PERMIT ATTACHMENT I

VADOSE ZONE MONITORING SYSTEM WORK PLAN

Prepared for:

TRIASSIC PARK WASTE DISPOSAL FACILITY
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Final

Vadose Zone Monitoring System Work Plan

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1.0 INTRODUCTION

1.1 BACKGROUND

The Gandy Marley Corporation (Gandy Marley) was granted a Groundwater Monitoring Waiver for its proposed Triassic Park Waste Disposal Facility by the Hazardous and Radioactive Materials Bureau (HRMB) of the New Mexico Environmental Department (NMED) on January 12, 2000. The Triassic Park Waste Disposal Facility will be located in Chaves County, New Mexico, east of Roswell (Figure 1, *Site Location Map*). The facility will be a full-service Resource Conservation and Recovery Act (RCRA) Subtitle C waste treatment, storage and disposal operation. Two treatment processes will be used at the facility. Evaporation ponds will be used for managing leachate fluids that meets landfill disposal restriction standards and a stabilization process will be used for treating fluids, sludge and solids prior to final disposal in the on-site landfill.

Site-specific hydrogeologic conditions and engineering safeguards for the regulated units were documented in the report titled *Groundwater Monitoring Waiver Request, Triassic Park Waste Disposal Facility* (Montgomery Watson, January 2000). The *Groundwater Monitoring Waiver Request* report indicated that hydrogeologic conditions at the site will minimize migration of potential leachate fluids from the facility to the uppermost aquifer. The conservative modeling calculations presented in the *Groundwater Monitoring Waiver Request* report estimated that the migration time for potential leaks from the disposal facility to the uppermost aquifer would be greater than 1000 years. As an alternative to conventional groundwater monitoring, the *Groundwater Monitoring Waiver Request* report recommended installation of a vadose zone monitoring system (VZMS) as a superior means for protecting human health and the environment because of its ability to detect potential leaks in a more timely manner.

This Work Plan presents the design of a VZMS at the site and will be an appendix to the Permit Application. It includes a discussion of the location and design of the vadose zone monitoring wells and methodologies for characterizing fluids that may accumulate in vadose zone wells and sumps from various sources. This Work Plan also discusses how data will be collected to select chemical parameters indicative of fluids (waste or non-waste) that may occur at the site. A summary of monitoring frequency, sampling procedures, laboratory analyses and data reporting associated with the monitoring system are also provided. Figure 2, *Location of Sumps and Monitoring Wells*, presents a map of the proposed facility showing significant site features including the locations of the waste management units, vadose zone monitoring wells and sumps.

(NOTE) Permit Part 7, Vadose Zone Monitoring, supercedes this Work Plan. Any conflict or contradiction between Permit Part 7 and this Work Plan shall cause the Permittee to abide by the conditions in the Permit Part.

1.2 PROJECT SCOPE AND OBJECTIVES

This Work Plan presents recommendations for a VZMS at the site. The vadose zone monitoring program for the facility allows collection of fluids beneath or downgradient of the facility and identification of the potential source(s) associated with these fluids. The following items are included as part of this Work Plan.

- A description of the methodology for installing a VZMS capable of detecting fluids migrating from the waste management units;
- A description of the methodology for developing baseline data characterizing the chemical characteristics of non-leachate fluids that may accumulate in sumps or vadose zone wells;

- A methodology for selection of appropriate indicator parameters that could be used to identify leachate fluids during future monitoring at the site;

- A description of the methodology to be used for collecting field and analytical data as part of the vadose zone monitoring program at the site; and,

- Description of the contingencies to the monitoring program if fluids are detected in the monitoring system. References to the Part B Permit Application or actual permit are presented where additional detail is required.

The primary VZMS consists of vadose zone monitoring sumps located beneath the landfill Phase IA cell and beneath each of two evaporation ponds. A secondary system consists of a series of vadose zone monitoring wells located adjacent to the landfill Phase IA cell and the evaporation ponds, and on the periphery of the facility. Neutron access probe tubes and lysimeters are also located adjacent to the landfill Phase IA cell and the evaporation ponds.

This Work Plan also describes how the chemical characteristics of non-leachate fluids from various sources (i.e., stormwater evaporation ponds, rainwater, consolidation water and water supply) are characterized. These data are used to develop a list of indicator parameters and/or water profiles that enable distinguishing between non-leachate fluids and leachate fluids.

Additional components of the vadose zone monitoring system presented in this Work Plan are listed below.

- Monitoring frequency
- Sampling procedures
- Laboratory analyses
- Data management
- Data reporting
- Health and Safety

The methods described within this Work Plan include the necessary elements for a Quality Assurance Project Plan (QAPP). The QAPP objectives are designed to assure that sampling, chain-of-custody, laboratory analysis, data measurements and reporting activities provide quality data that is representative of conditions at the site and legally defensible.

1.3 PROJECT ORGANIZATION

HRMB/NMED is the lead regulatory agency for this portion of the hazardous waste management Permit Application. Gandy Marley is the permittee and will review project documents prior to their submittal to the HRMB. Montgomery Watson, in conjunction with their sub-consultants, is the oversight contractor and responsible for coordination of field activities, subcontractors, data management, review and reporting of information concerning site characteristics and interpretation of data developed during the studies. A subcontractor to Montgomery Watson will conduct monitoring well construction and laboratory analyses.

1.4 GEOLOGY AND HYDROLOGY

A detailed discussion of regional and site-specific geology and hydrology is provided in the *Groundwater Monitoring Waiver Request, Triassic Park Waste Disposal Facility* (Montgomery Watson, January 2000) and Section 3 (Volume I) of the Part B Permit Application. A brief summary of the site-specific geology and hydrology is presented below.

1.4.1 Site Specific Geology

The thickness of Quaternary alluvial deposits (fine to very fine wind-blown sands) at the site varies from less than 10 to 35 feet. Two distinct Tertiary units, the Upper and Lower Dockum, exist beneath the alluvial deposits at the site. Within the proposed facility boundary, the Upper Dockum unit never exceeds 100 feet in thickness and the Lower Dockum is approximately 700 feet thick. The Upper Dockum consists of mudstones interbedded with siltstones and sandy siltstones. The Upper Dockum mudstones have an average permeability of 2.5 x 10^{-7} cm/s and the siltstones have an average permeability of 1.2 x 10^{-5} cm/s. The Upper Dockum sediments were deposited in a fluvial environment and individual lithologies may pinch out and not correlate over long distances.

The Lower Dockum was deposited in a lacustrine environment resulting in a thick accumulation of predominantly mudstones interbedded with thin siltstones. This unit is very homogeneous compared to the Upper Dockum. The Lower Dockum has an average permeability of 5.7 x 10^{-8} cm/s and represents a significant geologic barrier to downward migration of potential leachate from the proposed facility.

