Additional Information
Application for Significant Modification
Permit No. 2005-070
Log No. 2008-054

Clinton Landfill No. 3

0390055036 – DeWitt County

Submitted to:

Illinois Environmental Protection Agency
Bureau of Land
1021 N. Grand Avenue East
Springfield, Illinois 62794

Submitted by:

Clinton Landfill, Inc.
4700 North Sterling Avenue
P.O. Box 9071
Peoria, Illinois 61612-9071

January 23, 2009

Volume 1 of 1

PDC Technical Services, Inc.

January 23, 2009 PDC Project No. 91-118.31

Mr. Stephen F. Nightingale, P.E.
Manager, Bureau of Land – Permit Section
Illinois Environmental Protection Agency
1021 North Grand Avenue
P.O. Box 19276
Springfield, Illinois 62794-9276

Re: 0390055036 -- DeWitt County
Clinton Landfill No. 3
Log No. 2008-054
Permit File

Dear Mr. Nightingale:

On behalf of Clinton Landfill, Inc. (CLI), PDC Technical Services, Inc. (PDC) and Shaw Environmental, Inc. (Shaw) are providing additional information related to the previously submitted application to redesign approximately 22.5 acres of the southwest corner of Clinton Landfill No. 3 (Log No. 2008-054). This additional information is provided in response to the Illinois Environmental Protection Agency's (IEPA's) draft denial letter that was transmitted to CLI on July 2, 2008. Shaw, on behalf of CLI, submitted documentation to the IEPA on January 13, 2009 in response to the IEPA's draft denial letter that was transmitted to CLI on August 13, 2008.

The following provides the July 2, 2008 draft denial points (in bold), immediately followed by CLI's responses.

1. **The revised closure plan provided does not mention the Rail-Off Loading Facility or the Waste Processing Facility to manage excessively dusty wastes. Construction of the Rail-Off Loading Facility was approved in Modification No. 2, while construction of the Waste Processing Facility was approved in Modification No. 3.**

   Response: Neither the Rail Off-Loading Facility nor the Waste Processing Facility was approved as of the date that the subject application was submitted. The facility Closure Plan has been revised to incorporate the Rail Off-Loading Facility, Waste Processing Facility, and landfill units (MSW Unit and Chemical Waste Unit). The revised Closure Plan is provided as Appendix A.

2. **Section 812.108.1 (Page 3) of the application states that Asbestos Containing Waste Materials (ACWM) will be accepted at the Municipal Solid Waste (MSW) unit. Condition No. II.9 of Modification No. 1 states that ACWM shall not be accepted until a revised operating plan including appropriate NESHAPS requirements have been submitted to and approved by the Illinois EPA. The revised operating plan provided in this application only applies to the Chemical Waste Unit. No change is proposed to the MSW operating plan.**

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Response: CLI acknowledges the requirement for revising the Clinton Landfill No. 3 MSW Unit Operating Plan prior to accepting ACWM at Clinton Landfill No. 3. CLI will submit a separate significant modification application for this purpose.

3. **As per the application the redesigned components comply with the requirements of 35 Ill. Adm. Code Part 724. The following issues regarding compliance with the requirements of 35 Ill. Adm. Code Part 724 were noted:**

   a. **Pursuant to 35 Ill. Adm. Code 724.401(c)(3)(A) the leak detection system must be constructed with a slope of one percent or more. From the information provided in the application it is not possible to ascertain the slope of the redundant leachate layer.**

   b. **Pursuant to 35 Ill. Adm. Code 724.401(c)(5), the operator of a leak detection system that is not located completely above the seasonal high water table shall demonstrate that the operation of the leak detection system will not be adversely affected by the presence of groundwater. The application does not discuss compliance with 35 Ill. Adm. Code 724.401(c)(5).**

Response: CLI's responses to these comments are provided in Appendix B to this letter.

4. **The material properties for chemical wastes (Appendix A.2 – Table 1) are based on testing wastes from a single source. The application does not demonstrate that these properties accurately represent the types of wastes that will be received at Chemical Waste Unit (CWU).**

Response: CLI's response to this comment is provided in Appendix B to this letter.

5. **Drawing D-17 shows interim conditions of the landfill. As per this drawing and the Stormwater Management Plan provided in Attachment 4 a separation berm between the CWU and MSW units will have a ditch to collect runoff from the areas sloping towards the separation berm. Water entering the ditch will be pumped into the perimeter ditches. The application shall include additional details about conveying of surface water from the separation berm to Sedimentation basin B.**

Response: CLI's response to this comment is provided in Appendix B to this letter.

6. **As per the Design Report provided in Attachment 2 excavation face with circular failure (long and short term; static and seismic conditions) was modeled. However, the stability runs for this scenario were not included in the Appendix A.2.**

Response: CLI's response to this comment is provided in Appendix B to this letter.

7. **Pursuant to 35 Ill. Adm. Code 812.302 an application for landfill that accepts chemical wastes shall include results of a waste analysis showing that the wastes to be accepted at the facility meet the definition of chemical wastes. The analysis shall show that all wastes entering the unit will be compatible and will not react to form a hazardous substance or gaseous product. This information required by 35 Ill. Adm. Code 812.302 was not provided in the application.**

   Response: The CWU will only accept non-hazardous pollution control wastes, industrial process wastes and various wastes contaminated by PCBs (including, but not limited to PCB Articles, PCB Containers, PCB Bulk Product Waste, etc.). Based upon our experience, some of these wastes (particularly dredged contaminated river or lake sediments) might have nominal amounts of organic debris. It is also possible that the CWU will accept PCB-contaminated wastes from landfill remediation projects. While the organic materials within these wastes could (at least theoretically) meet the 35 Ill. Adm. Code Part 810.103 definition of putrescible wastes, CLI considers it very unlikely that significant malodors or gases will result due both the limited volume of such organic materials in the overall waste mass, and the consistency of the waste mass which will inhibit water and gas migration.

   The Chemical Waste Unit Operating Plan has been revised to require that all wastestreams accepted for disposal to be tested and reviewed by CLI's Waste Acceptance Committee to ensure that the various wastestreams will not interact and form hazardous gases. The revised Chemical Waste Unit Operating Plan is provided in Appendix C to this document.

   In addition to the above, CLI will install and monitor two gas monitoring wells within the CWU and four perimeter gas probes (PGP-14, PGP-16, PGP-17, and PGP-18) around the exterior perimeter of the CWU Unit. Proposed locations are shown on revised Drawing D16, provided in Appendix D. The interior gas monitoring wells will be installed once the landfilled waste grade at each location reaches Elevation 750 feet. Once installed, CLI proposes to monitor the interior gas monitoring wells on a quarterly basis during the remainder of the CWU active period and on an annual basis during the post-closure care period for the parameters listed at 35 Ill. Adm. Code Part 811.310(d)(1). The perimeter gas probes will be monitored in accordance with the requirements of 35 Ill. Adm. Code Part 310(c) and (d).

8. **Pursuant to 35 Ill. Adm. Code 811.304(f) the potential for an earthquake or blast induced liquefaction, and its effect on the stability and integrity of the unit shall be considered and taken into account in the design. The potential for landslides or earthquake induced liquefaction outside the unit shall be considered if such events could affect the unit. The stability analyses provided in the application does not address the requirements of 35 Ill. Adm. Code 811.304(f).**

   Response: CLI's response to this comment is provided in Appendix B to this letter.

9. **Pursuant to 35 Ill. Adm. Code 811.306(b) the liner and leachate collection system side slopes shall have a minimum factor of safety of 1.3 for static and 1.0 for seismic conditions**

at all times. The stability analyses provided in the application do not address the requirements of 35 Ill. Adm. Code 811.306(b).

Response: CLI's response to this comment is provided in Appendix B to this letter.

10. **Pursuant to 35 Ill. Adm. Code 811.308(g) the leachate collection system shall be equipped with a sufficient number of manholes and cleanout risers to allow cleaning and maintenance of all pipes throughout the design period. The details of the leachate collection system provided in Drawing Nos. D-8 and D-9 do not include details of the leachate cleanouts and leachate level monitoring locations.**

    Response: CLI's response to this comment is provided in Appendix B to this letter.

11. **Pursuant to 35 Ill. Adm. Code 811.309(b) the leachate management system shall consist of any combination of multiple treatment and storage structures, to allow management and disposal of leachate during routine maintenance and repairs. The application does not address the requirements specified in 35 Ill. Adm. Code 811.309(b).**

    Response: The leachate management system employs multiple treatment and storage structures to allow management and disposal of leachate during routine maintenance and repairs. As demonstrated in Section 812.308.2 of the February 2008 application, the maximum volume of leachate that is expected to be generated at the Chemical Waste Unit (CWU) is less than 20 gallons per day. As a result, only a limited volume of storage and treatment capacity is required to ensure that the leachate is effectively managed and disposed. Regardless, a 35,000 gallon double-wall underground storage tank (UST) will be installed to store leachate from the CWU. This large surplus volume of onsite storage capacity will provide sufficient onsite storage time to account for any disruptions to the processes used to treat leachate. With this in mind, the following leachate management systems provide the required multiple treatment and storage structures to allow management and disposal of leachate during routine maintenance and repairs:

    1. Transporting the leachate to an offsite commercial or municipal wastewater treatment facility for treatment and disposal. Numerous facilities are available for this purpose, including the Peoria Disposal Company commercial wastewater treatment facility in Peoria, Illinois. Besides the large surplus leachate storage capacity available at the CWU, most commercial, and many municipal, wastewater treatment plants maintain sufficient storage to accept leachate during routine maintenance or repairs to their treatment processes.

    2. Solidifying the leachate, and disposing the solidified leachate in the CWU or other permitted landfill. The limited volume of leachate that will be generated is cost-effectively amenable to solidification and disposal as a solid waste.

    3. Mobilizing a portable above ground leachate storage tank with secondary containment in the event the 35,000 gallon UST at the CWU requires maintenance or repairs. These types of tank systems are readily available from vendors such as Baker Tanks and Rain For Rent (see example, Appendix E).

12. Pursuant to 35 Ill. Adm. Code 811.309(e)(2) the operator is responsible for securing permission from offsite treatment works for authority to discharge to the treatment works. Application Log No. 2005-070 included information complying with the requirements of 35 Ill. Adm. Code 811.309(e). However, this application has to demonstrate that the information provided in Log No. 2005-070 remains valid for the CWU. Additionally, the application has to demonstrate that the unit cost of treating leachate from the CWU is the same as that for the MSW Unit.

