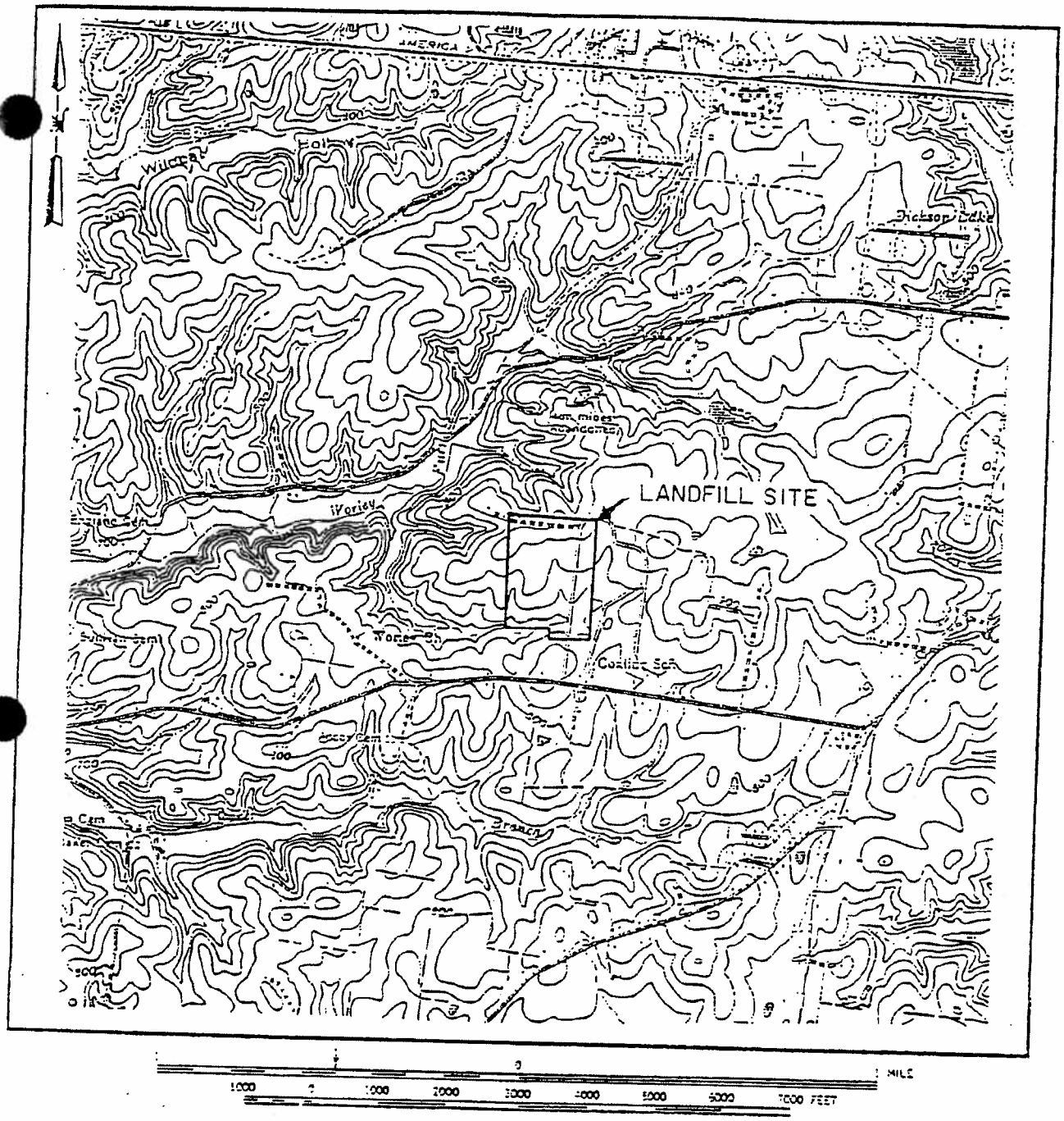
The site was originally opened in the 1960's and operated as the city dump for the City of Dickson, until the site was sold to Dickson County in 1971. Part of the site was permitted as a sanitary landfill in 1980 and extension areas were permitted in 1988 and 1990. The latest set of engineering plans for the site were submitted in 1992 to meet the revised DSWM regulations. According to the plans, the current Class I Balefill operation occupies approximately 14 acres and the Class IV Landfill occupies approximately 2.3 acres. The portion of the landfill to the east of the current area was closed prior to March, 1990 and is not subject to the Closure/Post Closure requirements.

The site is located on Eno Road approximately 1.5 miles southwest of Dickson, Tennessee.

A copy of the operating permit is shown in Appendix E

1.2. OPERATIONAL HISTORY

The United States Environmental Protection Agency (EPA) conducted an investigation of the eastern portion of the site in response to a report that there was a possibility of a release or threat of a release of hazardous substances from the site into the surrounding environment. The purpose of the investigation was to determine the nature and extent of contamination at the site and to determine what, if any, further response action would be appropriate. The investigation included the collection and analyses of surface and subsurface soil samples, groundwater, surface water, sediment, and air monitoring. The on-site field work was conducted early in 1991. The landfill manager at the time, Mr. Virgil Bellar, stated to Mr. Bill Griggs of Griggs & Maloney, Inc., that the EPA representatives called him in the fall of 1991 and informed him by telephone that the investigation had revealed no contamination and the investigation was concluded.



U.S.G.S.
7.5 Minute Series (Topographic)
Dickson Quadrangle

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FIGURE 1-1
Site Location / Topographic Map

Dickson County Landfill
Dickson County, Tennessee

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Sullivan Spring is located off-site to the northwest of the site. It was being used as a groundwater monitoring well when the samples taken on July 27, 1994 revealed the presence of cis 1,2 Dichloroethene; Trichloroethene; and 1,2 Dichloroethene in Sullivan Spring. This led to a Groundwater Quality Assessment Plan being developed and approved by the DSWM. As part of the assessment, additional shallow and deep rock groundwater monitoring wells were installed and sampled. A determination of the groundwater flow revealed that the shallow groundwater in the area is flowing to the southwest and the deep rock groundwater is flowing to the west northwest. The results are still being reviewed by the DSWM. A sampling event on July 25-26, 1995 revealed no parameters above regulatory limits.

According to records on file at the Division of Solid Waste Management (DSWM), the original permit was issued in 1972 with an extension permitted in 1988. In 1990 the permit was modified to allow the site to operate as a balefill. An air curtain destructor was later permitted by rule and is still operational. It is used to reduce combustible wastes.

A review of the site's inspection records at the DSWM Field Office reveals a history of operational deficiencies and violations. These deficiencies and violations have generally involved litter, leachate breakouts, erosion, inadequate run-on/run-off control, pooling water, inadequate cover, and inadequate cover stabilization. The county was the object of a Commissioner's order issued on January 19, 1995.

1.3. EXPECTED YEAR OF CLOSURE

If the baler and balefill continued in operation with a waste stream volume similar to the last few years, the site will have approximately 15 years of life remaining which gives a projected date of closure of 2011. However, the County has recently contracted with a commercial landfill for disposal of Class I wastes and has decided to partially close the Dickson County Landfill and temporarily suspend Class I operations. Operation of the Class I landfill was suspended in October, 1996. The County will keep their landfill permit active to provide as many future disposal options as possible. The County is contracting with an outside landfill for disposal of Class I solid waste and will continue to operate the Class IV site.

1.4. FACILITY CONTACT PERSON

The primary contact for landfill operations is:

Mr. Jim Lunn
Solid Waste Manager
100 Virgil Bellar Drive
Dickson, Tennessee 37055
(615) 446-0019
fax (615)446-3407

The owner of the landfill is Dickson County. The County Executive is:

Mr. William Field
Dickson County Executive
P.O. Box 220
Charlotte, Tennessee
(615) 789-4171

2. FACILITY CLOSURE

2.1. PARTIAL CLOSURE

Dickson County desires to contract with an outside landfill for disposal of Class I solid waste and keep its permit active. The portion of the landfill that has received Class I solid waste after 1990 will receive a final cover/cap in compliance with current Tennessee Regulations.

2.2. COVER

2.2.1. Placement of Final Cover

A. Pre March, 1990 Area

The portion of the landfill east of the large north-south drainage ditch did not receive solid waste after March of 1990, according to Dickson County representatives. This area has already been closed. However, erosion has occured in certain areas and other areas have settled casuing ponding, which is probably contributed to leachate production. As part of this partial closure the ponding areas of the pre-1990 area will be filled in to prevent ponding and the erosion areas will be repaired. A vegetative cover will be established on the repaired areas. Maintenance for 30 years of the pre-March, 1990 will be included in the maintennace activities of the post March, 1990 area.