The site is located in a geologically stable region of the United States based upon its distance from tectonic centers and historically low seismic activity. There are no identified faults in the immediate area of the site.

1.4.2 Site Specific Hydrology

There are no perennial stream drainages on or near the site. The nearest surface drainage is the Pecos River that is located approximately 30 miles to the west.

The basal sand unit (Santa Rosa Sandstone) within the Lower Dockum is considered the "uppermost aquifer" in the region. Previous exploratory drilling, consisting of approximately 50 boreholes within the site boundary, did not encounter groundwater within potential Triassic host sediments. There is no water being produced from the Triassic sediments within a four-mile radius of the site. Beyond the site boundary, groundwater flow in the uppermost aquifer is generally easterly in the direction of the regional dip of the unit.

Based on drilling information, the western boundary of the Quaternary Ogallala Aquifer is located topographically between one-half and two miles east and stratigraphically above the site. Because of its stratigraphic and physical location, it is highly unlikely that the proposed disposal facility will have any impact on this aquifer.

Groundwater was encountered in several wells during subsurface characterization for the Part B Application. Brackish groundwater was identified in a perched zone (~42 feet bgs) borehole PB-14, which is located to the southwest outside of the site footprint and appeared to be due to a lithologic depression on the surface of the Lower Dockum unit. Groundwater was also encountered in wells WW-1, WW-2, PB-1, and PB-26 which are located 2,000 feet or more to the north and south of the site. Additional detail on the results of this drilling can be found in Section 3.0 of the Permit Application.

1.4.3 Site Model

In order to justify the design of the VZMS, potential contaminant pathways, should there ever be a release from one of the waste management units, are shown in Figure 3, Schematic Site Model. There are several types of potential conduits for fluid movement through bedrock, including those listed below.

- Primary permeability (i.e., connected interstitial voids) in either bedrock or alluvial material
- Bedding planes (i.e., between interbeds within the Upper Dockum unit or along the contact between the Upper and Lower Dockum units).

J:RTL

- Secondary permeability (i.e., faults and fractures), although there is no evidence of faults in the area

Consequently, if there were a release of fluids from one of the regulated units, fluid could migrate vertically and/or laterally via one of the above-mentioned conduits. It is likely that lateral migration of the fluids along the dip of the units (i.e., along bedding planes) would dominate the flow regime. Therefore, a monitoring well located down dip of the facility and screened across the Upper Dockum/Lower Dockum contact and up into the Upper Dockum unit (i.e., across the silty and sandy silty interbeds) would be the most likely locations to observe these fluids if they ever were to occur.

Additionally, fluids that may have been released from a regulated unit, such as the evaporation ponds, could migrate through alluvium and along the alluvium/Upper Dockum contact, such that a shallow well located down dip of the unit and screened across the contact and up into the alluvium would be the most like place to observe these fluids. Furthermore, all non-leachate fluids, except consolidation water, would be expected to appear first in the shallow wells.

2.0 VADOSE ZONE MONITORING SYSTEM INSTALLATION

The landfill cells and evaporation ponds will be constructed in phases. The Phase IA landfill cell will be completed first and will include a single central sump system. The Phase II and Phase III cells will be completed at a much later date and will also include individual sump systems. Evaporation Ponds 1A and 1B will be constructed first and each will have its own central monitoring sump system. Evaporation Ponds 2A and 2B will be completed at a later date.

This Work Plan only addresses the vadose zone monitoring sumps and vadose zone monitoring wells associated with the Phase IA landfill cell and Evaporation Ponds 1A and 1B. Additional monitoring sumps and vadose zone monitoring wells will be addressed in a permit modification request for the remaining landfill cells and evaporation ponds. Construction details for the vadose zone monitoring sumps are provided in the design document *Design Drawings, Triassic Park Waste Disposal Facility, Chaves County, New Mexico, TerraMatrix, Montgomery Watson, December 1997* (Revised January 2000).

2.1 VADOSE ZONE SUMPS

Each landfill cell will have a triple leachate detection/removal sump system. Figure 4, *Typical Landfill Sump Detail Cross-Section*, provides a cross-section of the landfill sump system. The uppermost leachate collection and removal system (LCRS) consists of collection piping located above a primary liner system. The LCRS is sloped so any leachate above the primary liner drains to the sump within the landfill cell. A secondary landfill leak detection and removal system (LDRS), similar in design to the LCRS, will be located below the LCRS and primary liner. Beneath the LDRS and its secondary liner will be a vadose zone monitoring sump fitted with a transducer that will serve as a detection and removal system in the event of leakage through the primary and secondary liners. The vadose zone sump piping and gravel arrangement will be similar to the LCRS and LDRS arrangements.

The evaporation pond vadose zone monitoring sumps will serve as a detection system for possible leakage from the LDRS sump associated with the ponds. Figure 5, *Evaporation Pond LDRS and Vadose Plan and Details*, provides a cross-section of the evaporation pond sump system. Leakage through the secondary liner system will flow into vadose zone monitoring sumps. This will allow the leakage to be detected, contained and properly treated and disposed. The vadose zone monitoring sump piping and gravel arrangement is similar to the LDRS arrangement. The Permit Application provides additional details on the sump transducers. Operation and maintenance of the sumps and transducer is covered in the Operation and Maintenance Manual included in the Permit Application.

2.2 VADOSE ZONE MONITORING WELLS

2.2.1 Well Locations

Seventeen vadose zone monitoring wells will be installed to detect potential migration of fluids from the landfill (Phase IA cell) and evaporation ponds (1A and 1B), as shown in Figure 2. Ten of these wells will be deep (installed across the Lower Dockum/Upper Dockum contact and up into the Upper Dockum), six will be shallow (screened across the Upper Dockum/alluvium contact), as detailed in Section 2.2.2, and one will be very deep as described in Permit Part 7. Two of the shallow wells will be nested with a deep well and will be located 8 to 15 feet from the deep well.

2.2.2. Vadose Zone Monitoring Well Construction

A utility clearance will be conducted at all drill locations to insure that no subsurface utilities or obstacles exist in the area. This will be conducted using methods appropriate to the conditions of each location (e.g., geophysics, utility maps, or facility personnel knowledge). The vadose zone monitoring wells will be installed using an air-rotary drill rig with no drive casing. Soil samples from cuttings will be logged and collected for use in characterizing fluids that may accumulate in the sumps and vadose zone monitoring wells, as described in see Section 3.0. These samples will also be collected for baseline chemical analyses. For additional well construction requirements, see Permit Part 7.