Response: A letter from a commercial wastewater treatment facility demonstrating their ability, and fees, to accept leachate from the CWU is provided in Appendix F. A cost estimate to transport, treat and dispose of leachate from the CWU via the Peoria Disposal Company wastewater treatment facility is provided in Appendix G. Revised closure / post-closure care cost estimates are provided in Appendix H. The revised post-closure care cost estimates incorporates the following revisions:

- Updated leachate transportation and disposal costs provided in Appendix G,
- Updated leachate volumes for the CWU based on the revised HELP modeling provided by Shaw in their January 13, 2009 submittal to the IEPA,
- Costs to sample and analyze groundwater from three additional groundwater monitoring wells. The additional groundwater monitoring wells were added to the groundwater monitoring program in the Shaw January 13, 2009 response to comments from the IEPA,
- Updated leachate and groundwater analytical costs to reflect the revised analytical program included in the Shaw January 13, 2009 response to comments from the IEPA. Documentation of the updated leachate and groundwater analytical costs are provided in Appendix I,
- Revised leachate and groundwater sampling and analysis frequency to correspond to the frequencies included in the facility's current permit,
- Corrected duration of flare station/wellfield operations at the MSW Unit during post-closure care following premature closure, and
- Addition of closure costs for the Rail Off-Loading Facility and Waste Processing Facility.

13. Interface requirements for geomembrane and geocomposite drainage layers have changed. The application has to demonstrate that the stability analysis for the interim conditions for the municipal solid waste unit provided in Log No. 2005-070 remain valid.

Response: The stability analyses provided under Log No. 2005-070 were conducted for three critical interim conditions: 1) Sidewall Liner Excavation, 2) Active Phase – Initial Stage of

Development, and 3) Active Phase – Maximum Slope Height. Stability analyses for the critical Post-Design Phase were also provided under Log No. 2005-070.

The cross-sections that were analyzed as part of the stability analyses performed under Log No. 2005-070 are still considered representative of, and applicable to, the critical sections for the MSW Unit. Post-Design Phase stability analyses considering the effect of the CWU were included in the February 2008 submittal under Log No. 2008-054.

The following geosynthetic material interface shear strengths were used in the stability analyses provided under Log No. 2005-070:

Sidewall Liner System interfaces (i.e. sidewall geomembrane vs. geocomposite drainage layer, and sidewall geomembrane vs. Earth Liner):

Static Analyses	Seismic Analyses
Φ = 10 degrees	Φ = 15 degrees
c = 0 psf	c = 0 psf

Floor Liner System interfaces (i.e. floor geomembrane vs. sand drainage layer, and floor geomembrane vs. Earth Liner):

Static Analyses	Seismic Analyses
Φ = 10 degrees	Φ = 16 degrees
c = 0 psf	c = 0 psf

As previously demonstrated under Log No. 2005-070, residual interface shear strengths are appropriate for evaluating static conditions, whereas peak interface shear strengths are appropriate for evaluating seismic conditions.

The geosynthetic material interface friction values included in the specifications previously submitted under Log No. 2008-054 meet or exceed the interface shear strengths used in the stability analyses previously submitted under Log No. 2005-070.

14. The presence of the geosynthetic clay liner in the bottom liner of the CWU was not accounted for in the stability analysis. No interface requirements have been specified in the Technical Specifications for the geosynthetic clay liner.

Response: CLI's response to this comment is provided in Appendix B to this letter.

15. The Operating Plan proposes to solidify liquid PCB wastes. The use of cements, bentonite or 'other products' as reagents is proposed. The application has to include a complete list of reagents that will be used as reagents to solidify PCB liquids.

Response: The Chemical Waste Unit Operating Plan has been revised to indicate the reagents that may be used to solidify liquid PCB wastes. The revised Chemical Waste Unit Operating Plan is provided in Appendix C.

Notes:

a. **Page 13 of the Operating Plan states that 'PCBs and PCB items will be placed in a manner that will prevent damage to containers or articles'. Please provide a clarification as to what containers and articles are being referred to.**

Response: The Chemical Waste Unit Operating Plan has been revised to clarify the meaning of "containers and articles." The revised Chemical Waste Unit Operating Plan is provided in Appendix C.

b. **As per the application sidewall liner is to be cover with 18-inches of soil or select waste. Please provide a clarification about what select waste means.**

Response: The Chemical Waste Unit Operating Plan has been revised to clarify the meaning of "select waste." The revised Chemical Waste Unit Operating Plan is provided in Appendix C.

As described in the response to IEPA comment 3a, portions of the floor of the CWU have been raised slightly in order to maintain a minimum 1 percent slope on the redundant leachate collection system. This has slightly reduced the CWU airspace from 2,552,925 airspace cubic yards (ascy) to 2,529,506 ascy. Pages 4 and 5 of the application have been revised to reflect this change, and are provided in Appendix J.

We trust that this letter and appendices provide the information needed to approve the subject permit application. Please call Mr. Ron Edwards (CLI) at 309-676-4893 or the undersigned at 309-495-1566 if you have any questions or comments.

Sincerely,
PDC Technical Services, Inc.
Ill. Professional Design Firm 184-001145

George L. Armstrong, P.E.
Principal Engineer

cc: Ron Edwards
Gary Yaste
Shaw Environmental, Inc.

Appendices

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TABLE 1 – List of Appendices

APPENDIX	DESCRIPTION
A	Closure Plan (revised January 2009)
B	Responses to IEPA Draft Denial Points 3 through 6, 8 through 10, and 14. Prepared by Shaw Environmental, Inc.
C	Chemical Waste Unit Operating Plan (revised January 2009)
D	Drawing D16 - Landfill Gas Management System (revised January 2009)
E	General information regarding rental leachate tanks and secondary containment
F	Letter from Peoria Disposal Company regarding leachate disposal
G	Leachate transportation and disposal unit cost estimate
H	Revised Closure / Post-Closure Care Cost Estimates
I	Updated leachate and groundwater analytical costs
J	Revised application pages 4 and 5

APPENDIX A – CLOSURE PLAN (revised January 2009)

CLOSURE PLAN

Clinton Landfill No. 3

0390055036 – DeWitt County

January 2009

Prepared for: **Clinton Landfill, Inc.**

4700 N. Sterling Avenue

Peoria, Illinois 61615

Prepared by: **PDC Technical Services, Inc.**

4349 Southport Road

Peoria, Illinois 61615

PDC Project No. 91-0118.31

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CLOSURE PLAN

This Closure Plan describes the closure activities that will be performed at Clinton Landfill No. 3 in compliance with 35 Ill. Adm. Code Part 811.114. The facility configuration after closure of all units is illustrated on the approved drawings. The approved drawings show the final topography contours (after placement of the final cover) of all disturbed areas. The drawings also show the location of all facility-related structures that will remain as permanent features after closure.

The final configuration of the facility is designed to minimize the need for further maintenance following closure. Specific features of the design that accomplish this include:

- The overall final landfill slopes are mild with a grade of 4:1 (horizontal to vertical).
- The final cover design includes terraces and storm water letdown pipes with energy dissipaters. These features are incorporated to protect the final cover from erosion.
- The final cover vegetative cover is comprised of a hearty blend of grasses that have demonstrated effectiveness at landfills in the central Illinois climate.
- The perimeter ditches have been designed for the worst-case peak flow, i.e. that prior to establishment of vegetative cover. The vegetative cover will significantly reduce the peak flows in the perimeter ditches, which will ensure long-term protection against erosion and scour.
- No structure will be constructed over the unit.

812.114.1 Routine Closure Activities

Routine closure is closure at the end of the intended Operating Life. As detailed in Section 812.108 of the Application for Significant Modification, dated February 1, 2008 (Log No. 2008-459), the Operating Life is estimated to be 41 years. Therefore, assuming the landfill opens in year 2009, Routine Closure is expected to occur in the year 2050.

The Rail Off-Loading Facility, Waste Processing Facility, and Solidification Unit will be closed either prior to, or concurrent with, final closure of the Clinton Landfill No. 3 landfill units.

Final grades at closure are shown on the approved drawings. The closure activities will be performed in accordance with the applicable Specifications and Construction Quality Assurance (CQA) Plan sections. Steps necessary to close the facility at the end of the intended Operating Life are detailed below:

Equipment Decontamination: Equipment decontamination will consist of removing accumulated waste and pressure washing the landfill, Waste Processing Facility and Rail Off-Loading Facility equipment that has been in contact with the waste. Wash waters will be collected and either solidified and disposed at the facility in accordance with the facility's permit, or disposed offsite. Equipment used to construct the final cover will not contact waste and, therefore, will not require decontamination.

Solidification Unit: All waste will be removed from the solidification containers and disposed in the landfill. The containers will then be pressure washed as necessary to remove waste residuals, and removed from the site. All stockpiles of reagents and adsorbents will also be removed.

Remove All Unnecessary Equipment and Structures: All equipment and structures that are not necessary for the post-closure land use will be removed. This will include removing the scales, solidification reagent silos and other containers, landfill operations equipment (bulldozers, compactor, backhoe, etc.), Rail Off-Loading Facility equipment and structures, and the Waste Processing Facility equipment and structures. Additional details of the closure activities for the Rail Off-Loading Facility and Waste Processing Facility follow.

Rail Off-Loading Facility: Rail Off-Loading Facility operations equipment (bulldozers, compactor, backhoe, excavators, container handling equipment, intermodal containers, etc.), and rail track within the Facility Boundary will be removed upon closure of the Rail Off-Loading Facility. The roof structure above the Gondola Car Off-Loading Area and off-loading equipment platforms will be pressure washed until visibly clean of any waste materials. The roof structure, litter screen, platforms, rails, and railroad ties will be dismantled and either recycled or disposed in an approved landfill. All visibly impacted gravel within the Gondola Car Off-Loading Area will be removed and disposed in an approved landfill.

Soil samples will be taken from within the Gondola Car Off-Loading Area and analyzed for constituents consistent with the types of waste off-loaded at the facility to confirm that the facility has been adequately closed. Four sample locations from within the Gondola Car Off-

Loading Facility will be selected at random by the CQA Officer. Soil samples will be collected at 0 to 6 inches beneath the ground surface. An additional sample will be collected at 0 to 6 inches beneath the gravel subgrade in areas where the gravel is not completely removed.