B. Post March, 1990 Area

The portion of the landfill west of the large north-south drainage ditch did receive solid waste after March, 1990 and will be closed in accordance with this Closure/Post Closure Plan. In addition, the banks of the large north-south drainage ditch will be sloped back to make them more stable.

2.2.2. Documentation

To ensure that the final cover and grade comply with this closure/post-closure plan. The following procedure will be followed:

A Quality Assurance Contractor (QAC) and a Quality Assurance Officer (QAO) will be designated by the owner.

A. *Quality Assurance Contractor (QAC)*

The QAC will be a firm capable of conducting the soil and laboratory tests necessary to ensure that the final cover complies with this closure/post-closure plan. Such tests may include:

- Core samples to determine the depth and consistency of the final cap and/or borrow material.
- Visual-manual classification of soils (ASTM D 2488-84)
- Shelby tube samples
- Standard Proctor Tests (ASTM D 698)
- Atterberg Limits (ASTM D 4318)
- Permeability tests on re-compacted soil samples (ASTM D 5084)
- Moisture density tests (ASTM D 698)

B. *Quality Assurance Officer (QAO)*

The Quality Assurance Officer shall be selected by Dickson County. He shall be a professional engineer licensed to practice in the state of Tennessee and shall be independent the of the owner or the QAC. In addition, the QAO or his designee shall:

- have knowledge of the closure/post-closure plans and specifications.
- have the responsibility to inform the landfill owner and the contractor of any deficiencies in the construction that do not meet the design specifications of the closure/post-closure plan.
- inspect the site at an appropriate frequency and review all test data and QA monitoring logs.
- respond promptly to any inquiries in order to expedite the landfill closure.
- be responsible for the certification of the closure. Certification shall be based on conformance to the plan specifications and sound engineering judgment.
- visit the site, as required, to monitor all appropriate construction operations. Shall oversee all sampling and field testing mandated in the plans as may be required.
- complete a site visit report for each site visit and submit it to the owner.
- immediately report to the owner any construction or material that does not conform to the closure plan.

2.2.3. Procedure

A. Survey Monuments

Monuments that establish horizontal and vertical control shall be founded by a professional surveyor licensed in the state of Tennessee. These monuments shall be at an appropriate number and location in order to facilitate surveying during the landfill construction and operation. These monuments shall also be located and protected so they will not be destroyed during the closure activities. Each monument will be labeled on-site and located on a reproducible site plan. The QA Officer shall approve the monument locations.

B. Construction of Final Cover, Post 1990 Area

1. Before placement and compaction of any additional cover material, the existing surface shall be inspected and approved by the QA Officer or his designee.
2. The site shall be kept free of standing water during construction.
3. Place a 30 mil geomembrane liner over the areas that received solid waste after March, 1990.
4. Place 12 inches of compacted soil over the geomembrane. Place soil in two lifts of 6 inches each, compacted to a dry density of at least 85% of the maximum dry density.
5. Over the compacted soil, place 12 inches of top soil capable of supporting vegetation. Place topsoil in two lifts of 6 inches each, compacted to a dry density of at least 70% of the maximum dry density.
6. The soil and topsoil will be tested in accordance with parameters 1, 2, 3, and 4 in Table 2-2.
7. If the compacted soil is not acceptable, the QA Officer shall direct additional tests, if necessary, to locate the extent of the area that needs to be re-compacted. After corrective actions are taken, the QA Officer shall direct additional tests to determine if the area is suitable.
8. The QA Officer shall verify that the thickness and density of the soil comply with the construction plans. Any core holes shall be completely plugged with compacted soil. Any disturbance to the surface shall be smoothed.
9. The QA Officer shall approve the construction in writing. The approval shall be accompanied by a report with record drawings, and a summary of the site testing results.

10. Soil thickness shall be a minimum of 12 inches, top soil cover thickness shall be a minimum of 12 inches.

Table 2-2
Liner and Cap Quality Assurance Tests

Parameter	Test Method	Testing Frequency
1. Water Content (Note 1)	ASTM D3017 Nuclear Density or ASTM D4643 microwave	5 per acre per lift (Note 2)
2. Water Content (Note 3)	ASTM D2216 Oven Dry	1 per acre per lift (Note 3)
3. Density (Note 4)	ASTM D2922 Nuclear Density	5 per acre per lift (Note 2)
4. Density (Note 5)	ASTM D1556	1 per acre per lift (Note 5)
5. Permeability (Note 6)	ASTM D5084	1 per three acres or 1 per soil change
6. Permeability (Note 7)	Sealed Double Ring Infiltrometer	1 per test pad
7. Permeability (Note 8)	Two Stage Boutwell Permeameter	1 per 3 acres per lift or 1 per soil change
Number of Passes	Visual Observation	1 per acre per lift (Note 2)
Construction Oversight	Visual Observation	Continuous

Notes:

1. *ASTM D3017 is a nuclear method and ASTM D 4643 is microwave oven drying method.*
2. *In addition, at least one test should be performed each day soil is compacted and additional tests should be performed in areas for which CQA personnel have reason to suspect received inadequate compaction.*
3. *Every fifth sample tested with ASTM D3017 or D4643 should also be tested by direct oven drying (ASTM D2216) to aid in identifying any significant, systematic calibration errors with ASTM D3017 or D4643.*
4. *ASTM D2922 is a nuclear method.*
5. *The sand cone method (ASTM D1556) is required in the event that the liner or cap is to be constructed with soils having more than 20% retained on a number 4 sieve.*
6. *ASTM D5084 is a laboratory permeability test that is to be performed on Shelby Tube samples taken from the constructed liner or cap. This test is NOT acceptable for soils with more than 20% retained on a number 4 sieve.*
7. *The sealed double ring Infiltrometer test is a field test which is to be performed prior to construction of the cap or liner where soils have more than 20% retained on the number 4 sieve.*
8. *The Two Stage Boutwell Permeameter is a field permeability test that may be used during construction of the landfill caps or liners that have more than 20% retained on the number four sieve*

11. Site activities shall be coordinated to minimize the time between the completion of the geomembrane and the placement of the topsoil cover, including the seeding and mulching. Any cracks, holes, or ponding in the final cover shall be filled and compacted with soil.

12. Final elevations will be as shown on the plan ±1 foot. If the landfill is partially closed, the final elevations will be as shown on the plan ± 1 foot or a lower elevation than shown on the plan.

13. No ponding will be permitted on the site.

C. Alternative cover of post 1990 area, compacted soil/bentonite mixture

1. As an alternative, the geomembrane and the 12 inches of compacted soil maybe replaced by 12 inches of a soil/bentonite mixture, overlaid by 12 inches of top soil.

2. The soil/bentonite mixture will have a maximum permeability of 1 x 10^{-7} cm/sec. and will be tested in accordance with parameters 1 through 7 on Table 2-2.

D. Alternative cover pf post 1990 area, clay impregnated material

1. As an alternative, the geomembrane may be replaced by a clay impregnated material, overlaid by 12 inches of compacted soil and 12 inches of top soil.

2. The clay impregnated material will have a maximum permeability of 1 x 10^{-7} cm/sec. and will be tested in accordance with paramters 1, 2, 3, and 4 of Table 2-2.

E. Construction of pre-1990 area

1. A final cap has been placed on the area in use before 1990. However, areas are ponding and erosion is taking place in some areas. The ponding areas will be filled in with compacted soil. The repaired ponding areas and "bald" spots will be reseeded and mulched. The eroded areas will be repaired also.

2.2.4. Drainage System

The existing site drainage consists of a series of open drains. There is one sediment pond serving the site which will remain after closure. The calculations to verify the size and capacity of this pond are contained in the Appendix.

2.2.5. Vegetative Cover

Area topsoil will be used in the top 12 inches of the final cover. After the topsoil has been placed, compacted, and graded to conform to the plans, seeding will begin and a vegetative cover of grasses will be established as soon as practical.

A. Permanent Seeding Mixture
The permanent vegetation cover will consist of the following:

PLANTING PERIOD	SEED MIXTURE
March 15 - May 15	Kentucky 31 Fescue at 120 pounds per acre or Bermudagrass at 80 pounds per acre
May 15 - August 15	Mixture of Bermudagrass at 80 pounds per acre and Korean Lespedeza at 20 pounds per acre
August 15 - October 15	Mixture of Kentucky Fescue at 120 pounds per acre and White Clover at 30 pounds per acre

B. Temporary seeding mixture
The temporary vegetative cover will consist of the following:

Mixture of Annual Ryegrass at 160 pounds per acre and White Clover at 20 pounds per acre

If a temporary seeding mixture is planted, the permanent seeding mixture will be planted during the appropriate season also.