2.2.2.1 Deep Monitoring Wells

The deep vadose zone monitoring wells will be screened from 20 feet beneath the alluvium/Upper Dockum contact to 10 feet below the contact between the Upper and Lower Dockum with the screened interval extending five feet below the contact and a five-foot long sump below that. A detail of the well construction is shown on Figure 2. The on-site geologist will log the boring and confer with the driller regarding lithology changes that identify the Upper and Lower Dockum contact. The location of the contact will be confirmed using a down-hole geophysical tool (i.e., gamma ray and neutron logging methods). Monitoring wells that will continually undergo neutron logging shall have baseline logs created in both open and cased boreholes. It is estimated that the total depths for the deep landfill monitoring wells will range between 140 and 185 feet based on well location and final grading at the site. The anticipated depth for the deep evaporation pond monitoring wells will be approximately 70 feet, assuming the wells are drilled ten feet below the Upper and Lower Dockum contact.

Five feet of solid 4-inch diameter Schedule 80 PVC casing will be placed at the bottom of the borehole to serve as a liquid collection sump. Above this casing, 4-inch diameter Schedule 80 PVC flush-threaded 0.010 inch well screen will extend to 20 feet below the top of the Upper Dockum/alluvium contact. The top of the screened interval will extend to a depth that enables a minimum 20-foot seal below the Upper Dockum/alluvium contact and a minimum of 10 feet from the bottom of the adjacent shallow well's screened interval, if applicable.. This will result in 80- to 100-foot screened intervals in the deep wells. Solid 4-inch diameter Schedule 80 PVC casing will then be installed to the surface. Bottom caps will be attached with stainless steel rivets. Additionally, in order to minimize the chances of the bottom of the well being inadvertently broken out, extra care will be taken to ensure that the filterpack is filled in, while still hanging the well casing under tension, with maximum density around the end of the well casing for added stability.

The casing will be lowered into the borehole a section at a time by hanging the casing from the drill rig. The casing will be left hanging from the drill rig after all the well casing has been attached and during the emplacement of filter pack material and grout to ensure that the casing remains straight. Centralizers will also be used to ensure that the well is straight. It will be important for the well to be plumb (i.e., vertical) to allow adequate visual monitoring of the wells. This will be accomplished by drilling the borehole straight, which will be the responsibility of the driller, as well as using the methods described above.

Following placement of the well casing, fine-grained sand (e.g., 20/40 silica sand) will be placed in the annulus to form a filter pack. Sand will be placed approximately 3 feet above the top of the well screen. Three feet of transitional sand (i.e., 100-mesh sand) will be placed above the sand pack to prevent migration of the grout seal into the filterpack during emplacement. The main advantage of using transitional sand versus bentonite pellets is that it does not require hydration and will prevent any confusion of the source of the water if it were to enter into the well sump. The wells will be completed by pumping a grout mixture to form a seal from the top of the transitional sand to the top of the borehole using a tremie pipe. The grout mixture will consist of a high solids (~20 to 30%) bentonite grout (e.g., Aquaguard or equivalent) mixed to the manufacturer's specifications. The top of the well will be cemented with concrete and set with aboveground well protection. No water will be used in the construction of the well, except in the grout mixture, which will be pre-mixed aboveground prior to emplacement in the annulus to avoid any free water entering the well or annulus during well construction.

2.2.2.2 Shallow Monitoring Wells

If there is greater than four feet of alluvium present, the shallow vadose zone monitoring wells will be drilled to approximately three feet below the contact between the Upper Dockum and alluvium with a five foot screened interval extending two feet below the contact and with a one-foot long sump below that. If less than four feet of alluvium is encountered, no monitoring well will be installed at that location. A detail of the well construction is shown on Figure 2. The on-site geologist will log the boring and confer with the driller regarding lithology changes that identify the Upper Dockum/alluvium contact.

The thickness of the alluvium averages around 10 feet across the site. A minimum 3-foot seal or four feet of alluvium will be necessary to install a properly constructed monitoring well. One foot of solid 4-inch diameter Schedule 80 PVC casing will be placed at the bottom of the borehole to serve as a liquid collection sump. Above this casing, five feet of 4-inch diameter Schedule 80 PVC flush-threaded 0.010-inch well screen will extend to three feet above the Upper Dockum/alluvium contact.

Following placement of the well casing, fine-grained sand (e.g., 20/40 silica sand) will be placed in the annulus to form a filter pack. Sand will be placed between ½ and 1 foot above the top of the well screen followed by ½ to 1 foot of transitional sand. The actual thicknesses will be determined by the depth of the contact and a minimum 3-foot surface seal. The wells will be completed by emplacing a grout mixture to form the surface seal from the top of the bentonite to the top of the borehole. The grout mixture will be gravity emplaced if the wells are less than 50 feet deep and contain no formation water; if they are greater than 50 feet deep or contain formation water, the grout will be emplaced using the same procedures as the deep wells. The grout mixture will consist of a high solids (~20 to 30%) bentonite grout (e.g., Aquaguard or equivalent) mixed to the manufacturers specification. The top of the well will be cemented with concrete and set with aboveground well protection. No water will be used in the construction of the well, except in the grout mixture, which will be pre-mixed aboveground prior to emplacement in the annulus to avoid any free water entering the well or annulus during well construction.

2.2.2.3 Neutron Probe Access Tubes

Neutron probe access tube will be constructed with the same care as monitoring wells to ensure functionality and to prevent fluid contamination. Details are provided in Permit Part 7.

2.2.2.4 Suction Lysimeters

Suction lysimeters will be constructed with the same care as monitoring wells to ensure functionality and to prevent fluid contamination. Details are provided in Permit Part 7.

2.2.2.5 VZMS Construction Information

VZMS construction information will be recorded on boring logs and well construction forms by the field geologist for each well and will contain the following information.

- Name of geologist, site location, and date of activity
- Description and identification of drilling and sampling equipment
- Name of drilling contractor
- Soils description using the Unified Soil Classification System
- Description of soil texture, color, density, odors and other appropriate descriptions
- Description of rock type
- Depth and thickness of groundwater (if encountered)
- Total depth of the boring and well.
- All applicable well construction details

Following installation, a licensed surveyor using a benchmark of known elevation as a reference point will survey each vadose zone monitoring well and neutron probe access tube. A reference mark will be made at the top of each well casing and surveyed for horizontal coordinates (±0.1 feet) and height above mean seal level (±0.01 feet). Then the depth of the well will be measured and recorded to 0.01 feet below the top of casing, as well as below the well pad and ground surface. Any deviations from this Work Plan will be documented and justified.