Soil samples will be analyzed for volatile organics (SW 846 Method 8260), and the eight RCRA metals. The metals will be analyzed for total concentrations, and leachable concentrations by the Toxicity Characteristic Leaching Procedure (TCLP). In addition to the above, samples will be analyzed for polychlorinated bi-phenyls (PCBs) if the Gondola Car Off-Loading area is used to transload wastes exhibiting PCBs at concentrations greater than 50 parts per million (ppm). Samples will also be analyzed for polynuclear aromatic hydrocarbons (PNAs) in the event wastes from manufactured gas plant (MGP) sites are transloaded at the Gondola Car Off-Loading Area.

The analytical data will be compared to Illinois Environmental Protection Agency (IEPA) Soil Remediation Objectives (SROs) contained at 35 IAC 742. Additional samples will be collected and analyzed in the event soils exceed their applicable SROs in order to delineate the extent of impacts.

The CQA Officer will document the Rail Off-loading Facility closure activities, and prepare and submit to the IEPA a report of their observations, sample results, etc. with the facility's closure report.

The ground surface of the Rail Off-Loading Facility will be subsequently graded to properly drain and vegetated as required for erosion control.

<u>Waste Processing Facility</u>: All solid wastes and other materials above the waste processing cell Earth Liner (e.g. geomembrane, sand drainage layer, geotextile, and random fill) will be removed and disposed in the Clinton Landfill No. 3 active face. All liquids collected from the waste processing cell, and any remaining liquid wastes accepted for solidification, will be solidified and disposed in the Clinton Landfill No. 3 active face or transported to a permitted wastewater treatment facility for treatment prior to discharge.

Visible waste residues from the waste processing building floor will be removed and disposed in the Clinton Landfill No. 3 active face. The waste processing building will then be dismantled and disposed in the Clinton Landfill No. 3 active face. Alternatively, the interior of the waste processing building will be power washed to remove visible waste residues. The waste processing building will then be dismantled and removed from the site for reuse or recycling. All liquids collected from power washing will be captured, solidified, and disposed in the Clinton Landfill No. 3 active face, or transported to a permitted wastewater treatment facility for treatment prior to discharge.

Once the building is removed, the ground surface at the Waste Processing Facility site will either be graded to drain into one of the Clinton Landfill No. 3 sediment basins, or will be vegetated (or otherwise stabilized) to protect the disturbed area from erosion.

The CQA Officer will document the Waste Processing Facility closure activities, and prepare and submit to the IEPA a report of their observations with the facility's closure report.

Install Gas Extraction Wells and Piping: Gas extraction wells and associated piping will be installed during routine closure. The gas collection system will be installed in accordance with the facility's approved design details and specifications.

Final Cover Barrier Soil: The final cover includes a minimum 12-inch thick compacted low permeability Final Cover Barrier Soil. Final Cover Barrier Soil materials will be derived from onsite excavations or stockpiles of clay previously excavated from the site. Final Cover Barrier Soil construction includes foundation preparation, Final Cover Barrier Soil placement and compaction. Final Cover Barrier Soil construction will be in conformance with the facility's approved design details and specifications. The site has a substantial positive earth balance; therefore, an adequate volume of earth materials will be available onsite for final cover construction.

Geomembrane Installation: A 40 mil high density polyethylene (HDPE) geomembrane will be installed over all landfill units. Geomembrane installation includes subgrade preparation, geomembrane placement and anchoring. The final cover geomembrane materials and installation will conform to the facility's approved design details and specifications.

Vegetative Cover: An at least 3-feet-thick vegetative cover will be placed over the geomembrane in accordance with the facility's approved design details and specifications. The vegetative cover materials will be derived from onsite excavations or stockpiles of soil excavated during landfill development. These soils are expected to predominantly consist of silty clays and silts capable of supporting vegetation. An adequate volume of these soils is available for closure. The upper 12 inches (nominal) of the vegetative cover will be amended with fertilizers or other amendments as needed to ensure vigorous vegetative growth. Alternatively, naturally fertile topsoil will be placed.

Seed and Mulch: The final cover and stockpile/borrow area will be seeded and mulched in accordance with the facility's approved design details and specifications. Additional erosion controls, such as placement of silt fences, turf reinforcement, etc. will be placed in order to maintain compliance with storm water quality regulations while the vegetation is being established.

Storm Water Management Features: Storm water control berms/terraces and associated letdown pipes will be constructed during landfill closure. All other runoff control structures will have been constructed prior to closure.

CQA Activities: CQA activities will be performed in accordance with the approved CQA Plan. CQA activities will include field and laboratory testing of the Final Cover Barrier Soil, field geomembrane inspection and testing, laboratory geomembrane testing, vegetative soil cover inspection and surveys, confirmation that the Rail Off-Loading Facility and Waste Processing Facility are properly closed, and preparation of the CQA Acceptance Report.

Deed Notification: A notification on the deed to the landfill facility property will be recorded upon closure of all units. The notification will notify any potential purchaser of the property that the land has been used as a landfill facility and its use is restricted pursuant to 35 Ill. Adm. Code Part 811.111(d). A copy of this instrument will be placed in the Operating Record. The IEPA will be notified of these activities.

An estimated schedule to perform the routine closure activities is provided in Table 812.114-1. CLI will treat, remove from the site, or dispose all wastes and waste residues within 30 days after receipt of the final volume of waste. The schedule shows the total time required to close the site, and the time required for the various closure activities to allow tracking of the progress of closure. As indicated in Table 812.114-1, closure activities will be initiated within 30 days of the date the unit receives the final receipt of waste, and will be completed within 180 days of beginning closure.

TABLE 812.114-1

ESTIMATED ROUTINE CLOSURE SCHEDULE

ACTIVITY	WEEKS AFTER FINAL WASTE ACCEPTANCE	
	START	FINISH
Decontaminate Equipment	0	1
Solidification Unit Closure	0	1
Rail Off-Loading Facility Closure	0	8
Waste Processing Facility Closure	0	8
Remove Scales	3	8
Final Cover Barrier Soil Foundation Layer	0	2
Gas Extraction Wells / Driplegs	2	8
Final Cover Barrier Soil	8	12
Geomembrane	12	15
Gas and Condensate Transmission Piping, and Lift Station	6	20
Vegetative Cover	15	20
Storm Water Management Systems	19	24
Seed and Mulch	24	25
CQA Acceptance Report	20	26

812.114.2 Assumed Closure Date and Premature Closure

Premature closure is closure at the "assumed closure date," which is defined as "the date during the next permit term on which the costs of premature final closure of the facility will be the greatest." For the purposes of this Plan, it is assumed that such closure will occur at a point in time when the maximum amount of final cover would have to be placed and waste is being placed at a level below the elevation required to allow gravity drainage of storm water runoff. Clinton Landfill, Inc. expects to be operating in MSW Unit Phase 3 and Chemical Waste Unit (CWU) Cell CWU 1 at the end of the first 5-year permit term. Therefore, the assumed closure date corresponds to the MSW Unit Phase 3 and CWU Cell CWU 1 active period.

In the event premature closure is required, an engineer will inspect the site conditions, and review and modify the Closure Plan as needed to assure that the site is closed in accordance with 35 Ill. Adm. Code Part 812. The primary site features that will be reviewed and evaluated include slope stability, storm water drainage, gas extraction wells and transmission piping system, geomembrane installation requirements, protective cover material borrow and placement, and waste types and volumes within the Rail Off-Loading Facility and Waste Processing Facility. Anticipated steps necessary to prematurely close the facility are as described for routine closure in the previous section, with the addition of installing perimeter gas monitoring probes near the MSW Unit and upgrading the temporary storm water pump stations that would have been constructed in the bottom of the landfill excavations during the operating phase in order to handle storm water that drains into the excavations for the landfill.

An estimated schedule to perform the routine closure activities is provided in Table 812.114-2. CLI will treat, remove from the site, or dispose all wastes and waste residues within 30 days after receipt of the final volume of waste. The schedule shows the total time required to close the site, and the time required for the various closure activities to allow tracking of the progress of closure. As indicated in Table 812.114-2, closure activities will be initiated within 30 days of the date the unit receives the final receipt of waste, and will be completed within 180 days of beginning closure.

TABLE 812.114-2

ESTIMATED PREMATURE CLOSURE SCHEDULE

ACTIVITY	WEEKS AFTER FINAL WASTE ACCEPTANCE	
	START	FINISH
Decontaminate Equipment	0	1
Solidification Unit Closure	0	1
Rail Off-Loading Facility Closure	0	8
Waste Processing Facility Closure	0	8
Remove Scales	3	8
Final Cover Barrier Soil Foundation Layer	0	2
Gas Extraction Wells / Driplegs	2	8

ACTIVITY	WEEKS AFTER FINAL WASTE ACCEPTANCE	
	START	FINISH
Perimeter Gas Monitoring Probes	8	9
Final Cover Barrier Soil	8	12
Geomembrane	12	15
Gas and Condensate Transmission Piping, and Lift Station	6	20
Vegetative Cover	15	18
Storm Water Management Systems	18	20
Seed and Mulch	20	21
CQA Acceptance Report	18	23

812.114.3 Temporary Suspension of Waste

A temporary suspension of waste acceptance is not anticipated at any time. If this does occur, however, the following steps will be taken to protect the environment:

- Verify that the minimum daily cover has been placed over all exposed waste. If temporary waste suspension is expected to, or will occur, longer than 60 days, place intermediate cover over all wastes that have not received final or intermediate cover;
- Remove and properly dispose all waste from rail cars that have been delivered to the site;
- Remove and properly dispose all waste and leachate from the Waste Processing Facility, and close the building doors.
- Empty and cover the solidification containers, or remove them from the site;
- Secure the site, place a sign indicating the landfill status, and notify the public of the temporary suspension of waste acceptance;

- Verify that storm water management controls are in place and operating correctly. Arrange for storm water pumping if required;
- Inspect the site at least once a week and after each substantial rainfall. Repair damaged cover promptly;
- Remove and dispose of any illegally-dumped waste on or adjacent to the landfill;
- Operate the leachate collection/recirculation system and the landfill gas collection/disposal system;
- Perform all scheduled groundwater, surface water, leachate, and LFG monitoring activities during the temporary suspension of waste; and
- Decontaminate any equipment leaving the site in accordance with the Closure Plan.

CLI will not temporarily suspend waste acceptance for a period exceeding 1 year unless it receives an extension from the IEPA.

812.114.4 Largest Area Requiring Final Cover

Clinton Landfill No. 3 will receive final cover in stages in order to maintain compliance with 35 Ill. Adm. Code Part 811.314. The largest area requiring final cover at any time during the facility's active period is expected to occur just prior to final closure. This area is estimated to be approximately 55 acres.