2.2.6. Agricultural Limestone

Agricultural limestone will be applied and incorporated into the top 4" of the topsoil by use of a disk.

Agricultural limestone will be applied at the rate of 3 tons per acre. The limestone will be incorporated into the soil with a disk so that the limestone is incorporated within the top 4 inches of the seed bed.

2.2.7. Fertilizers

Commercial fertilizers will be applied simultaneously with the application of grass seed. This will be done to ensure that the grass will receive proper nutrients for a healthy vegetative cover. Unless otherwise specified, a commercial fertilizer consisting of 10-20-10 nitrogen, phosphoric acid, and potash will be used for seeding.

2.2.8. Mulch

A mulch cover of either hay or straw will also be applied to the grasses to insure a good vegetation cover. It will be air dried and reasonably free from weed seeds and other plant growth detrimental to a vegetative cover. The mulch will be of suitable dryness to be applied with air blower machinery after seeding.

2.2.9. Application of Grass Seed

Scarify, disc, harrow, rake, or otherwise work each area to be seeded until it has been loosened and pulverized to a suitable depth.

Uniformly incorporate fertilizer into the soil for a depth of approximately half an inch at the rate of not less than 800 lb. per acre.

Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water an applied with power sprayer equipment.

Sow seed of the specified group dependent on the time of year and as soon as preparation of the seedbed has been completed.

The seed will be uniformly applied by means of a rotary seeder, hydraulic equipment, or other satisfactory means unless otherwise specified.

Seed will not be applied during windy weather or when the ground surface is frozen, wet, or otherwise un-tillable.

The hay or straw mulch will be spread evenly over the seeded area at an approximate rate of 2 tons per acre immediately following the seeding operations. This rate may be varied depending on the texture and conditions of the mulch material and the characteristics of the area seeded.

2.2.10. Leachate Collection

Leachate has proven to be a problem in the past. Construction of a final cap/cover should reduce the generation of leachate but the leachate presently contained in the cells must be removed. The plans show the location of leachate withdrawal wells. These have proven effective in the past at this landfill.

Leachate disposal will be accomplished by recircluation, spray irrigation, on-site treatment including wetlands, or transport to a treatment facility.

The county is currently investigating disposal options. The chosen option will be coordinated with the DSWM and no disposal option will be initiated without the approval of the DSWM. At this landfill, past practices have proved that the leachate is drawn down via the collection wells and prevents leachate breakouts. The leachate has been pumped directly into transport trailers or directly into the wetlands area. Past practices has revealed that separate tanks for leachate storage is not necessary. The leachate collection and removal system will be maintained as necessary to prevent threats to human health or the environment.

2.2.11. Gas Collection

The pre-March, 1990 area has been inactive for several years. No gas vents will be installed in the pre-March, 1990 area.

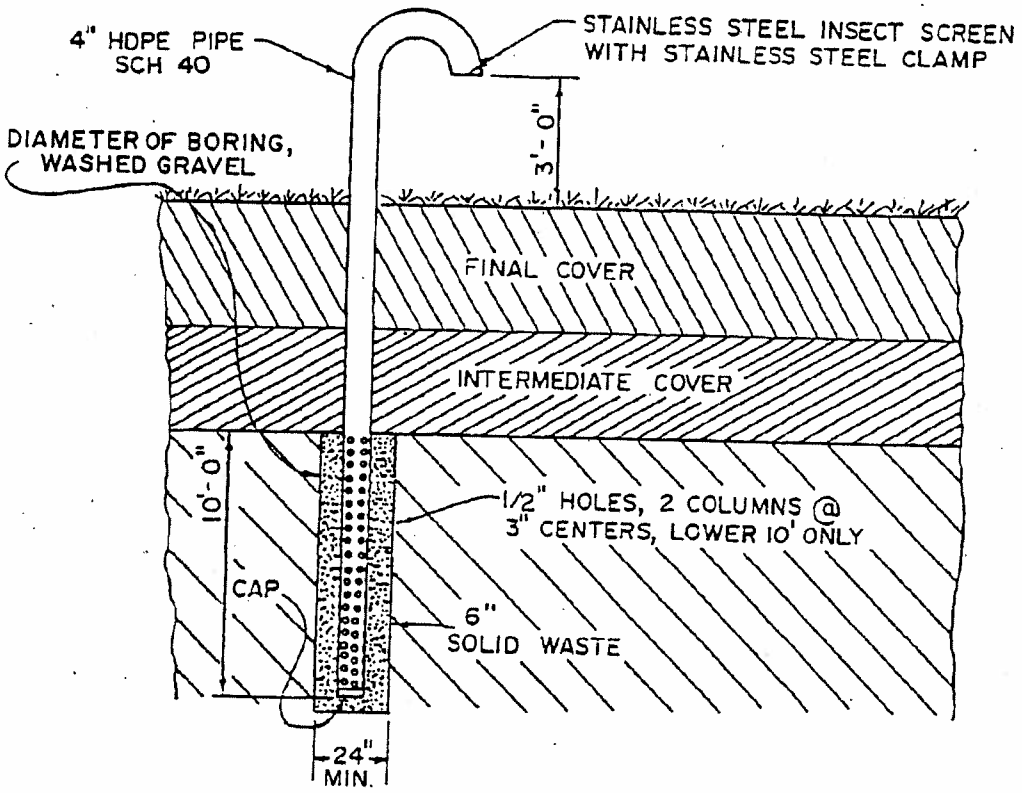
The post March, 1990 area will receive gas vents at the locations shown on the plans. It is possible (and likely) that additional gas vents will need to be added the first year after the final cap/cover is installed. Localized gas pockets may develop under the final cap/cover causing bubbles and/or cracks. If these indicators develop, additional gas vents will be added at these locations and the final cap/cover repaired.

A typical gas vent is shown on the following page.

2.2.12. Sediment Pond

The existing sediment pond has a surface area of 23,000 square feet and a volume of 3.06 acre feet. It needs to be enlarged to a surface area of 92,000 square feet and a volume of 11.8 acre feet. See Appendix H for sediment pond calculations. The pond is too small. It is in a location that would make expansion difficult As part of the partial closure, the sediment pond will be cleaned of sediment and the discharge piping repaired to mazimize the effect of the pond. See Figure in Appendix I.

CLOSURE/POST CLOSURE PLAN
DICKSON COUNTY CLASS I LANDFILL
DICKSON COUNTY, TENNESSEE



NOTE: PLACE 3 STEEL POST AROUND EXPOSED PIPE, PAINT FENCE POST YELLOW, PLUS ONE MARKER POST.

GAS VENT IN SOIL LINER

N.T.S.

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2.2.13. Closure Scheduling

A. It is anticipated that the partial closure of the landfill will proceed as follows:

Tasks	Months
1. Submit Closure/Post-Closure Plan to the Commissioner	0
2. Review of Plan by Commissioner	2
3. Modifications to plan and resubmission	1
4. Review and approval by Commissioner; Commissioner establish amount of financial assurance required	1
5. Owner provide financial assurance	1
6. Owner to let partial closure construction bids, select quality control officer	1
7. Review bids and award contract	1
8. Construction	4
Total	**11**

B. If the Class I Landfill is utilized until it reaches capacity, it is anticipated that the closure of the Class I Landfill will proceed as follows:

Tasks	Months
1. Submit Closure/Post-Closure Plan to the Commissioner	0
2. Review of Plan by Commissioner	2
3. Modifications to plan and resubmission	1
4. Review and approval by Commissioner; Commissioner establish amount of financial assurance required	1
5. Owner provide financial assurance	1
6. Complete operation of the landfill	180
7. Owner to let closure construction bids, select quality control officer	1
8. Review bids and award contract	1
9. Construction	3
Total	**190**

C. The operator will notify the Director of the DSWM of his intent to close at least 60 days prior to the date be expects to begin final closure or partial closure of the disposal facility or disposal facility parcel. The operator will complete closure activities including grading and establishing vegetative cover in the shortest practicable time, not to exceed 180 days, after any fill areas or any portion of the fill area has achieved final grade. The operator will notify the Director of the DSWM in writing of his completion of closure of the disposal facility or disposal facility parcel. Such notification will include a certification by the operator that the disposal facility or disposal facility parcel has been closed in accordance with the approved closure care plan. Within 21 days of the receipt of such notice, DSWM will inspect the facility to verify that closure has been completed in accordance with the approved plan. Within 10 days of such verification, the Commissioner will approve the closure in writing to the operator or inform the operator of any deficiencies. Closure shall not be considered final and complete until approval has been made.