2.2.3 Decontamination

The drill rig and equipment used for installing the vadose zone monitoring wells for the landfill Phase IA cell and evaporation ponds will be decontaminated prior to drilling and between boreholes. Decontamination procedures are described below.

Drilling equipment which comes into direct contact with subsurface soils or groundwater will be decontaminated between each boring by removing adherent soil, steam cleaning and/or scrubbing with an anionic detergent in potable water followed by a double rinse with purified (deionized) water.

Investigation derived waste (IDW) will be handled in accordance with the WAP.

2.2.4 Well Development

Based upon previous investigations, groundwater is not anticipated in any of the vadose zone monitoring wells, therefore, well development should not be necessary. However, a description of protocols for well development is provided below in the unlikely event groundwater is encountered. In the unlikely event that groundwater is encountered during the installation of monitoring wells, NMED will be contacted within 24 hours of the event.

If groundwater is encountered, wells will be developed to remove fine material from the formation and filter pack surrounding the well. Following well construction, the cement grout will be allowed to cure for approximately one week after which development will consist of bailing and surging until relatively clear water (i.e., groundwater with low turbidity) is produced. Each well will be surged and bailed using a development rig equipped with a winch and a 3-inch diameter steel bailer. Surging and bailing of fines is anticipated to take up to 4 hours per well to complete. The volume of water removed may vary between one casing volume for low recharge wells (i.e., those that don't fully recharge within 12 hours) and 6 casing volumes.

3.0 BASELINE LIQUID CHARACTERIZATION

Potential sources for water detected in the vadose zone monitoring wells and sumps may include those shown below.

- Non-leachate fluids
  - Rainwater
  - Stormwater detention pond fluids
  - Consolidation water from prepared subgrade or geosynthetic clay liner (GCL)
  - Pipeline leaks from facility water supply
- Leachate fluids
  - Fluids that have migrated through waste from the landfill
  - Evaporation pond fluids

A baseline liquid characterization program will be conducted within three months of activating the facility water supply system to evaluate the water quality characteristics of sources of non-leachate fluids that could accumulate in sumps or vadose zone monitoring wells. Additionally, leachate fluids will be evaluated as part of the WAP and will include sampling and analysis of each of the leachate fluids types listed above. The potential characteristics of leachate fluids will be evaluated after a sufficient amount of waste materials have been placed in the landfill and landfill leachate has been collected, if it occurs. These data will be used to distinguish leachate fluids from non-leachate fluids that could accumulate in sumps or vadose zone monitoring wells during operation, according to the methods discussed in Section 6.4.

The baseline characterization program will be conducted on samples of non-leachate fluids to produce preliminary chemical profiles for these waters. Samples of non-leachate fluids will be analyzed according to the program described in Table 1. These data will be used to develop a water quality profile representative of each potential non-leachate fluid source.

A sample of the potential consolidation water will be analyzed as part of the baseline characterization program. The sample will be obtained by running a permeability test (ASTM D 5084-90) on a representative sample of the clay liner and/or GCL. The extract from that test will then be analyzed according to Table 1.

Water representative of the potential non-leachate fluid sources will be used in conjunction with drill cuttings from both the Upper and Lower Dockum Units to establish a chemical baseline using the Meteoric Water Mobility Procedure (see Appendix A, *MWMP*). The MWMP will be used to test three samples representative of the lithologies (e.g., mudstone, siltstone and sandy siltstone) of both the Upper and Lower Dockum Units using each distinct non-leachate fluid type. If the water profiling discussed in the previous paragraph reveals that the different non-leachate fluids each have distinct profiles, each water type will be used to conduct the MWMP tests; otherwise, water representative of all the non-leachate fluids combined will be used. Cuttings will be collected for use in these tests during installation of the vadose zone monitoring wells. The extract from these tests will be analyzed according to the program described in Table 1. If it is determined that the solids are too fine to conduct the standard extraction method (column leaching) for the MWMP test (see

Appendix A), an alternative method will be used (i.e., bottle roll). These data will provide an indication of the chemical profile (in terms of major ion chemistry, radiochemistry and trace metals) of water that would occur as a result of Dockum sediments being subjected to non-leachate fluid sources. Certain constituents listed in Table 1, such as volatile organic compounds, are not expected to be detected during these tests, however their absence will be confirmed in case any natural organic materials (e.g., hydrocarbons) exist in the geologic materials.

Additionally, the samples collected of the Dockum cuttings during drilling will be used to analyze the material (solid) for background determination. These samples will be analyzed for heavy metals and radionuclides, as listed in Table 1, *Baseline Chemical Analyses*.

TABLE 1
BASELINE CHEMICAL ANALYSES

Analytes	Analytical Method	Sample Containers	Preservation Method/Holding Time
General Water Quality			
Bicarbonate/carbonate	EPA 310.1	250 ml HDPE	4°C / 48 hours
Chloride	EPA 300.0	125 ml HDPE	4°C / 28 days
Dissolved major cations (Na, K, Mg, Ca, Fe)	EPA 6010B	500 ml HDPE	4°C / pH < 2 with HNO_3 / 6mo.
Total dissolved solids	EPA 160.1	125 ml HDPE	4°C / 7 days
Sulfate	EPA 300	500 ml HDPE	4°C / 28 days
Heavy Metals			
Dissolved and total metals (Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl, Zn)	EPA 6010B/7000	1L HDPE	4°C pH < 2 with HNO_3 / 6mo.; Hg – 28 days
Radionuclides			
Gross alpha, gross beta, gamma emitters	EPA 900.0/901.1	250 ml CWM glass jar	4°C / 6 months
Uranium, total	EPA 200.8	250 ml CWM glass jar	4°C / 6 months
Radium 226/228	EPA 903/9320	250 ml CWM glass jar	4°C / 6 months
Radon	EPA 913	250 ml CWM glass jar	4°C / 6 months
Organics			
Volatile Organic Compounds	EPA 624	3 x 40 ml VOA vial	4°C pH < 2 with HCl / 14 days
Semi-Volatile Organics	EPA 625	1 liter HDPE	4°C / 7 days extraction, 40 days analysis
Pesticides	EPA 608	1 liter HDPE	4°C / 7 days extraction, 40 days
Polychlorinated biphenyls	EPA 608	1 liter HDPE	4°C / 7 days extraction, 40 days
Perchlorate	EPA 300	1 liter HDPE	4°C / 2 days
Cyanide	EPA 335.3	1 liter HDPE	4°C / 2 days
Sulfide, reactive	EPA 376.2	1 liter HDPE	4°C / 14 days
TPH-Gasoline	EPA 8015M	3 x 40 ml VOA vial	4°C / 7 days extraction, 40 days analysis
TPH-Diesel	EPA 8015M	1 liter glass	4°C / 14 days
Oil & Grease	EPA 9071	1 liter HDPE	4°C, H2SO4 / 28 days

Notes:

VOA - volatile organic analysis
CWM - clear wide-mouth jar
HDPE - high density polyethyrene bottles
HNO_3 - nitric acid
HCL - hydrochloric acid

4.0 MONITORING PROCEDURES

4.1 MONITORING FREQUENCY

Following installation, vadose zone sumps will be monitored for the presence of fluids daily and vadose zone wells monthly. The total depth of the vadose zone wells will also be measured each time the wells are monitored. Table 2, *Monitoring Frequency*, presents a summary of the monitoring program for the facility.