812.114.5 Maximum Inventory of Waste

The maximum inventory of waste in storage at any time at the Waste Processing Facility is the capacity of the waste processing cell plus leachate storage tank, as summarized below:

- Waste processing cell: 120 cubic yards (120 tons)
- Leachate storage tank: 250 gallons

The maximum inventory of waste in storage at any time at the Rail Off-Loading Facility is the capacity of the number of rail cars that can be positioned at the facility, as summarized below:

- Gondola Car Off-Loading Area: 4 cars = 400 cubic yards (400 tons)

- Intermodal Off-Loading Area: 2 cars = 200 cubic yards (200 tons)

The maximum inventory of waste disposed at the landfill units is estimated to be as follows:

- MSW Unit: 29,259,566 airspace cubic yards (17,555,740 tons at 0.6 tons per ascy)

- CWU: 2,529,506 airspace cubic yards (2,529,506 tons at 1.0 tons per ascy).

APPENDIX B – RESPONSES TO IEPA DRAFT DENIAL POINTS 3 THROUGH 6, 8 THROUGH 10, AND 14 (prepared by Shaw Environmental, Inc.)

January 14, 2009

Mr. George Armstrong
PDC Technical Services, Inc.
P. O. Box 9071
Peoria, Illinois 61612-9071

RE: 0390055036 – DeWitt County
Clinton Landfill 3
Log No. 2008-054
Response to Draft Denial Points

Shaw Environmental, Inc. (Shaw) is submitting this response to comments received by the IEPA during the review of the application for the permit modification of Clinton Landfill No. 3. The following information responds to comments 3, 4, 5, 6, 8, 9, 10, and 14 identified by the IEPA in the draft denial letter received on July 2, 2008.

3. *As per the application the redesigned components comply with the requirements of 35 Ill. Adm. Code Part 724. The following issues regarding compliance with the requirements of 35 Ill. Adm. Code Part 724 were noted:*

   a. *Pursuant to 35 Ill. Adm. Code 724.401(c)(3)(A) the leak detection system must be constructed with a slope of one percent or more. From the information provided in the application it is not possible to ascertain the slope of the redundant leachate layer.*

   b. *Pursuant to 35 Ill. Adm. Code 724.401(c)(5), the operator of a leak detection system that is not located completely above the seasonal high water table shall demonstrate that the operation of the leak detection system will not adversely affected by the presence of groundwater. The application does not discuss compliance with 35 Ill. Adm. Code 724.401(c)(5).*

   The leak detection system, as part of the redundant leachate drainage layer, directly underlies and parallels the primary leachate collection drainage layer as shown on Design Drawing No. D9. The slope of the primary leachate collection pipe and leak detection layer has been increased to at least one percent as shown on Design Drawing Nos. D7 and D9 and provided in Attachment 1. The revised leachate head calculation is provided in Attachment 2. A revised HELP Model will be provided under separate cover as a response to IEPA draft groundwater denial points, dated August 13, 2008.

   The HELP Model simulations conservatively assume that groundwater from discontinuous saturated zones within the Tiskilwa Till and Roxana Silt-Robein Member will seep into the leak detection system (i.e. the redundant leachate collection system). A groundwater seepage rate of 0.0548 inches per year was calculated using an equation previously provided to Shaw by the IEPA Groundwater Assistance Unit (see Appendix B.2 of the original application). This seepage rate was included in the HELP Model as Subsurface Inflow into the Compacted Earth Liner. The equations used within the HELP Model applied this Subsurface Inflow to the next layer above the liner system, i.e. the leak detection system.

The results of the HELP Model demonstrate that the leak detection system will not be adversely affected by the presence of groundwater. The results are summarized below:

- To be conservative, it was assumed that the maximum groundwater hydraulic head and seepage rate was constant across the entire landfill; when it reality the maximum groundwater seepage rate is only applicable to the sump areas. As the liner elevation grades increase, the groundwater hydraulic head and, therefore seepage rate, decreases.
- The HELP Model predicts that the maximum liquid head within the leak detection system will be 0.001 inches including that contributed by groundwater seepage into the leak detection system. This is significantly less than the thickness of the leak detection layer (0.20 inches) which indicates that there is significant flow capacity within the leak detection layer to safely transmit the groundwater seepage and other liquids.
- The extremely low groundwater seepage rate/volume of water (0.0548 inches per year) will not impact the ability to detect leakage through the primary liner system.

4. *The material properties for chemical wastes (Appendix A.2 – Table 1) are based on testing wastes from a single source. The application does not demonstrate that these properties accurately represent the types of wastes that will be received at Chemical Waste Unit (CWU).*

Shaw Environmental, Inc. believes that the strength parameters provided in the original application accurately represent the types of chemical wastes that will be received at the Chemical Waste Unit (CWU) due to several factors.

The CWU will primarily accept soils contaminated by MGP wastes and/or PCBs. The CWU will also be accepting dewatered sediments. The dewatered sediments were determined to be the critical material; therefore the analysis conservatively assumed the dewatered sediments were the only material placed in the CWU. Dewatered sediments are the end product of dewatering dredged material. The sediments will be dewatered by mechanical presses.

The wastes tested exhibit properties typical of wastes that have undergone hydraulic dredging and dewatering processes and is representative of the dewatered sediments that will be accepted at the CWU. As illustrated in photographs from a July 2007 site visit (Attachment 3), the extensive dewatering process at the site involves the addition of a polymer to the sediment waste, which results in dry sediments that are physically very similar to typical fine grained soils.

The tests performed on the waste were done without compaction. The waste will be placed in the landfill in lifts and compacted, using a sheepsfoot roller. This compaction will increase the unit weight of the waste, therefore improving its engineering properties by increasing its shear strength, decreasing its compressibility, decreasing its hydraulic conductivity and void ratio. In addition, the waste will be further compacted as more waste is placed on top of it.

Attachment 3 contains an article from the Army Corps of Engineers *(Predicting Geotechnical Parameters of Fine-grained Dredged Materials Using the Slump Test Method and Index Property Correlations*). Figure 7 in this article illustrates that as the water content of typical sediments is decreased, due to processes such as those used to dewater the representative test samples, the strength parameters of the sediments increase drastically. As the sediments approach lower water contents, the sediments portray strength characteristics similar to those of the representative soils tested for the CWU.

Referencing typical cohesion strengths and friction angles for a variety of soils (Waltham, A.C., Attachment 3) reveals that the representative soils tested for the CWU exhibit long term friction angles higher than those typically seen even in gravels and sands, as well as short term cohesion strengths similar to clays. Consequently, dewatered sediment wastes received at the CWU would not be at risk for stability failure.

5. *Drawing D-17 shows interim conditions of the landfill. As per this drawing and the Stormwater Management Plan provided in Attachment 4 a separation berm between the CWU and MSW units will have a ditch to collect runoff from the areas sloping towards the separation berm. Water entering the ditch will be pumped into the perimeter ditches. The application shall include additional details about conveying of surface water from the separation berm to Sedimentation basin B.*

   Applicant's Response: Design Drawing No. D22 (Attachment 1) has been added to show the locations of sumps along with cross sectional and plan view details of the dewatering sump located in the separation berm ditch. The separation berm ditch has been designed to handle stormwater for the 100-year, 1-hour storm event. Stormwater from higher areas will be intercepted by temporary terrace berms before it reaches the separation ditch and is directed to the perimeter ditches. Attachment 3 contains details of the dewatering pump currently used at the facility. Similar types of pumps will be used for the proposed stormwater sump.

6. *As per the Design Report provided in Attachment 2 excavation face with circular failure (long and short term; static and seismic conditions) was modeled. However, the stability runs for this scenario were not included in the Appendix A.2.*

   Applicant's Response: A SLIDE analysis was performed for the excavation face for static and seismic conditions. The factor of safety for static conditions was determined to be 3.299 and the factor of safety for seismic conditions was determined to be 2.197. This SLIDE analysis is provided in Attachment 5. The analysis is only applicable for short term conditions because the slope would be covered with waste before long term strength conditions develop in the soils.

8. *Pursuant to 35 Ill. Adm. Code 811.304(f) the potential for an earthquake or blast induced liquefaction, and its effect on the stability and integrity of the unit shall be*

considered and taken into account in the design. The potential for landslides or earthquake induced liquefaction outside the unit shall be considered if such events could affect the unit. The stability analyses provided in the application does not address the requirements of 35 Ill. Adm. Code 811.304(f).

Applicant's Response: An evaluation of the potential for liquefaction of the sand layer under the chemical waste unit was performed and is contained in Attachment 6. It was determined that the potential for liquefaction in this area not a concern.

9. *Pursuant to 35 Ill. Adm. Code 811.306(b) the liner and leachate collection system side slopes shall have a minimum factor of safety of 1.3 for static and 1.0 for seismic conditions at all times. The stability analyses provided in the application do not address the requirements of 35 Ill. Adm. Code 811.306(b).*

Applicant's Response: A stability analysis of the liner and leachate collection system was performed using a friction angle of 24 degrees and is included in Attachment 6. Using a friction angle of 24 degrees demonstrates that a factor of safety of at least 1.3 for static conditions and a factor of safety of 1.0 will be reached. The Table 02650-3: Geomembrane Interface Shear Strength Criteria Table has been updated with the new friction angle and is included in Attachment 7.

10. *Pursuant to 35 Ill. Adm. Code 811.308(g) the leachate collection system shall be equipped with a sufficient number of manholes and cleanout risers to allow cleaning and maintenance of all pipes throughout the design period. The details of the leachate collection system provided in Drawing Nos. D-8 and D-9 do not include details of the leachate cleanouts and leachate level monitoring locations.*

Applicant's Response: Design Drawing No. D9 has been updated to show that a 6" diameter leachate cleanout pipe will run along side the 18" diameter riser pipe in the primary leachate collection sump. Design Drawing No. D9 has been updated to show that a leachate level indicator will be used to monitor leachate levels within the 18" diameter riser pipe in the secondary leachate collection sump.