2.2.14. Notice in Deed to Property

The operator will ensure that within 90 days of completion of final closure of the facility and prior to sale or lease of the property on which the facility is located, there is recorded in accordance to State law a notation on the deed to the property or on some other instrument which is normally examined during title search that will in perpetuity notify any person conducting a title search that the land has been used as a Class I Landfill.

3. GROUNDWATER MONITORING PLAN

3.1. GENERAL

There are eight existing groundwater monitoring wells at the Dickson County Landfill. Several of these wells were installed as part of the groundwater assessment. Monitoring well 1 is upgradient of both the shallow groundwater flow and the deep rock groundwater flow. Monitoring wells 2 and 4 are down gradient from the shallow groundwater flow. Monitoring wells 6 and 8 are downgradient of the deep rock groundwater flow.

Therefore, the groundwater monitoring plan will include the semiannual monitoring of wells 1, 2, 4, and 8 for the indicator parameters shown on Table 3-2. Additional wells will be sampled if directed by the Division of Solid Waste Management.

3.2. COMPLIANCE BOUNDARY

The compliance boundary shall be the waste management boundary of the facility which is the boundary of the property as shown in the plans.

3.3. FILL AREA TOPOGRAPHY

The plans show the existing contours and site topography as well as the proposed (closed) final contours and fill area of the landfill if the landfill is closed when it reaches capacity. If the landfill is partially closed, the contours will be equal in elevation or lower in elevation to those on the plans.

3.4. LOCATION OF THE MONITORING WELLS

See Figure 3-1 for the location of the existing groundwater monitoring wells.

3.5. GROUNDWATER FLOW

Appendix F contains the groundwater flow map for the site. The location of the existing groundwater monitoring wells are also shown.

3.6. SURFACE WATER MONITORING

There are no surface streams on site. There will be no surface water monitoring for this site.

3.7. GROUNDWATER MONITORING WELL PHYSICAL DATA

Table 3-1 presents the following information for the four groundwater monitoring wells;

a. well number or other distinguishing designation

b. survey coordinates

c. elevation for the top of the casing

d. ground surface elevation at the well location

e. bottom of the well elevation

f. water level in the well

Table 3-1
Groundwater Monitoring Well Physical Data
Dickson County Landfill

	WELL			
	1	2	4	8
Well Casing Diameter, Inch	2	2	2	2
Top of Casing Elevation, Feet	856.26	819.60	819.82	835.48
Total Well Depth, Feet	85.75	64.5	84.0	182.00

3.8. GROUNDWATER MONITORING WELL SITTING

See the plans for the location of the existing groundwater monitoring wells.

3.9. MONITORING WELL CONSTRUCTION AND DEVELOPMENT

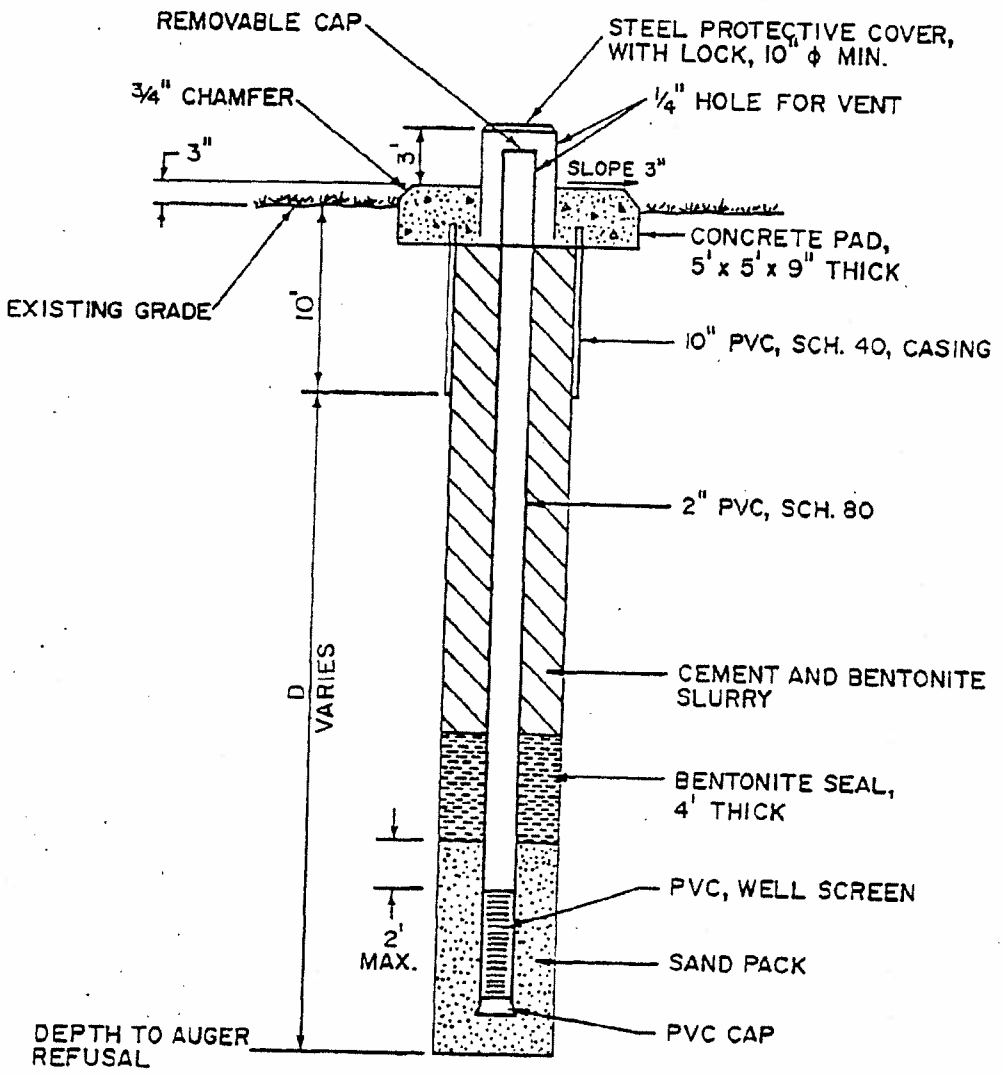
Groundwater monitoring wells 6, 7, 8, 9 and 10 were constructed in accordance with the details in the Groundwater Quality Assessment Plan dated November, 1994 which was reviewed and approved by the DSWM. It is not known exactly how the previous wells were constructed and developed. They are cased, lockable and appear to be grouted in place. Any future monitoring wells will be constructed and developed as outlined hereinafter.

The well will be constructed by boring a hole to the proper depth with a hollow stem auger. A 2-inch schedule 80 PVC threaded, flush-jointed casing will be inserted through the hollow stem auger. The well will be constructed with 10 feet of 0.01 inch horizontally slotted screen, fitted with a screw thread schedule 80 PVC bottom cap.

The annular space between the well casing and borehole wall will be filled with rescreened sand to a depth of approximately one foot above the screened interval. the sand will be added slowly and tamped into place as the auger is removed form the borehole. A four foot bentonite seal will be placed directly above the sand. The remainder of the space above the bentonite will be filled with grout. The well casing will extend approximately one foot above the ground surface and will be fitted with a lockable cover. See Figure 3-1.

Before the drilller is allowed to drill the borehole, the auger will be steam cleaned. Following removal of the auger from the borehole, it will be steam cleaned. Water from both steam cleanings will be collected and disposed of as outlined hereinafter. The Appendix contains a schematic diagram of a typical monitoring well.

Following construction the well will be allowed to stabilize for at least 24 hours. Once adequate water has collected in the well following the twenty-four hour waiting period, the well will be purged three times (see well purging procedures contained hereinafter).



NOTES:

1. PLACE 4 STEEL POSTS AROUND EXPOSED PIPE. PAINT FENCE POSTS YELLOW.
2. INSTALL SURVEYORS PIN FLUSH IN CONCRETE PAD.
3. D AS APPROVED BY THE DIVISION OF SOLID WASTE MANAGEMENT.

FIGURE 3-1

TYPICAL GROUNDWATER MONITORING WELL

N.T.S.