Table 2
Monitoring Frequency

Time Period	Landfill		Evaporation Ponds	
	Sumps	Vadose Wells	Sumps	Vadose Wells
Operation	Daily	Monthly	Daily	Monthly
Closure	Daily	Monthly	Daily	Monthly
Post-Closure	Semi-annually	Semi-annually	Semi-annually	Semi-annually

The Permittee shall inspect each neutron probe access tube, plus Vadose Zone Monitoring Wells 1, 2 and 3, every six months.

4.2 RESPONSE ACTIONS

The following response actions, plus those identified in Permit Part 7, will be conducted based on the outcome of each monitoring event.

- Liquid not present: no further action
- Liquid present: the fluids will be sampled and analyzed. All remaining fluids will be removed and properly disposed of.

If the source of water in the sumps or vadose monitoring well is determined to be non-leachate fluids, no further action will be conducted other than removing the liquid and mitigating the source, if possible (e.g., a break in the water supply system). As part of the source mitigation, the applicant will submit a written plan for determining and mitigating the source of the fluids to NMED for their approval within one week of its occurrence. If the source of the water is determined to be leachate fluids, corrective action steps will be taken, as described in the applicable permit module. Additionally, if the Action Leakage Rate (ALR) is exceeded, corrective action or contingency steps will be taken, as described in the applicable permit modules, to include an increase in the monitoring frequency to weekly for one month or until the ALR is reduced, whichever occurs first. All response actions will be assessed by an independent New Mexico Professional Engineer. Reporting commitments are described in Section 6.4.

If fluids are detected in one of the shallow wells, the depth of the fluids will be compared to the depth of the waste. This comparison will aid in evaluating whether the source of the fluids could be from the waste disposal units.

4.3 MONITORING METHOD

The sumps are fitted with a dedicated transducer fitted with a manual readout. Consequently, the readout will be recorded and documented manually at the frequency indicated in Table 2.

The wells will not be fitted with transducers and so will be monitored visually and manually, as listed below.

- A light source, such as a flashlight or mirror, will be directed down the well and used to inspect for a reflection off fluids.

- An interface probe, capable of detecting water as well as petroleum hydrocarbons, will be lowered down the well and used to measure the depth of any water and/or the thickness of any petroleum hydrocarbons present.

- If fluids or petroleum hydrocarbons are suspected, a clean disposable bailer will be lowered into the well to collect a sample of the fluid for visual inspection and confirmation of its presence prior to collecting any for laboratory analysis.

The interface probe will be decontaminated prior to using it at each well. The results of this monitoring will be documented.

The procedures and schedule for inspection and maintenance of the VZMS sumps are described in the Operations and Maintenance Manual included in the Permit Application. The wells will be visually inspected for damage or malfunction at the time of each monitoring event. Any problems will be communicated to the NMED and fixed in a timely manner.

4.4 SAMPLE COLLECTION

Consolidation water from prepared subgrade or GCL will be sampled for baseline characterization if and when it occurs. The most likely locations for consolidation water to collect are in the LDRS and VZMS sumps, as shown on Figure 5. As such, if it occurs prior to initial placement of waste in the landfill, it likely will represent consolidation water, provided there is no other significant source of fluids in the LDRS sump, like rainwater. If it is observed after initial placement of waste in the landfill, it will still be sampled, but may not represent consolidation water. The exact nature of that water will be determined at the time of occurrence.

If fluids are encountered in the sumps or vadose zone monitoring wells, samples will be collected as described below. The vadose zone monitoring sumps will each be equipped with a bladder pump. Samples will be collected from the pump using the minimal flow rate if sufficient volume exists in the sump. Laboratory analyses of samples will be completed by a chemical laboratory, as described in the WAP.

Groundwater is not anticipated in the vadose zone monitoring wells based on results from previous hydrogeologic investigations at the site. In the unlikely event groundwater is encountered following well installation, the wells will be initially sampled approximately one week after installation and development, or whenever water shows up.

Static water level measurements will be taken in the wells using an interface probe prior to sampling. Measurements will be taken to the nearest 0.01 foot from the surveyed reference point on the well casing. The interface probe will be cleaned between each well using a non-phosphate biodegradable detergent and fresh tap water followed by a distilled or de-ionized water rinse. New chemical-resistant disposable sample gloves will be used while collecting samples at each sump or well.

Following water-level measurement, well purging will commence and field measurements of pH, conductivity, temperature and turbidity will be recorded every 2 to 5 minutes to demonstrate parameter stabilization prior to sampling. Purging will be discontinued once the parameters have stabilized or when three well volumes of water have been purged from the well, whichever occurs first. If there is insufficient recharge for the well to fully recover within 12 hours , the well will only be purged once and sampled as soon as sufficient volume is recharged to the well, as per the guidelines in the Technical Enforcement Guidance Document (EPA, 1989). Groundwater samples will be collected using a disposable polyethylene bailer attached to a nylon rope. However, groundwater may also be collected from a submersible pump under a reduced flow to prevent volatilization if sufficient water exists.

Groundwater samples will be placed in appropriate containers provided by the laboratory. Table 1 indicates the appropriate sample containers, volumes and preservation required for each analyte. Samples will then be labeled and immediately placed in a refrigerated cooler for transport to the laboratory. Sample information will also be recorded in the field log book.

4.5 SAMPLE PRESERVATION AND TRANSPORTATION

After sealing the sample container, samples will be placed into a cooler as soon as possible and maintained at a temperature of approximately 4 degrees Celsius. Samples will be transported to the analytical laboratory at the end of each sampling event. Samples in breakable containers will be packed in such a way as to prevent breakage during transportation. Table 1 provides a summary of sample preservation and holding times required for each analyte.

4.6 QUALITY ASSURANCE SAMPLES

Duplicate samples will be collected in order to check the precision of laboratory analyses. Duplicates will be included for each parameter requested with samples sent to the laboratory and labeled so that the samples are not identified as quality assurance samples. Approximately one duplicate sample will be collected for each ten samples sent to the laboratory or one per sample batch, whichever is less.