14. *The presence of the geosynthetic clay liner in the bottom liner of the CWU was not accounted for in the stability analysis. No interface requirements have been specified in the Technical Specifications for the geosynthetic clay liner.*

Applicant's Response: The geosynthetic clay liner was accounted for in the stability analysis in Appendix A.2 of the Application for Significant Modification of Clinton Landfill No. 3 submitted to the IEPA on February 1, 2008. A failure analysis was run for the liner system stability through the critical interface of the bottom liner system. Technical Specifications have been established for the interface between the floor geomembrane and the geosynthetic clay liner for both the minimum requirements for peak and residual shear strength are contained in Table 02650-4: Geomembrane Interface Shear Strength Criteria in Attachment 7 of the Application for Significant Modification: Permit No. 2005-070 submitted to the IEPA on February 1, 2008. Table 02650-4 also contains testing specifications for floor liner material interfaces.

Should you need any additional information or clarification on this submittal, please contact me at (630) 762-1400.

Sincerely,

Shaw Environmental, Inc.

Jesse Varsho, P.E., P.G.
Project Manager

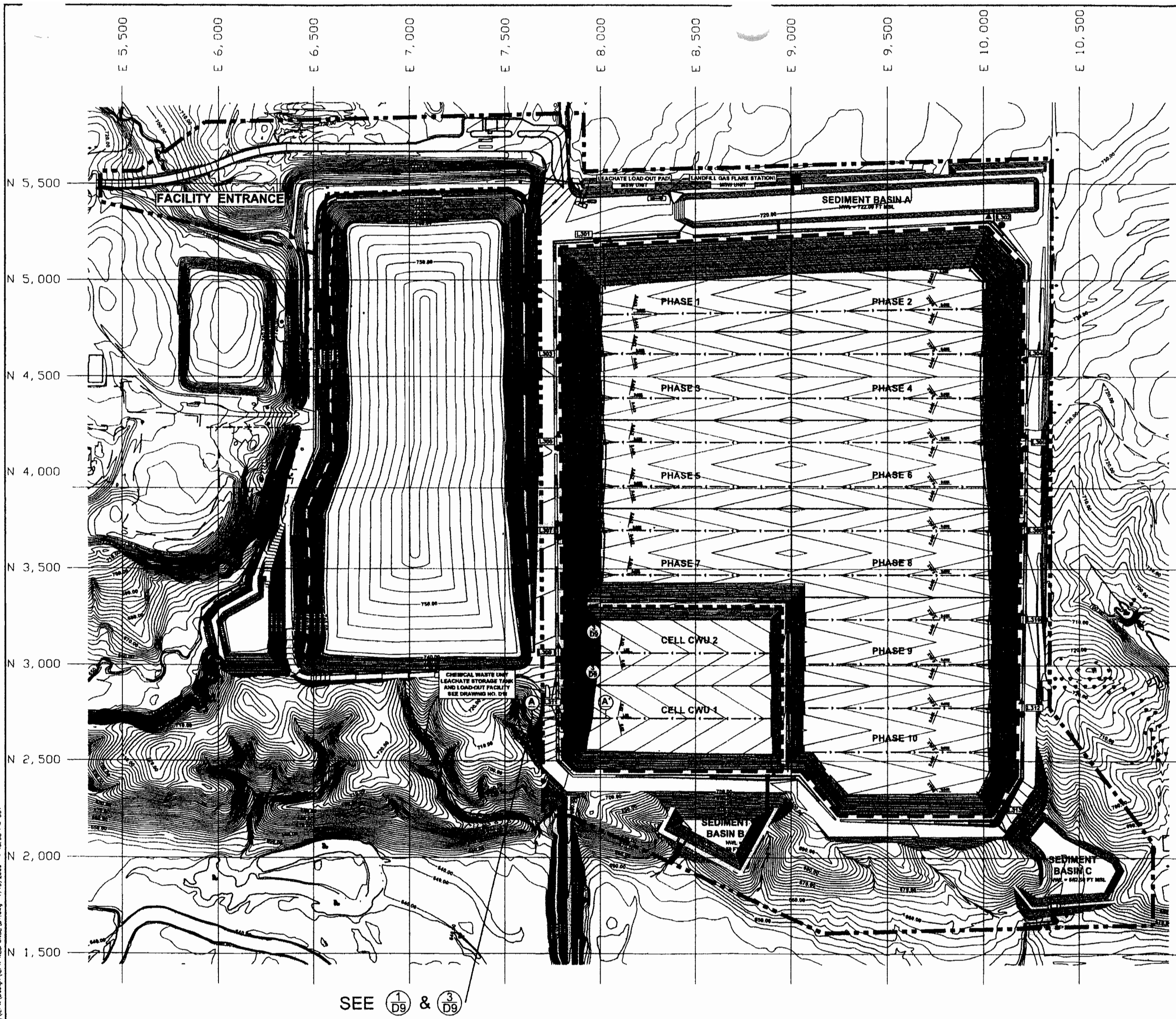
Attachments

LIST OF ATTACHMENTS

Attachment 1:	Revised Design Drawings
Attachment 2:	Revised Leachate Head Calculation
Attachment 3:	Dewatered Sediment Strength References
Attachment 4:	Dewatering Pump Reference
Attachment 5:	SLIDE Analysis
Attachment 6:	Liquefaction Analysis
Attachment 7:	Liner and Leachate Collection System Stability Analysis

ATTACHMENT 1

REVISED DESIGN DRAWINGS



GRAPHIC SCALE
200' 0 200'

LEGEND

- APPROXIMATE CLINTON LANDFILL NO.3 FACILITY BOUNDARY
- APPROXIMATE EXISTING PERMITTED CLINTON LANDFILL NO.3 WASTE BOUNDARY
- APPROXIMATE CHEMICAL WASTE UNIT BOUNDARY
- 690.00 — ELEVATION CONTOUR–FEET, MSL (SEE NOTE 6)
- APPROXIMATE CELL BOUNDARY
- LEACHATE COLLECTION PIPE
- ▲ PROPOSED CLEANOUT
- ● PROPOSED COLLECTION

NOTES

1. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
2. CURRENT TOPOGRAPHY MAY DIFFER FROM THAT SHOWN.
3. THE NEED FOR FLEXIBILITY TO ACCOMMODATE ADJUSTMENTS AND MODIFICATIONS IS ANTICIPATED CONSIDERING THE SIZE, COMPLEXITY, AND LIFE OF THE PROJECT.
4. PERIMETER STORMWATER CONTROL WILL BE CONSTRUCTED AS FILLING PROGRESSES TO PREVENT 'RUN-ON' ONTO THE LANDFILL AND TO PROPERLY CONTROL RUN-OFF FROM DISTURBED AREAS.
5. SITE DEVELOPMENT IS EXPECTED TO PROCEED ACCORDING TO THE NUMERICAL SEQUENCE OF CELLS SHOWN ON THIS PLAN BUT IS SUBJECT TO CHANGE. THE EXCAVATION OF THE SUBSEQUENT CELLS WILL OCCUR AS THE PREVIOUS CELL IS FILLED. FINAL COVER OR INTERIM COVER WILL BE PLACED WITHIN 60 DAYS OF THE PLACEMENT OF THE FINAL LIFT OF WASTE.
6. THE PROPOSED CONTOURS WITHIN THE CLINTON LANDFILL NO. 3 WASTE BOUNDARY ON THIS DRAWING REPRESENT THE APPROXIMATE TOP OF LEACHATE COLLECTION SYSTEM.
7. PRIOR TO WASTE PLACEMENT WITHIN THE "MSW WEDGE", LEACHATE COLLECTION PIPING WILL BE INSTALLED AND GRADED AS SHOWN ON THIS DRAWING.
8. LEACHATE FROM CHEMICAL WASTE UNIT MAY BE COMMINGLED WITH LEACHATE FROM MUNICIPAL SOLID WASTE UNIT UNTIL TSCA REGULATED MATERIAL IS DISPOSED WITHIN THE CHEMICAL WASTE UNIT.

REV NO	DATE	DESCRIPTION
2	JAN. 2009	CHANGED LEACHATE COLLECTION PIPE SLOPE TO 1%
1	AUG. 2008	ADDITION OF LEACHATE CLEANOUT

area Clinton Landfill, Inc.

Shaw® Shaw Environmental, Inc.

CLINTON LANDFILL NO. 3 CHEMICAL WASTE UNIT
DEWITT COUNTY, ILLINOIS

PROPOSED LEACHATE COLLECTION GRADES

PROJ. NO.:	128017	DATE:	JANUARY 2009
DESIGNED BY:	JPV	DRAWING NO.	D7
DRAWN BY:	PEL		
CHECKED BY:	JPV		
APPROVED BY:	DAM		7 OF 22 SHEETS

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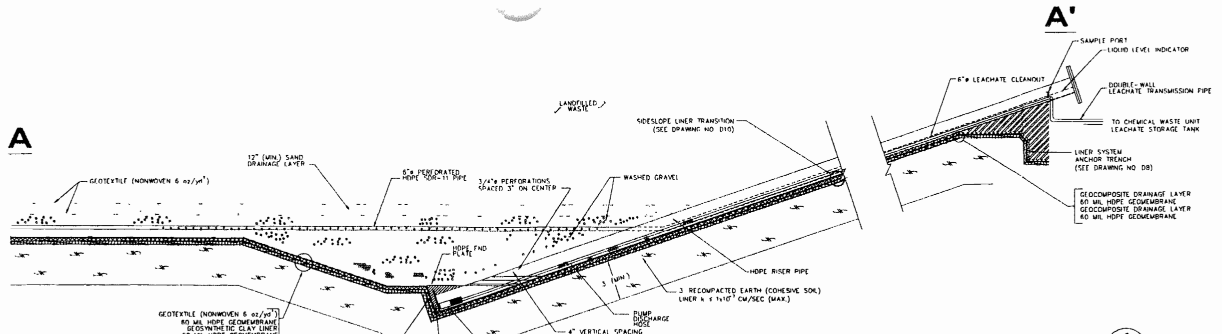
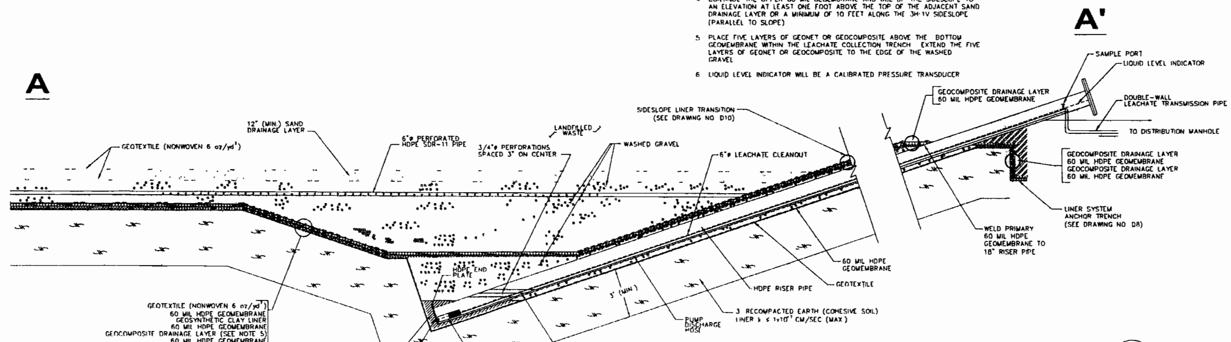