PROJECT 143-11 JUNE, 1996

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3.10. GROUNDWATER MONITORING

3.10.1. Parameters and frequency

3.10.1.1. Sampling

During the operating life, and during the 30 year post closure period, the selected monitoring wells will be monitored semiannually for the indicator parameters in Table 3-2.

Table 3-2
Indicator Parameters

1. Ammonia (As N)
2. Calcium
3. Chloride
4. Iron
5. Magnesium
6. Manganese, Dissolved
7. Nitrate (As N)
8. Potassium
9. Sodium
10. Sulfate
11. COD
12. TDS
13. TOC
14. pH

The parameters in Table 3-3 (Appendix I Parameters) will not be monitored unless directed by the DSWM or unless it appears that the groundwater may be subject to contamination.

Table 3-3
APPENDIX I – GROUNDWATER MONITORING PARAMETERS

Inorganic Constituents	
1. Antimony	10. Lead
2. Arsenic	11. Mercury
3. Barium	12. Nickel
4. Beryllium	13. Selenium
5. Cadmium	14. Silver
6. Chromium	15. Thallium
7. Cobalt	16. Vanadium
8. Copper	17. Zinc
9. Fluoride	
Organic Constituents	
18. Acetone	42. trans-1,3-Dichloropropene
19. Acrylonitrile	43. Ethylbenzene
20. Benzene	44. 2-Hexanone; Methyl butyl ketone
21. Bromochloromethane	45. Methyl bromide; Bromomethane
22. Bromodichloromethane	46. Methyl chloride; Chloromethane
23. Bromoform; Tribromomethane	47. Methylene bromide; Dibromomethane
24. Carbon disulfide	48. Methylene chloride; Dichloromethane
25. Carbon tetrachloride	49. Methyl ethyl ketone; MEK; 2-Butanone
26. Chlorobenzene	50. Methyl iodide; Iodomethane
27. Chloroethane; Ethyl chloride	51. 4-Methyl-2-pentanone; Methyl isobutyl ketone
28. Chloroform; Trichloromethane	52. Styrene
29. Dibromochloromethane; Chlorodibromomethane	53. 1,1,1,2-Tetrachloroethane
30. 1,2-Dibromo-3-chloropropane; DBCP	54. 1,1,2,2-Tetrachloroethane
31. 1,2-Dibromoethane; Ethylene dibromide; EDB	55. Tetrachloroethylene; Tetrachloroethene; Perchloroethylene
32. o-Dichlorobenzene; 1,2-Dichlorobenzene	56. Toluene
33. p-Dichlorobenzene; 1,4-Dichlorobenzene	57. 1,1,1-Trichloroethane; Methylchloroform
34. trans-1,4-Dichloro-2-butene	58. 1,1,2-Trichloroethane
35. 1,1-Dichloroethane; Ethylidene-chloride	59. Trichloroethylene; Trichloroethene
36. 1,2-Dichloroethane; Ethylene dichloride	60. Trichlorofluoromethane; CFC-11
37. 1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	61. 1,2,3-Trichloropropane
38. cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	62. Vinyl acetate
39. trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	63. Vinyl chloride
40. 1,2-Dichloropropane; Propylene dichloride	64. Xylene
41. cis-1,3-Dichloropropene	

3.10.1.2. Groundwater Surface Elevations

Determine and record the groundwater surface elevation at each monitoring well before a sample is obtained and before any pumping or bailing of the well occurs.

3.10.2. Record Keeping and Reporting

A record of all groundwater sampling activities conducted will be kept including the sample analysis results, and the associated groundwater surface elevation throughout the active life of the facility and throughout the post-closure care period as well. Such records must be kept at the owner's office.

All groundwater sample analysis results and associated recordings of groundwater surface elevations will be submitted to the Commissioner within thirty days after completing the analysis.

3.11. QUALITY ASSURANCE/QUALITY CONTROL PLAN MONITORING WELLS

These guidelines are to be followed for sampling of groundwater monitoring wells.

This plan covers the complete process utilized for the collection of quality groundwater monitoring samples including the following:

- measurement of groundwater levels
- purging of wells
- sample collection, handling, and analysis
- quality control and quality assurance

See Section 3.10.1 for frequency of sampling and a list of parameters.

3.12. GROUNDWATER LEVEL AND WELL DEPTH MEASUREMENT

3.12.1. Static Water Level Measurements

The depth to water level in the wells must be measured to calculate the casing water volume for purging and also for the purpose of determining the hydrological groundwater characteristics.

The static water level in the well is measured prior to the well evacuation. Initial static water levels are measured typically seven to ten days after installation and development of a new well and additional measurements are performed prior to each purging and sampling event. All waster level measurements utilized to construct a piezomatric surface map must be obtained within a consecutive twenty four hour (24) hour period.

The water level elevation will be determined to the nearest 0.01 feet as measured with a water level meter. The meter consists of an alarm and a reel containing a length of weighted, marked fiberglass tape, which has a conducting probe attached to detect the air/water interface.

The water level measurement is performed three (3) times to insure accuracy and water level stability. Always measure the upgradient or background wells first to reduce the potential for cross contamination.

The following procedure will be followed for water level measurement in groundwater monitoring wells.

1. Prepare a "Monitoring Well Purging and Sampling" (MWP&S) form (Appendix A) for each well to be measured, and enter all reference information for each well.

2. Locate the well identification on the casing and the well elevation reference mark and check against the site map for verification. If identification or elevation markings are not found on the well, verify the well identification, and mark the well with the identification number and an elevation mark. Note the changes on the MWP&S form and inform the project manager. If a new elevation mark is placed on the well, a survey must be performed.

3. Place a plastic sheet on the ground surrounding the well by cutting a slit in a piece of plastic and inserting the well through it. The plastic sheet should be of sufficient size to prevent contamination of equipment and supplies during the water level measurement process.

4. Unlock and open the protective well cover and the well cap. Note the well condition and any odors observed on the MWP&S form.

5. Sample the well head space for volatile organics with a HNU-101 photoionization detector (previously calibrated) and record the HNU reading on the MWP&S form.

6. Put on a clean pair of unpowdered, disposable gloves. (When gloves become soiled or damaged replace with a clean pair). Dispose of used gloves as per instructions in Section 3.21.

7. Determine if the water level tape and probe has been decontaminated. If not, wash with soap and water, and rinse with DI water. Dispose of wash and rinse water as per instructions in Section 3.21 .

8. Check the probe sensor and battery by immersing the probe in water. Note the level of the water on the electrode sensor when the alarm just begins to sound. If the probe operation is normal, proceed with item 8. If the alarm does not sound when the electrode tip contacts the water's surface, determine what is causing the malfunction before proceeding or obtain another water level meter.

9. Lower the probe and tape into the well carefully and slowly. Do not allow the tape to contact the well casing to prevent damage to the tape's surface. Surface abrasions will cause difficulty with later cleaning and decontamination.

10. When the probe contacts the water's surface and the alarm sounds, retrieve the probe until the alarm just ceases. Continue lowering and raising the probe until the point where the alarm just begins to sound is determined.

11. Hold the tape against the well elevation mark on the casing.

12. Note and record on the MWP&S form the distance from the well elevation mark to the groundwater's surface to the nearest 0.01 feet.

13. Repeat parts 9-12 two more times to verify the measurements. If the readings are not constant, continue to measure at greater time intervals until the levels stabilize. The elevation of the well minus the distance to the water surface is equal to the elevation of the water.

14. To measure the total well depth, lower the weighted tape slowly to the bottom of the well.

15. Mark the tape, and read at the well elevation reference mark to the nearest 0.01 feet.

16. Record the distance from the well elevation reference mark to the well bottom on the MWP&S log sheet.

17. Remove the tape and probe from the well being careful not to allow the tape to rub on the well pipe or casing.

18. Replace the well cap and lock the well or continue with purging and sampling.

19. If gross contamination is not encountered or suspected, wash the tape after each use with soap and water and DI water rinse.

20. If gross contamination is encountered or suspected:

    a. rinse the tape and probe with alcohol; rinse with water;
    b. wash with soap and water; rinse with DI water rinse;
    c. rinse with alcohol; rinse with DI water rinse

21. All wash and rinse water and alcohol rinse must be collected and held for proper disposal according to the guidelines set forth hereinafter.

3.13. WELL PURGING

3.13.1. Groundwater Monitoring Well Purging

The water standing in the well prior to sampling may not be representative of the on-site groundwater quality. Therefore, the standing water in the well and filter pack will be removed so that fresh water from the aquifer can replace the stagnant water.