One trip blank sample will also be sent with each cooler containing samples for volatile organics analysis. Blank samples will be labeled so that the samples are not identified as quality assurance samples.

4.7 CHAIN-OF-CUSTODY PROCEDURES

Chain-of-custody documentation will be used to ensure the integrity of samples from the time of collection to reporting of analytical results. This documentation will permit tracing of the possession and handling of samples from the time of collection through analysis and final disposition. Copies of the chain-of-custodies will be kept in the facility operating record.

Sample custody will be initiated at the time of sample collection by placing a label on the sample container and filling out a chain-of-custody form. Each sample collected will be identified in the chain-of-custody form. Each person handling the sample will be identified on the form.

4.8 FIELD EQUIPMENT

Field equipment required for collecting samples will include: sample containers; gloves; refrigerated cooler; sample labels; physical parameter meter; log book; and miscellaneous equipment.

Calibration of field equipment (e.g., pH meter or organic vapor meter) will be conducted at the beginning and end of each work day.

4.9 DECONTAMINATION

In order to prevent cross contamination between sampling sites, sampling equipment will be decontaminated according to the following procedures.

- Remove excess soil or other adhering substances
- Wash with a solution of non-phosphate detergent in tap water
- Rinse with tap water
- Double rinse with distilled water

Decontamination of all equipment that comes into direct contact with sampled media will be carried out between samples and prior to equipment leaving the site. If a pump and hose system is used, the system will be cleaned prior to each groundwater sampling event by pumping a non-phosphate detergent dissolved in fresh tap water followed by a double rinse with de-ionized water. Should bailers be necessary, an unused, disposable bailer will be used at each well to prevent cross contamination.

5.0 LABORATORY ANALYSIS

5.1 ANALYTICAL METHODS

Table 1 summarizes the analytical program for the baseline liquid characterization program, as well as for water detected in vadose zone monitoring wells and sumps. Detection limits will be below drinking water standards for applicable parameters. This analytical program is designed to "fingerprint" fluids associated with the landfill operations so that if water is detected in the vadose zone sumps or monitoring wells, the source of that water can be determined. As such, it may become justifiable to revise the vadose zone sump and monitoring well analytical program based on the results of the baseline liquid characterization program. NMED approval will be obtained prior to making any changes to the program.

5.2 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

Internal laboratory Quality Assurance/Quality Control procedures will include the following:

- Laboratory chain-of-custody tracking of samples.
- Instrument calibration using calibration check standards and laboratory blanks.
- Use of reagent and method blanks.
- QC spike samples (approximately one every 20 samples).
- Matrix spike samples (approximately one every 20 samples).
- Laboratory split sample duplicates (approximately one every 20 samples).
- Laboratory check standards (approximately one every 20 samples).

5.3 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

All analytical laboratory data will be presented as SW-846 [i.e., EPA SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition* (EPA, 1986)] documentation packages that provide the same level of detail as EPA Contract Laboratory Program (CLP) Level IV [see OLM02.1, *USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration* (EPA, 1990a) and OLM03.0, *USEPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration* (EPA, 1990b)]. A tabular key will be provided with the package that relates field/laboratory sample numbers to: 1) QA and QC samples; 2) cooler receipt form(s); 3) reporting requirements for organic and inorganic analyses; 4) reporting of internal QC results (e.g., laboratory blanks, surrogate spike samples, matrix spike samples, laboratory duplicates and/or matrix spike duplicate pairs, and laboratory control standards); and 5) identification of field duplicates and all types of blanks. Actual chromatograms will be provided for all samples analyzed by gas chromatography (GC) methods.

At a minimum, data package verification will include evaluation of sampling documentation and representativeness, technical holding time, instrument calibration and tuning, field and lab blank sample analyses, method QC sample results, field duplicates, compound identification and quantification, the presence of any elevated detection limits, and a summary of qualified data. All data will be flagged with appropriate qualifiers.

The data validation and verification procedures will include: 1) an initial review or verification of the completeness of individual data packages for each sample delivery group; 2) validation of the data using guidelines tailored to the type of analyses performed (i.e., organics, inorganics, or radiochemical); 3) resolution of data discrepancies, where possible, by liaison with the responsible laboratory; 4) qualification of data by flagging with appropriate codes, with emphasis on data usability for decision-making purposes; and 5) preparation of sample delivery group specific data assessment summaries and a narrative report.

6.0 DATA MANAGEMENT

6.1 FIELD DOCUMENTATION

Records of all field activities will be kept in the facility operating record and the following items will be used to document field activities

- Field log book
- Boring logs and well construction diagrams
- Well or sump sampling logs
- Chain-of-custody forms

Field log books will be maintained during the operating and post closure period of the facility and used to record details of work including daily activities, any deviations from sampling or quality assurance plans and equipment calibration.

Geologic boring logs will be produced by the field geologist during drilling activities. The logs will be prepared under the direct supervision of a qualified geologist or geotechnical engineer. Field logs will also be reviewed by the supervising geologist or engineer prior to finalization.

6.2 LABORATORY DOCUMENTATION

Once custody of a sample has been relinquished to the laboratory, complete documentation of the progress of the sample through the analytical process will be carried out by the laboratory. This will include a description of sample condition upon receipt, recording of sample receipt in the laboratory log book, documentation of steps in the analytical process and recording of the results of analysis.

6.3 LABORATORY REPORTING

The laboratory reports (Level IV Data Validation Packages) will include the information listed below.

- Sample number (as recorded on sample label and in field log book)
- Date sample received by laboratory
- Date of analysis
- Analysis performed

- Results of analysis
- Detection limits
- Reporting units
- Signatures of persons responsible for analysis

In addition, laboratory reports will include the raw data (e.g., chromatograms), copies of chain-of-custody forms and results of laboratory QC procedures indicating accuracy and precision of analytical results.

6.4 DATA ANALYSIS

Data analysis will include tabular and graphical representation, graphical comparison between various parameters and statistical analysis,if appropriate, to determine whether fluids detected in the VZMS during the monitoring period are from leachate fluids sources or not. The application of data analysis methods is dependent on the data reported during monitoring of the VZMS, if any.

Using primarily the baseline characterizations and the leachate fluid analyses (WAP), chemical profiles of the water types as well as a suite of appropriate analytical indicator parameters will be selected to be incorporated into the vadose zone monitoring program for leak detection during facility operation. The indicator parameters will be based primarily on the leachate fluid analyses, while the non-leachate fluids profiles will be based primarily on major ion chemistry established in the baseline, if available. Therefore, the indicator parameter list is expected to evolve as varying waste streams are accepted by the facility. In addition, all hazardous chemicals ever received at the facility will be considered as indicator parameters.