PRIMARY LEACHATE COLLECTION SUMP SECTION (CHEMCIAL WASTE UNIT) 1/D9

NOT TO SCALE

NOTES:

1. WRAP PERFORATED SECTION OF LEACHATE COLLECTION SUMP RISER WITH TWO LAYERS OF GEONET
2. 60 MIL HDPE GEOMEMBRANE RUBSHEET AT BASE OF 18" HDPE RISER PIPE
3. ALL GEOMEMBRANES SHALL BE DOUBLE-SIDED TEXTURED
4. CONTINUE THE UPPER 60 MIL GEOEMBRANE AND GCL UP THE SIDESLOPE TO AN ELEVATION AT LEAST ONE FOOT ABOVE THE TOP OF THE ADJACENT SAND DRAINAGE LAYER OR A MINIMUM OF 10 FEET ALONG THE 3H:1V SIDESLOPE (PARALLEL TO SLOPE)
5. PLACE FIVE LAYERS OF GEONET OR GEOCOMPOSITE ABOVE THE BOTTOM GEOMEMBRANE WITHIN THE LEACHATE COLLECTION TRENCH. EXTEND THE FIVE LAYERS OF GEONET OR GEOCOMPOSITE TO THE EDGE OF THE WASHED GRAVEL
6. LIQUID LEVEL INDICATOR WILL BE A CALIBRATED PRESSURE TRANSDUCER

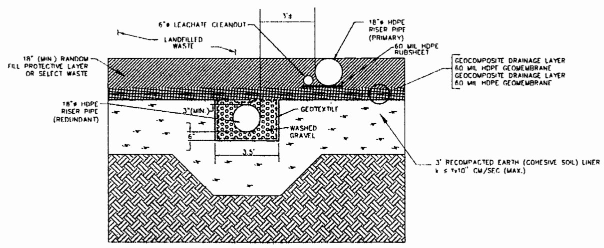


REDUNDANT LEACHATE COLLECTION SUMP SECTION (CHEMICAL WASTE UNIT) 2/D9

NOT TO SCALE

NOTES:

1. WRAP PERFORATED SECTION OF LEACHATE COLLECTION SUMP RISER WITH TWO LAYERS OF GEONET
2. 60 MIL HDPE GEOMEMBRANE RUBSHEET AT BASE OF 18" HDPE RISER PIPE
3. ALL GEOMEMBRANES SHALL BE DOUBLE-SIDED TEXTURED
4. CONTINUE THE UPPER 60 MIL GEOEMBRANE AND GCL UP THE SIDESLOPE TO AN ELEVATION AT LEAST ONE FOOT ABOVE THE TOP OF THE ADJACENT SAND DRAINAGE LAYER OR A MINIMUM OF 10 FEET ALONG THE 3H:1V SIDESLOPE (PARALLEL TO SLOPE)
5. PLACE FIVE LAYERS OF GEONET OR GEOCOMPOSITE ABOVE THE BOTTOM GEOMEMBRANE WITHIN THE LEACHATE COLLECTION TRENCH. EXTEND THE FIVE LAYERS OF GEONET OR GEOCOMPOSITE TO THE EDGE OF THE WASHED GRAVEL
6. LIQUID LEVEL INDICATOR WILL BE A CALIBRATED PRESSURE TRANSDUCER



TYPICAL SIDESLOPE RISER SECTION 3/D9

NOT TO SCALE

NOTES:

1. PROVIDE 60 MIL HDPE GEOMEMBRANE RUB SHEET BENEATH PRIMARY SIDESLOPE RISER PIPE
2. ALL GEOMEMBRANES SHALL BE DOUBLE-SIDED TEXTURED

REV. NO.	DATE	DESCRIPTION
1	AUG. 2008	ADDITION OF LEACHATE CLEANOUT

Clinton Landfill, Inc.

Shaw® Shaw Environmental, Inc.

CLINTON LANDFILL NO. 3 CHEMICAL WASTE UNIT
DEWITT COUNTY, ILLINOIS

LINER / LEACHATE COLLECTION SYSTEM DETAILS - 2
CHEMICAL WASTE UNIT

PROJ. NO.	128017	DATE: NOVEMBER 2008
DESIGNED BY:	JPV	DRAWING NO
DRAWN BY	PEL	D9
CHECKED BY:	JPV	
APPROVED BY	DAM	9 OF 22 SHEETS

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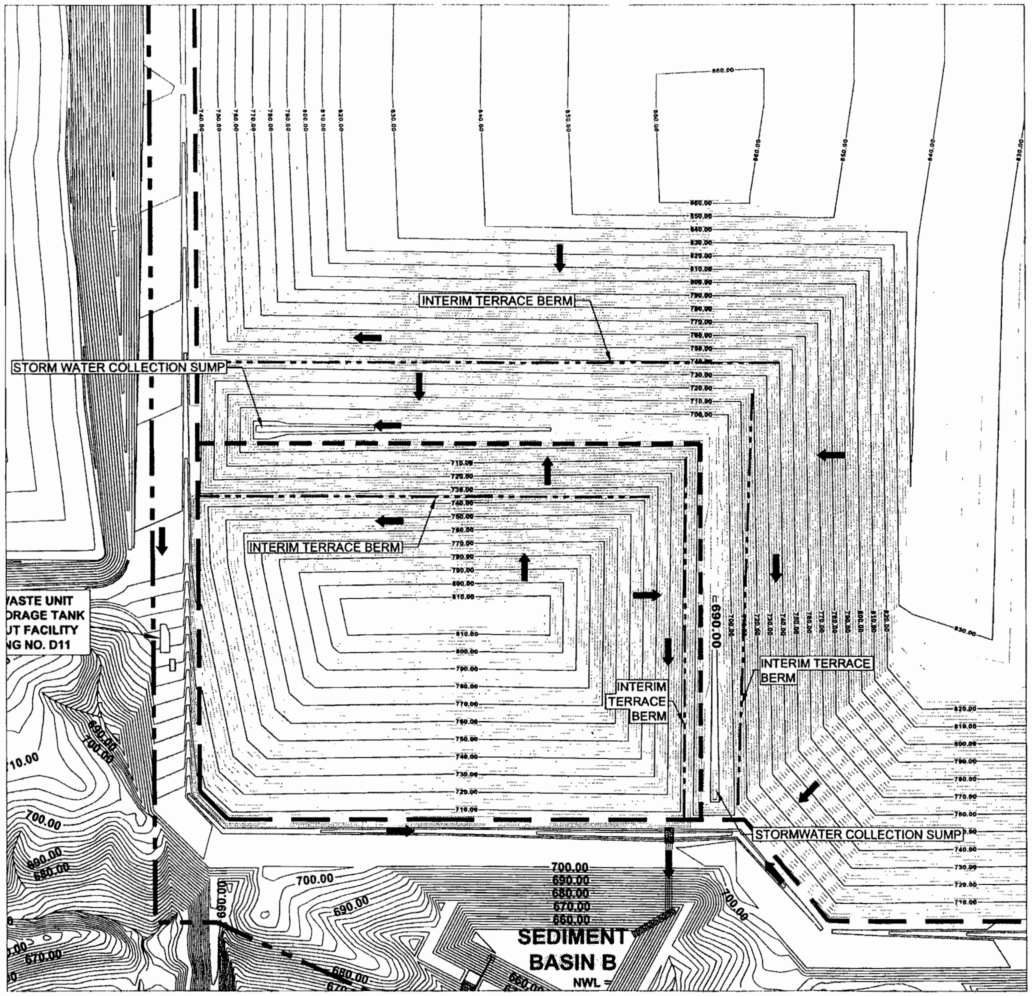


GRAPHIC SCALE

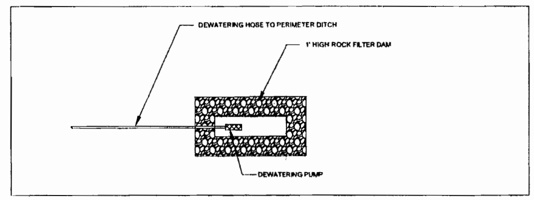
100' 0 100'

LEGEND

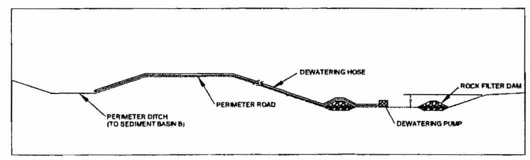
- APPROXIMATE CLINTON LANDFILL NO. 3 FACILITY BOUNDARY
- APPROXIMATE CLINTON LANDFILL NO. 3 PERMITTED WASTE BOUNDARY
- APPROXIMATE CHEMICAL WASTE UNIT BOUNDARY
- 690.00 ELEVATION CONTOUR-FEET, MSL (SEE NOTE 5)
- INTERIM TERRACE BERM
- OVERLAND FLOW DIRECTION

NOTES

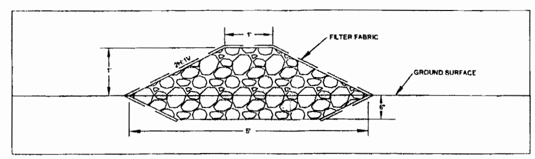
1. INTERMEDIATE/FINAL CHEMICAL WASTE GRADES DEVELOPED FROM DRAWINGS NO. P-FG1 AND P-FG4, DATED 6\7\06. FROM SIGNIFICANT MODIFICATION PERMIT APPLICATION LOG NO. 2005-070.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. CURRENT TOPOGRAPHY MAY DIFFER FROM THAT SHOWN.
4. THE NEED FOR FLEXIBILITY TO ACCOMMODATE ADJUSTMENTS AND MODIFICATIONS IS ANTICIPATED CONSIDERING THE SIZE, COMPLEXITY, AND LIFE OF THE PROJECT.
5. THE PROPOSED CONTOURS WITHIN THE CLINTON LANDFILL NO. 3 WASTE BOUNDARY ON THIS DRAWING REPRESENT THE APPROXIMATE TOP OF CLINTON LANDFILL NO. 3 WASTE GRADES FOR INTERIM CONDITIONS.
6. THE STORMWATER MANAGEMENT PLAN FOR THE FINAL LANDFORM IS SHOWN ON PDC TECHNICAL SERVICES, INC DRAWING P-SW1, AS APPROVED BY ILLINOIS EPA PERMIT.