If the well is in a high yield formation, the well will be evacuated from above the sand pack to draw fresh water up through the well. The most efficient exchange of water in the well is effected by pumping from near the top of the water column. This causes the stagnant water in the casing above the filter screen to be evacuated first. A minimum of three (3) well volumes of water will be evacuated from the well. The capacity for the well to recharge and the drawdown of the water column should be noted for future reference.

Low yield wells will be evacuated to dryness and allowed to recharge slowly. Whenever full recovery of the water in the well exceeds two (2) hours, samples will be collected as sufficient water becomes available. When the recharge rate is less than two (2) hours, monitor the water quality (pH, conductivity, and temperature) until the readings become stable, indicating the well has been sufficiently purged.

Peristaltic pumps, positive gas displacement Teflon bladder pumps, or disposable bailers will be utilized to evacuate the wells prior to sampling. Peristaltic pumps may be utilized when the water lift is less than twenty-five (25) feet. At depths exceeding twenty-five (25) feet, positive displacement pumps may be used. Bailers may be utilized in all wells, although the limited capacity of the bailer makes their use laborious. When using bailers, lower and raise slowly to prevent agitation of the water in the well.

Care will be taken to protect the bailer, pumps, suspension cords, tubing and cables from contacting the areas surrounding the well. A plastic sheet will be utilized to cover the ground and well opening area to protect the equipment.

When lowering the pumping equipment into the well, the pump and tubing will be supported to prevent it from dragging on the top of the well casing or binding when being lowered or raised.

The well may be considered to be evacuated when the water becomes clear and sufficient quantity has been evacuated (3x volume of water in well). Purged water will be collected and screened to determine if it may be hazardous. If there is a possibility that the water contains hazardous contaminant levels which exceed those levels which may endanger the health of personnel or the environment, the water will be drummed and held for proper disposal by post treatment on-site or disposal by certified waste disposal handlers.

3.13.2. Purging Procedures for Groundwater Monitoring Wells

The following procedure will be followed for purging of groundwater from monitoring wells.

1. Prepare a "Monitoring Well Purging and Sampling" (MWP&S) form (Appendix A) for each well to be measured, and enter all reference information for each well.

2. Locate the well identification on the casing and the well elevation reference mark and check against the site map for verification. If identification or elevation markings are not found on the well, verify the well identification, and mark the well with the identification number and an elevation mark. Note the changes on the MWP&S form and inform the project manager. If a new elevation mark is placed on the well, a survey must be performed.

3. Place a plastic sheet on the ground surrounding the well by cutting a slit in a piece of plastic and inserting the well through it. The plastic sheet should be of sufficient size to prevent contamination of equipment and supplies during the water level measurement process.

4. Unlock and open the protective well cover and the well cap. Note the well condition and any odors observed on the MWP&S form.

5. Sample the well head space for volatile organics with an HNU-101 photoionization detector (previously calibrated) and record the HNU reading on the MWP&S form.

6. Put on a clean pair of unpowdered, disposable gloves. (When gloves become soiled or damaged replace with a clean pair). Dispose of used gloves as per instructions hereinafter.

7. Determine the static water level following procedures hereinafter.

8. Determine the purging method to be followed.

9. Calculate the volume of water in the well from information gathered when measuring the well depth and static water level by one of the following methods:

   A. Depth of well – Depth to water = Height of water column

   B. By formula:

   $$3.14 \times r^2 \times h \times 7.48 = \text{gallons of water}$$

   where: r = radius of the well pipe in feet
   h = height of water column in the well in feet
   7.48 = gallons/cubic foot of water

   C. By well pipe size:

   a) for 2" diameter wells:
   Gallons = 0.1632 (gal/ft) x h (ft)
   where h = height of water column in the well

   b) for 4" diameter wells:
   Gallons = 0.6528 (gal/ft) x h (ft)
   where h = height of water column in the well

c) for 6" diameter wells:
Gallons = 1.4688 (gal/ft) x h (ft)
where h = height of water column in the well

Record the purge volume on the MWP&S form.

10. Sample the water in the well and test for pH, specific conductance, and temperature. Record results on the MWP&S form.

11. Purge the calculated volume of water from the well.

12. Dispose of the purged water per the instructions hereinafter.

13. Repeat items 10 and 11 two additional times to purge a minimum of three (3) well volumes from the well when the recharge rate is sufficient.

14. Record all purge times, volumes, and water quality test results on the MWP&S form.

15. Remove the purge pump or bailer (if not dedicated) from the well.

16. Remove all plastic sheeting, etc., from the well area.

17. Wash the pumps and bailers with soap and water; rinse with DI water; rinse with alcohol; and, finally, rinse with DI water prior to use in other wells. Combine the washings and rinse water with the purge water for disposal per the instructions in hereinafter.

18. Samples will be collected as soon as possible after purging, allowing sufficient time for the well to recharge.

19. Replace the well cap and lock the well.

20. Dispose of all contaminated materials, gloves, etc., according to the guidelines set forth hereinafter.

3.14. SAMPLE COLLECTION

3.14.1. Sample Integrity

To ensure the sample collected is representative of the formation, it is important to minimize physically altering or chemically contaminating the sample during the collection process.

Care will be taken to protect the sampling equipment, tubing and cables from contacting the area surrounding the well. A plastic sheet will be utilized to cover the ground and well opening area to protect the equipment.

3.14.2. Sample Collection - Bailer

A bailer is a long cylindrical tube constructed of materials which will not alter the quality of the sample being collected. Bailers used will not have glued joints. Bailers used will be of the disposable, bottom-fill type, constructed of polyethylene.

The bailer will be lowered into the well by a line into the groundwater where it fills from the bottom. The bailer has a ball, which seals the bottom of the bailer to prevent the water from emptying when the bailer is lifted from the well.

3.14.3. Sampling Procedures For Bailers

The following procedure will be followed for sampling of groundwater in monitoring wells when using bailers.

1. Prepare a "Monitoring Well Purging and Sampling" (MWP&S) form (Appendix A) for each well to be measured, and enter all reference information for each well.

2. Locate the well identification on the casing and the well elevation reference mark and check against the site map for verification. If identification or elevation markings are not found on the well, verify the well identification and mark the well with the identification number and an elevation mark. Note the changes on the MWP&S form and inform the project manager. If a new elevation mark is placed on the well, a survey must be performed.

3. Place a plastic sheet on the ground surrounding the well by cutting a slit in a piece of plastic and inserting the well through it. The plastic sheet should be of sufficient size to prevent contamination of equipment and supplies during the sample collection.

4. Unlock and open the protective well cover and the well cap. Note the well condition and any odors observed on the MWP&S form.

5. Sample the well head space for volatile organics with a HNU-101 photoionization detector (previously calibrated) and record the HNU reading on the MWP&S form.

6. Put on a clean pair of unpowdered, disposable gloves. (When gloves become soiled or damaged replace with a clean pair). Dispose of used gloves as per instructions hereinafter.

7. Determine the static water level following procedures hereinafter.

8. Purge the well of the required three (3) well volumes of groundwater or to dryness. (see previous section).

9. Attach new line to a new disposable bailer or use a dedicated bailer for each well to be sampled.

10. Carefully and slowly lower the bailer to the groundwater surface.

11. Allow the bailer to fill slowly with a minimum of water surface agitation to prevent aeration.

12. Raise the filled bailer to the surface while protecting the line from becoming contaminated.

13. Remove the cap from the VOA vial, and tilt slightly.

14. Pour the sample slowly into the vial to avoid spillage and air entrainment, making sure to quantitatively transfer any sediment in the sample. Fill the vial to overflowing to provide for a zero airspace sample, and cap. Invert, tap the vial with a finger and check for air bubbles. If bubbles appear repeat the filling process.

15. Properly dispose of excess sample collected from the well by combining with the purge water or wash water.

16. Label, package, and store the sample according to instructions hereinafter for sample handling and documentation.

17. Replace the well cap and lock the well.

18. Wash and rinse all equipment prior to leaving the site and rinse the exterior of all samples.

19. All wash and rinse water, alcohol rinse water, and excess sample must be collected and held for proper disposal according to the guidelines set forth in Section 3.21.

20. Dispose of all contaminated materials (bailers, line, plastic sheeting, gloves, etc.) according to the guidelines set forth hereinafter).