Analytical data from samples of fluids detected in the VZMS will be compared to the non-leachate fluids baseline characterizations and leachate fluids evaluations discussed in Section 3.0. These comparisons will be based on evaluating trilinear plots of major ion chemistry characterization (e.g., calcium, magnesium, potassium, sodium, bicarbonate, sulfate and chloride) and tabular and graphical summaries of metals/nonmetals, radionuclides, hydrocarbons and other constituents. Through these evaluations, an obvious correlation between the water types and concentration ranges of the monitoring sample to either the leachate fluids or non-leachate fluids characterization may be observed. If the monitoring sample data cannot be easily characterized as leachate fluid or non-leachate fluid, or if concentrations fall outside the ranges established during baseline characterization, the monitoring sample will be characterized using statistical methods. In this case, a tolerance or prediction interval statistical procedure will be applied, unless a more appropriate statistical method is identified.

In order to apply these statistics, it may become necessary to collect additional baseline data for non-leachate fluids to establish a more concrete background profile. The need for additional baseline sampling and analysis will be evaluated at the time of occurrence and evaluation of fluids in the VZMS.

Solid and liquid wastes accepted by the facility, as well as leachate fluids will be sampled and analyzed separately and individually as per the WAP. These data will be used to develop a list of indicator parameters (i.e., waste constituents) to monitor for in the VZMS and will be used to determine if fluids detected in the VZMS are in fact leachate fluids. Additionally, if based on these data it is not clear whether the fluids detected in the VZMS are leachate fluids or not, additional samples of any fluids present in the LCRSs and the evaporation ponds will be collected and analyzed for major ions and metals, as per Table 1. These data will then be used to develop a chemical profile of these waters at the time of occurrence of fluids in the VZMS and used to compare to the baseline non-leachate fluid profile(s) to aid in determining the source of fluids in the VZMS.

6.5 DATA REPORTING

Data will be summarized and presented to NMED on a quarterly basis. The report will include an executive summary that highlights any significant findings during the reporting period. The main body of the report will include discussions or summaries of the following topics listed below.

- Monitoring and sampling methodology
- Current and historical analytical results
- Current and historical fluid levels, if applicable
- VZMS inspection and maintenance results
- Volumes of fluids removed from all monitoring points, including the LCRSs and LDRSs
- Significant historical changes in fluid levels or fluid chemistry (e.g., leachate fluids)
- A cumulative list of chemicals managed in the regulated units, as identified in the WAP.

The report will also include the items listed below.

- Maps illustrating facility waste management units and monitoring sump and well locations
- Maps illustrating groundwater depth, gradient and flow direction (if appropriate)
- Map (plan view or cross-section) illustrating groundwater pathways (if appropriate)
- Graphs and/or tables depicting water quality
- Laboratory documentation, chain-of-custody and QA/QC documentation
- Copies of well and sump sampling logs and other pertinent documentation
- Conclusions and recommendations

If fluids are detected in either the sumps or wells, NMED will be notified within 24 hours. Subsequently, an additional report (i.e., not a regularly scheduled quarterly report) will then be submitted to NMED within 14 days of fluid appearance. This report will include an assessment of the amount and source of the fluids; the possible size, location, and cause of the leak; and the seriousness of the any leak in terms of potential releases to the environment. It will also include a summary of any immediate short or long term response actions to be taken. The report will also include those items listed below.

- Monitoring results from the sumps and wells (volumes/fluid levels and analytical results)
- A comparison to the baseline characterization results
- Analytical results for all fluids

Within 30 days of fluid appearance, a report will be submitted to NMED describing the effectiveness of the response actions. Monthly reports will be submitted to NMED as long as fluids are present in the VZMS.

6.6 DATA STORAGE

All completed data analyses and reports from this project will be stored electronically. Copies of the electronic data and hard copies of the data and laboratory reports will be placed in the facility record during the operating and post-closure periods.

7.0 HEALTH AND SAFETY

If there is reasonable potential for exposure to toxic compounds, field personnel will be required to have current certification of 40-hour health and safety training per OSHA 29 CFR 1910.120(e). Personnel will adhere to proper health and safety protocols as described in a separate Health and Safety Plan that will be submitted to NMED for review and approval prior to initiation of Work Plan activities. The selected contractor will also provide a health and safety plan relating to their operation (e.g. drilling equipment).

A Health and Safety Officer (HSO) will be designated that will be responsible for monitoring potentially hazardous situations during all field activities, ensuring that all personnel know the potential physical and chemical hazards and are trained in the proper use of personal protective equipment (PPE). It is anticipated that safety Level D will be the highest level of PPE necessary (i.e., work clothes, hard hats, steel-toed boots and safety glasses). The HSO will make the decision when it is necessary to upgrade to a higher level of PPE. The HSO will also conduct periodic air monitoring (documented following Rule 1166-type requirements) and determine if conditions require an immediate termination of work.

8.0 REFERENCES

Environmental Protection Agency, 1989, Technical Enforcement Document.

Montgomery Watson Mining Group, October 1999, Groundwater Monitoring Waiver Request, Triassic Park Waste Disposal Facility.

TerraMatrix, Montgomery Watson, December 1997 (Revised November 1998), Design Drawings, Triassic Park Waste Disposal Facility, Chaves County, New Mexico.

TerraMatrix, Montgomery Watson, December 1997 (Revised January 2000), Design Drawings, Triassic Park Waste Disposal Facility, Chaves County, New Mexico.

APPENDIX A
METEORIC WATER MOBILITY PROCEDURE

Original Draft, June 1995
Second Draft, July 31 and August 1, 1995
Third Draft, November 1995
Fourth Draft, January 1996

METEORIC WATER MOBILITY PROCEDURE
(MWMP)
Standardized Column Percolation Test Procedure

1. Scope
The purpose of the Meteoric Water Mobility Procedure (MWMP) is to evaluate the potential for dissolution and mobility of certain constituents from a mine rock sample by meteoric water. The procedure consists of a single-pass column leach over a 24 hour period using a mine rock sample to extraction fluid (effluent) ratio of 1:1. The extraction fluid is Type II reagent grade water.

2. Reference Documents
   2.1 Meteoric Water Mobility Procedure, Bureau of Mining Regulation and Reclamation, Nevada Division of Environmental Protection, 9/19/90.
   2.2 Standard Methods for the Examination of Water and Wastewater, 18th edition, APHA/AWWA/WEF, 1992, Method 1080.