STORMWATER SUMP PLANVIEW



STORMWATER SUMP CROSS SECTION



ROCK CHECK DAM CROSS SECTION

REV NO	DATE	DESCRIPTION

Clinton Landfill, Inc.

Shaw Environmental, Inc.

CLINTON LANDFILL NO. 3 CHEMICAL WASTE UNIT
DEWITT COUNTY, ILLINOIS

STORMWATER MANAGEMENT SYSTEM - INTERIM CONDITIONS

PROJ. NO.:	128017	DATE:	NOVEMBER 2008
DESIGNED BY:	JPV	DRAWING NO	
DRAWN BY:	PEL	D22	
CHECKED BY	JPV		
APPROVED BY	DAM	22 OF 22 SHEETS	

ATTACHMENT 2

REVISED LEACHATE HEAD CALCULATIONS

Shaw® Shaw Environmental, Inc.

Client:	Clinton Landfill, Inc.		
Project:	Clinton Landfill No. 3 Chemical Waste Unit		
Proj. #:	128017		
Calculated By:	JWP	Date:	1/6/09
Checked By:	MNF	Date:	1/8/09

TITLE: LEACHATE HEAD (LEACHATE COLLECTION DESIGN)

Problem Statement:

Determine the leachate head on the landfill liner system. The leachate collection system is designed to maintain a maximum one (1) foot of head of leachate on the liner.

Given:

1. Richardson, G., *Design of Waste Containment and Final Closure Systems.* ASCE Publication, April 2001. (Please see attached pages.)

2. Landfill cellular design presented in the design drawings.

Assumptions:

1. Giroud's Approximate Numerical Solution used to calculate leachate head on a liner.

$$t_{max} = (j)\left[\frac{\sqrt{\tan^2(\beta) + 4\frac{q_h}{k}} - \tan(\beta)}{2\cos(\beta)}\right](L)$$

Where:

t_{max} = leachate head on landfill liner (ft)

β = slope angle (degrees)

q_h = leachate generation rate (ft/yr)

k = hydraulic conductivity of drainage material (ft/yr)

L = maximum horizontal drainage distance (ft)

j = numerical modifying factor given as:

$$j = 1 - 0.12\exp\left\{-\left[\log\left(\frac{8\left(\frac{q_h}{k}\right)}{5\tan^2(\beta)}\right)^{5/8}\right]^2\right\}$$

Shaw® Shaw Environmental, Inc.

Client:	Clinton Landfill, Inc.
Project:	Clinton Landfill No. 3 Chemical Waste Unit
Proj. #:	128017
Calculated By: JWP	Date: 1/6/09
Checked By: MNF	Date: 1/8/09

TITLE: LEACHATE HEAD (LEACHATE COLLECTION DESIGN)

2. The maximum flow length (L) to a leachate collection pipe is 170 feet.

3. q_L = 0.986 ft/yr = Estimated maximum leachate generation rate due to percolation of moisture through the waste during the operational and closure periods of the proposed landfill. It was conservatively assumed equal to the Peak Daily Value from the HELP Model Daily Cover Scenario results — 0.032 inches/day = 880.28 gallons/acre-day (refer to Attachment 11).

4. q_s = 0.00457 ft/yr

5. $q_h = q_L + q_s$ = 0.9907 ft/yr

6. $$k = \frac{3.0 * 10^{-2}\ \text{cm}}{\text{sec}} * \left(\frac{1\ \text{in}}{2.54\ \text{cm}}\right) * \left(\frac{1\ \text{ft}}{12\ \text{in}}\right) * \left(\frac{86,400\ \text{sec}}{1\ \text{day}}\right) * \left(\frac{365\ \text{days}}{1\ \text{year}}\right) = \frac{31,039.4\ \text{ft}}{\text{year}}$$

7. Slope of liner = 2.0%, therefore, tan(β) = 0.02

8. Chemical Waste Unit is at field capacity

9. The final cover is in place

Calculations:

$$j = 1\text{-}0.12\exp\left\{-\left[\log\left(\frac{8\left(\frac{q_h}{k}\right)}{5\tan^2(\beta)}\right)^{5/8}\right]^2\right\}$$

$$j = 1\text{-}0.12\exp\left\{-\left[\log\left(\frac{8\left(\frac{0.9907}{31,039}\right)}{5(0.02)^2}\right)^{5/8}\right]^2\right\} = 0.9122$$

Shaw® Shaw Environmental, Inc.

Client:	Clinton Landfill, Inc.		
Project:	Clinton Landfill No. 3 Chemical Waste Unit		
Proj. #:	128017		
Calculated By:	JWP	Date:	1/6/09
Checked By:	MNF	Date:	1/8/09

TITLE: LEACHATE HEAD (LEACHATE COLLECTION DESIGN)

$$t_{max} = (j)\left[\frac{\sqrt{\tan^2(\beta) + 4\frac{q_h}{k}} - \tan(\beta)}{2\cos(\beta)}\right](L)$$

$$t_{max} = (0.9122)\left[\frac{\sqrt{\left((0.02)^2 + 4\frac{(0.9907)}{(31{,}039)}\right)} - 0.02}{2\cos\left(\tan^{-1}(0.02)\right)}\right](170)$$

$$t_{max} = 0.2303 \text{ feet}$$

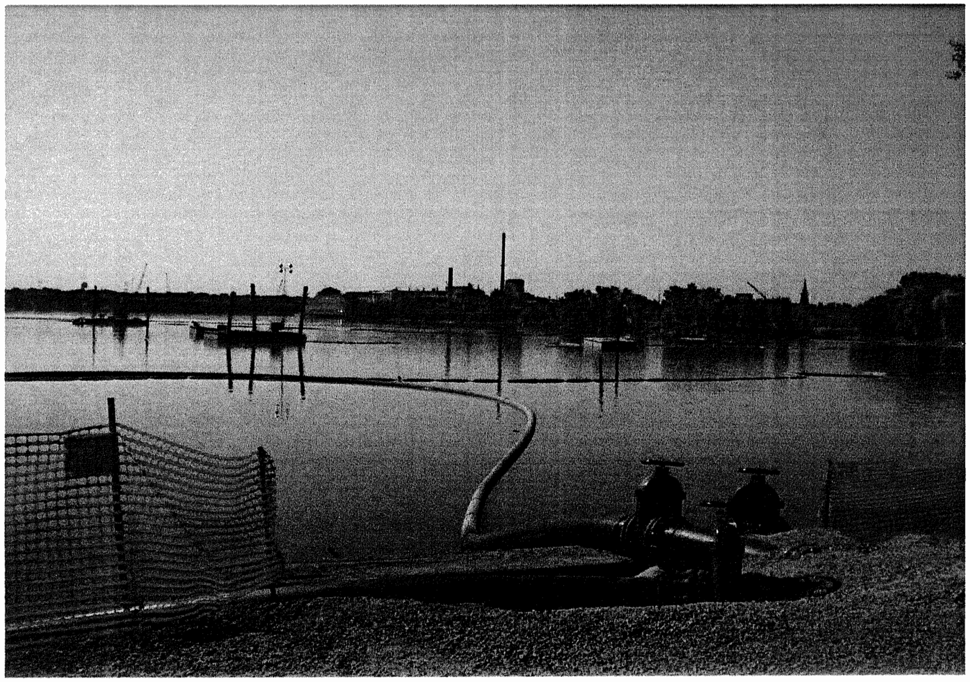
Results:

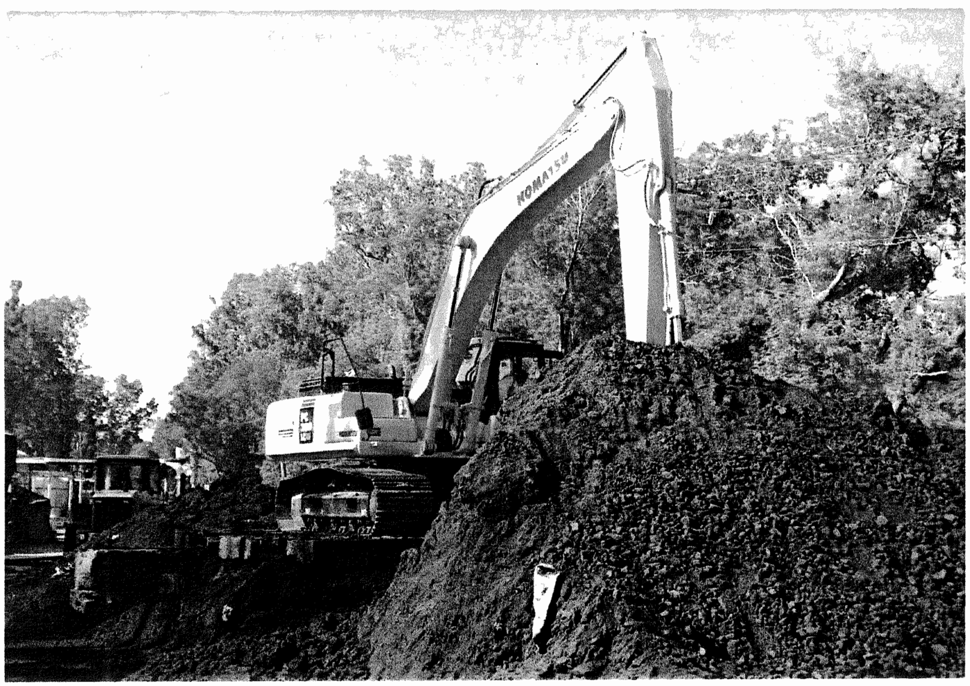
The leachate drainage and collection system has been designed to maintain less than one (1) foot of head above the liner.