21. Samples will be labeled, packaged, stored, and shipped according to the guidelines set forth hereinafter.

22. Complete the required chain-of-custody and documentation for the sampling.

3.14.4. Sample Collection - Bladder Pump

A bladder pump is a long cylindrical tube with a flexible air operated bladder, constructed of materials which will not alter the quality of the sample being collected. Bladder pumps operate by alternately inflating and deflating the flexible bladder to alternately withdraw water from the well and pump the water to the surface.

3.14.5. Sampling Procedures For Bladder Pumps

The following procedure will be followed for sampling of groundwater in monitoring wells when using bladder pumps.

1. Prepare a "Monitoring Well Purging and Sampling" (MWP&S) form (Appendix A) for each well to be measured, and enter all reference information for each well.

2. Locate the well identification on the casing and the well elevation reference mark and check against the site map for verification. If identification or elevation markings are not found on the well, verify the well identification and mark the well with the identification number and an elevation mark. Note the changes on the MWP&S form and inform the project manager. If a new elevation mark is placed on the well, a survey must be performed.

3. Place a plastic sheet on the ground surrounding the well by cutting a slit in a piece of plastic and inserting the well through it. The plastic sheet should be of sufficient size to prevent contamination of equipment and supplies during the water level measurement process.

4. Unlock and open the protective well cover and the well cap. Note the well condition and any odors observed on the MWP&S form.

5. Sample the well head space for volatile organics with a HNU-101 photoionization detector (previously calibrated) and record the HNU reading on the MWP&S form.

6. Put on a clean pair of unpowdered, disposable gloves. (When gloves become soiled or damaged replace with a clean pair). Dispose of used gloves as per instructions hereinafter.

7. Determine the static water level following procedures hereinafter.

8. Purge the well of the required three (3) well volumes of groundwater or to dryness (see previous section).

9. Attach the compressor lines to the gas control box.

10. Connect the battery to the gas control box.

11. Attach the compressed gas lines from the gas control box to the bladder pump, and turn on the power and compressed air.

12. Adjust the gas control box to the desired pump, and fill cycle time to optimize the pumping rate.

13. Remove the cap from the VOA vial, and tilt slightly.

14. Allow the water being discharged from the pump to be slowly discharged into a precleaned 40 ml VOA vial. Fill the vial slowly to avoid entrainment of air, making sure to quantitatively transfer any sediment in the sample. Fill the vial to overflowing to provide for a zero airspace sample, and cap. Invert, tap the vial with a finger, and check for air bubbles. If bubbles appear, repeat the filling process.

15. Properly dispose of excess sample collected from the well by combining with the purge water or wash water.

16. Label, package, and store the sample according to instructions hereinafter for sample handling and documentation.
17. Replace the well cap and lock the well.
18. Wash and rinse all equipment prior to leaving the site and rinse the exterior of the sample container.
19. All wash and rinse water, alcohol rinse and excess sample must be collected and held for proper disposal according to the guidelines set forth hereinafter.
20. Dispose of all contaminated materials (plastic sheeting, gloves, etc.) according to the guidelines set forth in hereinafter.
21. Samples will be labeled, packaged, stored, and shipped according to the guidelines set forth in other sections of this plan.
22. Complete the required chain-of-custody and documentation for the sampling.

3.15. FIELD MEASUREMENT PROCEDURES

3.15.1. Field Measurement Procedure - Temperature

The measurement of temperature during the purging and sampling of monitoring wells is required to monitor the purging process. Temperature will be measured by use of a glass thermometer which is stored in a plastic case.

Samples of water from the well or surface stream are taken and prior to purging and at intervals during the purging process. The thermometer is inserted in the sample as soon as possible after withdrawing the water, swirled to mix, and read when the thermometer fluid column has stabilized.

The temperature is recorded and the sample utilized for the measurement of pH and specific conductance. The thermometer is dried by wiping gently and is stored in its protective case.

3.15.2. Field Measurement Procedure – pH

The pH of the ground or surface water sample is determined electrometrically with a combination glass pH electrode. The following procedure will be utilized for pH measurements:

1. Collect a fresh sample of the water to be tested, or use the sample used for the measurement of temperature.
2. Measure and note the temperature of a sample of pH=7 buffer solution.
3. Measure and note the temperature of a sample of either pH=4 or pH=10 buffer solutions (to bracket the pH of the ground or surface water). The temperature of the pH=7 and the other buffer used should be the same.
4. Turn on instrument power, select pH mode, remove the electrode protective cover and rinse with DI water.
5. Check the calibration of the pH meter by immersing the electrode in a fresh sample of standard pH=7 buffer solution.

6. Slide back the battery compartment cover exposing the adjustment pots.
7. Adjust the CAL (calibrate) pot until the display reads 7.00.
8. Remove the electrode from the pH=7 buffer solution and rinse the electrode with DI water.
9. Check the slope of the pH meter by immersing the electrode in a fresh sample of standard pH=4 or pH=10 buffer solution.
10. Adjust the SLOPE pot until the display reads the value of the buffer being used.
11. Remove the electrode from the buffer solution and rinse the electrode with DI water.
12. Immerse the electrode into a sample of the ground or surface water which is at the same temperature as the buffering standard solutions.
13. Swirl or mix slowly until the reading stabilizes.
14. Read and record the value of the pH.
15. Dispose of the sample and wash water properly.
16. Turn off the power switch.
17. Rinse the electrode thoroughly with DI water and replace the protective electrode cap.
18. The electrode should be rinsed with DI water after each test.
19. Calibrate the meter with buffers within 3.0 pH units of the test sample.
20. Place pH 4 buffer solution in the protective electrode cap.
21. Remove the battery when the meter will not be used for long periods of time to prevent the battery from leaking or corroding the meter.

3.15.3. Field Measurement Procedure – Specific Conductivity

The specific conductance of the ground or surface water sample is determined with a digital conductivity probe. The following procedure will be utilized for conductivity measurements:

1. Collect a fresh sample of the ground or surface water to be tested or use the sample used for the measurement of temperature.
2. Measure and note the temperature of a sample of conductivity standard which is near the conductance of the samples to be tested.
3. Check the conductivity probe tip for dried solids. If present rinse with DI water and allow the probe tip to air dry. Turn on instrument power and select the conductivity mode.
4. Turn on instrument power and select the conductivity mode.
5. Slide back the battery compartment cover exposing the adjustment pots.

6. Check the zero of the meter by measuring the conductivity in air. Adjust the meter to zero by adjusting the zero pot.

7. Immerse the electrode in the conductivity standard and adjust the SPAN pot until the display reads the correct value for the standard.

8. Remove the electrode from the conductivity standard solution and rinse the electrode with DI water.

9. Immerse the electrode into a sample of the ground or surface water which is at the same temperature as the conductivity standard solution.

10. Swirl or mix slowly until the reading stabilizes.

11. Read and record the value of the specific conductance of the sample.

12. Dispose of the sample and wash water properly.

13. Turn off the power switch.

14. Rinse the electrode thoroughly with DI water.

15. The electrode should be rinsed with DI water after each test.

16. Remove the battery when the meter will not be used for long periods of time to prevent the battery from leaking or corroding the meter.

3.16. SAMPLING QUALITY ASSURANCE / QUALITY CONTROL

3.16.1. Field Blanks

Trip blanks, equipment blanks, and duplicate samples are examples of Quality Assurance/Quality Control (QA/QC) sampling requirements.

3.16.2. Trip Blanks

Trip Blanks are prepared in the laboratory with laboratory grade (distilled or deionized) water. The water is placed into the sample containers to verify their cleanliness before and during the sampling project. In the case of volatile organics, the trip blank sample will monitor the contamination of outside contamination on samples during storage and transportation. One trip blank sample is to be used for each cooler of samples sent out.

3.16.3. Equipment Blanks

Equipment blanks are utilized to monitor the contamination of sampling equipment. Samples of distilled or deionized water are taken using the sample equipment. One sample per equipment type per day is required. However, if the wells well be sampled with disposable bailers which are used only once for that well or dedicated bladder pumps, no equipment blank will be collected.

3.16.4. Duplicate Samples

Duplicate samples are utilized to monitor the reproducibility of the sampling procedures and to provide the laboratory with sufficient sample to perform laboratory matrix spike and duplicate sample analysis. Duplicate samples are essentially identical samples. They are collected, preserved, handled, shipped, stored, and analyzed in the same manner as the regular samples. One duplicate sample will be collected for each sample interval.

3.17. CLEANING AND DECONTAMINATION OF SAMPLING EQUIPMENT

3.17.1. Sample containers

The containers to be used for samples will be either purchased precleaned or cleaned by the following procedure prior to use by the laboratory or field team.