3. Significance and Use
   3.1 This procedure is intended as a means for obtaining extracts from mine rock samples. The extracts may be used to evaluate the final pH and release of certain consituents of mine rocks exposed to meteoric events.
   3.2 The pH of the extraction fluid used in this procedure is to reflect the pH of precipitation in the geographic region in which the mine rock is being evaluated (in this case, the State of Nevada).
   3.3 This procedure is designed to mobilize potential contaminants present in the solids, so that the resulting extract can be used to assess leachate which could potentially be produced from mine rock in the field.
   3.4 This procedure produces extracts that are amenable to the determination of both major and minor (trace) constituents. When minor constituents are being determined, it is especially important that precautions be taken in sample storage and handling to avoid possible contamination of the samples.
   3.5 This procedure may not be suitable for obtaining extracts from finely divided solids (such as clayey soils, sludges, mill tailings, etc.). An alternate extraction procedure may then be advised.

4. Apparatus
   4.1 Extraction Device, PVC column of 15 cm (6") O.D. of sufficient height to contain a minimum of 5 kg of minus 5 cm (2") mine rock sample and sufficient additional height to contain applied extraction fluid should blinding (ponding) occur. (Approximately 8 kg of minus 5 cm solids per 30.5 cm of column height). For a 5 kg mine rock sample, a 15 cm O.D. x 45 cm high column is recommended. Additional column height will be required for mine rock sample quantities greater than 5 kg. The bottom of the column must be sealed (bubble cap) and a solution discharge outlet situated above the sealed bottom of the column and below the "punch plate". A drawing of the extraction device is appended.
   4.2 Glass Wool (inert) - glass wool is placed onto the "punch plate" before loading the mine rock charge into the column to minimize

fines migration and onto the top of the mine rock charge after column loading to aid even extraction fluid distribution.

4.3 Metering pump or constant head device to insure constant rate extraction fluid application

4.4 Extraction fluid (influent) and effluent containers sufficient in size to contain liquid used during extraction. Containers must be covered to avoid possible contamination from sources outside the test apparatus.

4.5 Laboratory balance capable of weighing to 1.0 g.

4.6 Drying pans or dishes for moisture content determinations.

4.7 pH meter with a readability of 0.01 units and an accuracy of 0.05 units at 25øC.

4.8 Filtration assembly device of a composition suitable to the nature of the analyses to be performed and equipped with a 0.45 um pore size filter. An assembly for prefiltration or centrifugation may be required if 0.45 m filtration is difficult.

4.9 Tubing - surgical or Tygon tubing sufficient in diameter and length for the extraction device assembly (pump, column effluent outlet).

5. Reagents

5.1 Water, Type II reagent grade - Water purified by distillation, ion exchange, reverse osmosis, electrodialysis, or a combination thereof, conforming to the specifications for Type II reagent grade water.

6. Sampling (Field)

6.1 Field sampling should be accomplished to insure a representative mine rock sample is obtained.

6.2 The minimum quantity of mine rock sample required for the MWMP is 5 kg. At least 7 kg of mine rock sample should be submitted to the laboratory for feed moisture content determination, MWMP, and other potential analyses requested by the submitting company. Mine rock samples of up to 25 kg are appropriate for submittal.

6.3 It is important that the mine rock sample be representative with respect to surface area, as variations in surface area may directly affect the leaching characteristics of the sample. Mine rock samples should contain a representative distribution of particle sizes.

6.4 Keep samples in closed containers (bags, buckets) appropriate to sample type and analysis for transport to the laboratory.

7. Sample Preparation (Laboratory)

7.1 Remove mine rock sample from the container and blend by coning or rolling and obtain sample for feed moisture content (÷1 kg).

7.2 Screen remainder (5 kg or more) on a 5 cm (2") screen. Save minus 5 cm material for subsequent recombination with crushed plus 5 cm material.

7.3 After screening, weigh plus and minus 5 cm screened materials and calculate
plus and minus 5 cm weight distributions.

Ex: (wt of +5 cm)/(total wt) x 100 = % plus 5 cm.

7.4 Crush (may hand break) plus 5 cm material to just pass a 5 cm (2") screen and recombine with the screened minus 5 cm material.

7.5 Thoroughly blend the recombined 100% minus 5 cm mine rock sample, and using the feed moisture content (7.1 above), calculate the dry weight of the sample to insure a minimum of 5 kg (dry weight) is available for the MWMP extraction (column percolation) test.

7.6 Load the 100% minus 5 cm mine rock sample into the extraction device (column). To minimize particle segregation and compaction during column loading, the sample shall be dropped from no more than 24 inches when introduced from the top of the column, and no tamping, shaking, or other methods to compact the sample will be employed.

8. Extraction Procedure

8.1 Adjust the extraction fluid application rate such that the number of milliliters of water applied to the column in a 24 hour period will be equal to the number of dry grams of mine rock sample in the column.
Ex: 5000 g x 1 ml/g x 1 hr/60 min x 1/24 hr = 3.47 ml/min

8.2 Measure and record the initial pH of the extraction fluid.

8.3 Begin metering the extraction fluid onto the top of the mine rock contained in the column at the predetermined rate.

8.4 When a volume equal to the mass of dry solids in the column has been delivered through the column (assume 1 ml/g), cease application of the extraction fluid.

Note: The mine rock charge will retain water so extraction fluid application must continue until the target effluent volume (1:1 solids to effluent ratio) has been collected. This will require application time beyond 24 hours, but not to exceed 48 hours.

8.5 Thoroughly mix the effluent immediately. Then procure sufficient quantity for the required analyses (usually Profile I or Profile II).

8.6 Measure and record the pH of the extract.

8.7 Filter the sample through a 0.45 m inert membrane to obtain extract for dissolved constituent analyses.

8.8 Preserve the extract sample appropriately for the required analyses.

8.9 Allow the mine rock solids, after extraction, to drain until the surface of the sample no longer "glistens" and at least two minutes elapse between drops of effluent from the column.

8.10 Remove the mine rock residue (solids) from the column and take a representative portion for residual moisture determination.

8.11 Blend and split the moist mine rock residue to obtain samples for additional analysis if necessary.

8.12 If it is evident at Step 8.3 that the particle size of the sample (finely divided solids such as clayey soils, sludges, mill tailings, etc.) is not allowing reasonable percolation of the extraction fluid to occur, aborting the extraction procedure and submitting the sample to an alternate extraction procedure may be advised.

9. Reporting (record and report the following to NDEP)

9.1 pH of extraction fluid (influent).

9.2 pH of effluent after extraction.

9.3 Total dry weight of mine rock sample used for MWMP.

9.4 Feed and retained (after extraction and draining) moisture contents.

9.5 Time of contact in the extraction device.

9.6 Procedures (synopsis) used for MWMP extraction, effluent filtration, and extract preservation.

9.7 Results of Profile I or Profile II analyses on extract.