1. Vials, jars, caps, and lids will be washed with phosphate free detergent and hot water.
2. Rinse thoroughly with hot, tap water.
3. Rinse with a solution of 10% nitric acid (CAUTION !!).
4. Rinse with tap water followed with DI water.
5. Rinse twice with isopropyl (or methyl) alcohol and allow to air dry for 24 hours.
6. Wrap with aluminum foil to prevent contamination during storage and transport to the site.
7. All alcohol and acid used for the decontamination process will be collected and disposed of properly whether generated in the laboratory or in the field.

3.17.2. Sampling Equipment

All sampling equipment used which is not dedicated to a specific well or disposable, must be cleaned by the following procedure prior to use:

1. Sampling equipment will be washed with phosphate-free detergent and hot water.
2. Rinse thoroughly with hot, tap water.
3. Rinse with a solution of 10% nitric acid (CAUTION !!).
4. Rinse with tap water followed with DI water.
5. Rinse twice with isopropyl (or methyl) alcohol and allow to air dry for 24 hours.
6. Wrap with aluminum foil to prevent contamination during storage and transport to the site.
7. All alcohol and acid used for the decontamination process will be collected and disposed of properly whether generated in the laboratory or in the field.

3.18. SAMPLE LABELING AND PACKAGING

3.18.1. Sample Labeling

All samples will be handled as prescribed by methodology set forth in the latest edition of SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. The following are guidelines for sample handling and preservation of ground and surface water samples to be used.

The sample label will contain the following information:

- Monitoring Well Number or "Surface Steam"
- Project Number
- Date and Time of collection
- Samplers identifying name or initials
- Analysis requested
- Preservative added

A example of a sample label is included in Appendix B.

3.18.2. Sample Packaging And Shipping

Samples will be packaged to insure the physical as well as chemical integrity of the samples. Samples will be delivered to the laboratory as soon as possible after sampling, preferably on the same day. If samples must be shipped by common carrier, use of next day service is required.

Volatile organic samples will be collected in 40 ml VOA vials. Immediately after sampling and proper labeling, the samples will be inserted into foam sleeves, placed in ziploc® bags, and placed into a cooler which contains ice or cold packs for cooling.

Prior to transport or shipping, the cooler will be packed with shock absorbent material to prevent breakage of the sample containers and prevent the coolant from shifting. Appropriate Chain-of-Custody documentation will be enclosed in the cooler with the samples, and the lid will be secured and sealed. The exterior of the cooler will be labeled with the name and address of the destination, and of the sender, and the total weight of the package. Warning labels will be affixed noting "THIS SIDE UP" and "FRAGILE" and any appropriate hazardous warning.

3.19. CHAIN OF CUSTODY

Because the samples collected from the investigations may be involved in legalistic proceedings at a later time, chain-of-custody documentation of all samples must be maintained. A Chain of Custody is required anytime the sample leaves the custody of the sampler. The possession of samples from the time of collection must be traceable.

A typical chain-of-custody form is included in Appendix C. The form must be filled out completely, legibly, and accurately, and accompany the sample at all times for documentation of the sample handling. When common carriers or shippers are utilized to ship samples to the laboratory, the receipts and shipping manifest must be attached to the Chain-of-Custody to complete the chain.

When samples are split between two or more parties, a separate Chain-of Custody shall be prepared and accompany the sample.

3.20. SAMPLE ANALYSIS

All of the ground and surface water samples will be analyzed per the latest edition of USEPA, SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.*

3.21. DISPOSAL OF CONTAMINATED MATERIALS

All equipment, supplies, and waste which may contain or may be contaminated with hazardous materials must be properly disposed of. The following are examples of possible contaminated materials:

- Water used for washing, rinsing, or decontaminating of sampling equipment or supplies.
- Water purged from wells or excess samples.
- Alcohols and acids from sample container decontamination.
- Disposable and heavy work gloves.
- Disposable bailers and bailer support lines.
- Pump tubing and suction tubing.
- Plastic sheeting used for ground cover or work surfaces.

3.21.1. Disposal of Contaminated Waters

Water from the decontamination, purging, and sampling activities must be collected in pails, drums, or tanks for disposal. The containers will be screened with the HNU PID for indications of organics. If the HNU does not indicate volatile organics above the detectable level, the water will be wasted. If volatile organics are detected, the water will be sampled and analyzed to determine if it is a hazardous waste, and if determined to be hazardous, disposed of by proper disposal methods following rules and regulations in force at the time of disposal.

3.21.2. Disposal of Solvents and Acids

Solvents used to rinse cleaned containers and equipment and not believed to have significant levels of contamination will be disposed of by placing in a vented area and allowed to evaporate.

Solvents used to rinse contaminated equipment which are believed to have significant levels of contamination will be disposed of by placing in an approved shipping container, sampled and analyzed to determine if it is a hazardous waste, and, if determined to be hazardous, disposed of by proper disposal methods following rules and regulations in force at the time of disposal.

Nitric acid utilized for rinsing sampling equipment, containers, and supplies in the laboratory will be collected and disposed of by neutralizing with sodium hydroxide and discharging into the publicly owned treatment works (POTW) serving the laboratory. Nitric acid utilized in the field will be disposed of by neutralizing with sodium hydroxide and discharging to the Gates or Halls POTW.

3.21.3. Disposal of Solid Waste

All solid waste including plastic sheeting, bailers, bailer support line, pump and suction tubing, gloves, and trash will be collected and screened with the HNU PID for indications of volatile organics.

If the HNU does not indicate volatile organics above the detectable level, and there are no other contaminates of concern on the site, the waste will be placed into the owner's dumpster.

If volatile organics are detected, the waste will be sampled and analyzed to determine if it is a hazardous waste, and, if determined to be hazardous, disposed of by proper disposal methods following rules and regulations in force at the time of disposal.

3.22. SURFACE WATER MONITORING

No surface water monitoring will be conducted.

4. POST CLOSURE INSPECTION/MONITORING

4.1. LEACHATE MONITORING SYSTEM

The groundwater monitoring wells should provide an indication if leachate is contaminating the groundwater. In addition, when the wells are sampled, the site boundary will be examined for any leachate seeps or breakthroughs. Such indications of leachate will be noted in the report to the commissioner with the groundwater monitoring well analyses.

4.2. GAS MONITORING SYSTEM

Figure 2-1 shows the construction details of the gas collection vents. The vents shall be monitored quarterly for methane and other combustible gases. The measurement will be by a portable explosive gas meter that measures combustible gases as a percent of lower explosive limit (LEL). The values will be forwarded to the Division quarterly.

4.3. FINAL COVER

Throughout the post closure period, the site will be inspected to ensure that all waste disposed of in the facility remains covered with a minimum of 36 inches of final cover. Any areas that are damaged will be repaired immediately with clay and topsoil. Inspections will be quarterly for the first year and annually during the balance of the post closure care period, if warranted by results of past inspections. This inspection will cover the area west of the large north-south ditch (post 1990 area) and the area east of the large north-south ditch (pre-1990 area).

4.4. SILTATION AND EROSION CONTROL

Throughout the post closure care period, all ditches, diversion berms, culverts, rip-rap, silt fences, and other drainage structures will be maintained at least until the vegetation cover is established sufficiently enough to render such maintenance unnecessary. Erosion control structures will be maintained so as to prevent damage to the final cover.

4.5. VEGETATIVE COVER

Throughout the post closure care period, all areas lacking proper vegetation will be revegetated annually and maintained.

4.6. SITE INSPECTIONS

Routine quarterly inspections will be conducted for the first year to monitor and maintain the final cap. Based on the results of past inspections, the frequency of inspections may be reduced after the first year, but to not less than once per year. Inspections will include: methane monitoring (quarterly), inspections of ditches with accumulated sediment removed as needed, inspection and repair of final cap to include revegetation, verification that site access is controlled, etc. The owner will make an annual site assessment which will consist of the results of inspections and maintenance activities within that year.

4.7. POST CLOSURE USE OF THE PROPERTY

The operator will ensure that post closure use of the property will not disturb the integrity of the final cover or any other component of the containment system or the function of the monitoring system, unless the DSWM concurs that the activities will not increase the potential threat to human health or the environment and the activities are necessary to reduce a threat to human health or the environment.

The final land use of this property during the post closure care period will be determined at the time of site closure. Access to the site during the post closure care period will be restricted by the owner by means of a locked gate as needed for maintenance, inspections, and end use.