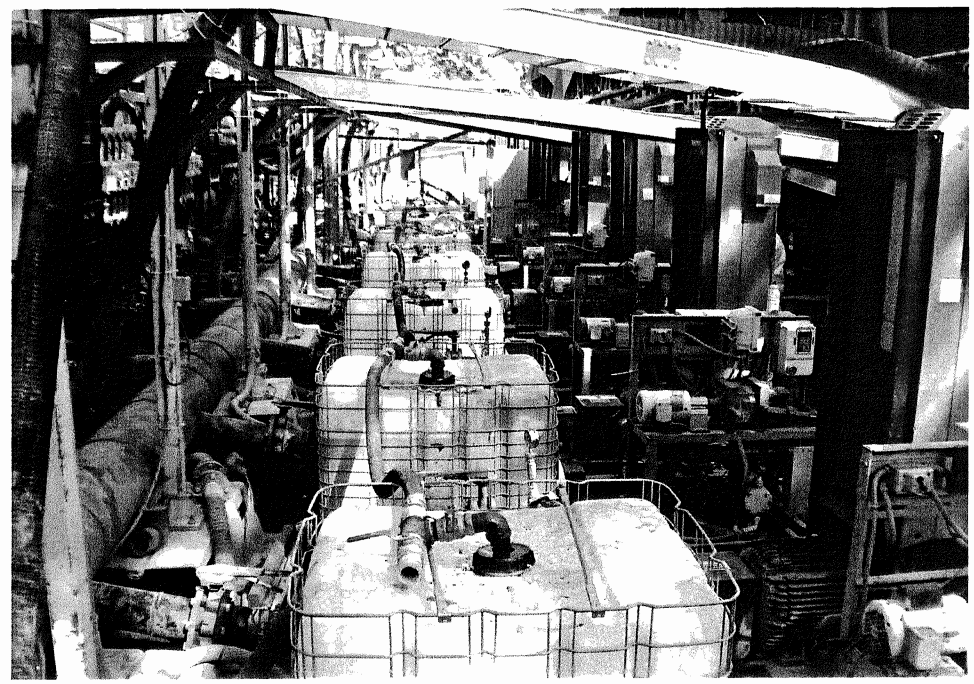
Maximum Flow Length "L" (ft)	Head "t_{max}" (ft)
170	0.2303

ATTACHMENT 3

DEWATERED SEDIMENT STRENGTH REFERENCES




KOMATSU



ERDC TN-DOER-D1
August 2004

Predicting Geotechnical Parameters of Fine-grained Dredged Materials Using the Slump Test Method and Index Property Correlations

PURPOSE: This technical note describes an innovative method for estimating selected geotechnical properties of physically remolded dredged materials using the proposed laboratory slump test and correlation equations. Material property assessment requires laboratory testing of dredged material samples. The index properties (including bulk density, void ratio, porosity, water content, percent solids, Atterberg limits, and specific gravity) are ultimately needed as geotechnical parameter inputs into the engineering planning, design, construction, operational, and management aspects of dredging and dredged material placement. This technical note explores innovative, non-standardized, and expedient methods to estimate numerous material index properties and engineering behavior properties without running standardized time-consuming and expensive laboratory tests. The proposed methods are presented only as optional engineering tools based on experimental data and are not intended to usurp any standard laboratory testing protocol.

BACKGROUND: During nearshore dredging operations, the dredging process often involves a large amount of material handling, manipulation, and remolding. By the time an original undisturbed (or previously deposited) material has been dredged, transported, and re-deposited, its original geotechnical properties have changed. Dredged material is characterized by its physical and engineering properties, and the level of detail needed to fully characterize those properties is dependent upon factors such as the site geology, the dredging technique, and the dredged material management plan. Numerous options are available for managing dredged material removal, handling, and placement. For example, maintenance dredging may be accomplished by a trailing suction hopper dredge with open ocean disposal, by a cutterhead dredge with pipelined beach disposal, or by several other methods. The presence of contaminated sediments requires evaluation of additional sub-strategies exploring proper disposal and/or treatment such as confined aquatic disposal (Palermo et al. 1998).

For any dredging operation, the dredged material properties need to be measured or predicted. The material properties are input into dredging operation and water quality models (such as MDFATE, LTFATE, and ADDAMS), and accurate geotechnical parameters are required to provide realistic modeling similitude.

GEOTECHNICAL PROPERTIES OF REMOLDED SOILS: Dredged materials exhibit properties similar to those of undisturbed native soil and rock materials in a subaqueous environment, but when excavated, removed, remolded, or re-deposited, the properties change accordingly as the original material structure changes. High water contents, low dry densities, and low shear strengths typify remolded and deposited fine-grained dredged materials (Bartos 1977).

Physical Properties and Engineering Behavior. The most common physical property needed for dredged material characterization is the grain-size distribution, based on either the weight (which is the standardized method) or volume measurement. The material classification is then selected using the grain-size distribution and the Atterberg limit criteria. Other material properties include water content, specific gravity, organic content, bulk density, percent solids, and void ratio. Engineering behavior properties include shear strength, consolidation behavior, hydraulic conductivity (permeability), critical erosion stress, and viscosity.

Undisturbed native soil and rock materials exhibit mechanical properties that are influenced by the material structure. Intergranular bonding and physico-chemical effects influence the material's behavior (Mitchell 1993). As the water content in the material matrix is increased during remolding and the solid particles become more separated, the material behaves more like a slurry or suspension, and the intergranular bonding forces decrease. As the bonding and cohesive forces decrease, the resulting shear strength decreases. If fine-grained particles (silt and clay) constitute more than about 35 percent of the total matrix solids, the slurry will behave as a viscous material (Spigolon 1993). Fibrous materials, high organic content, and gas bubbles are known to affect the shear strength behavior of high-water-content soils (Klein and Sarsby 2000, Edil and Wang 2000). Examining the rheological behavior of soil slurries is not a traditional geotechnical topic, and standardized laboratory tests for determining the engineering properties of soil slurries have yet to be developed.

One objective for determining the engineering properties of soil slurry during nearshore dredging operations is to establish the navigation channel bottom location (horizon) when clayey suspended sediments are surficial to the channel bottom (Teeter 1992). The slurry threshold (yield) shear stress (or the amount of stress imposed on the material to initiate its movement) is determined as a function of slurry density and viscosity for a given sediment, and the nautical horizon is chosen based on established procedures (Dasch and Wurpts 2001). DeMeyer and Mahlerbe (1987) determined that the threshold (yield) shear stress of most clayey slurries is less than 2 psf (10 Pa), with in situ bulk densities of 72 to 84 pcf (1.15 to 1.35 kg/l). As the sediment consolidates and develops a higher density and threshold (yield) shear stress beyond its rheological behavior range, the geotechnical concept of effective stress (Terzaghi 1953) has been shown to govern and describe the material's physical and mechanical behavior.

Another reason for determining the properties of soil slurries is to quantify slurry strength during nearshore or contaminated dredged material placement operations. For example, when placing a sand cap over contaminated dredged materials, the engineering behavior of the dredged material must be predicted or known in order to achieve successful cap placement. If the soft dredged material has insufficient shear strength to resist the imposed cap stress, failure will occur and the purpose of the cap will be defeated. As the soft dredged material is allowed to consolidate from a slurry state into a non-zero effective stress state, its ability to resist imposed stresses will significantly increase. This phenomenon of strength increase was observed at a subaqueous capping site by Myre et al. (2000), where the soft dredged material was allowed to consolidate for about 5 months before it achieved a shear strength of about 20 psf (1 kPa), which allowed subsequent successful cap placement.

Measuring the Physical Properties and Engineering Behavior of Dredged Materials. When fine-grained dredged material is remolded from a soft and highly compressible soil into suspended sediment or slurry, and its behavior needs to be quantified, standardized geotechnical testing methods may not be fully adequate.

Testing methods are available to measure strength gain in very soft soils as a function of time. In situ methods include the field vane shear and cone penetrometer, but in situ methods require testing to be accomplished at discrete time intervals, which in itself does not provide a method to predict strength gain as a function of time for an ongoing project. Laboratory methods such as the oedometer, direct shear, and triaxial tests allow determination of strength indices, but the very soft or fluid material is generally incompatible with the test setup.

The laboratory miniature shear vane test D4648 (American Society for Testing and Materials (ASTM) 1994) has been the most common method to estimate shear strength of marine soils (Lee 1985), and works well for very soft cohesive dredged materials. Measuring the shear strength gain directly as a function of time is possible with the laboratory vane test, but a faster and more economical method is to measure the shear strength gain as a function of decreasing water content. A consolidating dredged material's water content has been shown to decrease as a function of time in a manner consistent with its self-weight consolidation curve (Cargill 1983), implying strength gain as a function of decreasing water content. For this reason, the laboratory vane test is useful for measuring the shear strength gain as a function of decreasing water content. When the need exists for a rapid and economical field monitoring method to measure or predict shear strength gain as a function of time (or water content), a method is needed to supplement the laboratory vane test, primarily because of the time required to determine the water content based on the standard test method D2216 (ASTM 1998). A simple new test method has been demonstrated that is a unique tool for monitoring changes in strength index properties and water content of physically disturbed (remolded) dredged material.

THE SLUMP TEST METHOD: The slump test is a simple procedure that basically consists of filling an upright open-ended cylinder with remolded dredged material, striking off the excess material at the top, slowly lifting the cylinder, and measuring the change in height (slump) as the material completes its outward flow. The only equipment required is an open cylinder, a smooth flat plate to rest it on, and a straightedge ruler. Minimal operator training is required for achieving consistent results.

The slump test for concrete (ASTM 2000a) has been used for years as a rapid field method to measure the consistency of freshly mixed concrete for quality control purposes. A conical upright open-ended cylinder is filled with wet concrete and tamped in three layers with a rod. After striking off the excess material at the top, the conical cylinder is slowly lifted, and the resulting change in height (slump) of the concrete is measured. The conical cylinder dimensions are 8 in. (200 mm) at the bottom, tapered 12 in. (300mm) high, with a 4 in. (100 mm) opening at the top.

The consistency test for controlled low strength materials (CLSM) (ASTM 1997) applies to flowable fills and soil-cement slurries. Instead of measuring the vertical change in material height (slump), the outward spread diameter is noted. The CLSM test's open-ended cylinder size is 6 in. (150 mm) in height with a 3 in. (76 mm) inside diameter.

Another application of the slump test has been to determine the yield stress of mine tailing waste materials (Pashias et al. 1996). For highly flocculated mineral suspensions, the test was shown to be an inexpensive method for plant operators to monitor suspension handling and transport. Especially useful was the ability to rapidly monitor changes in the slurry solids concentration.

The benefits of observing lateral displacement of dredged material samples as a function of time were first noted during a dredged capping project in the Boston Harbor (Fredette et al. 2000). Grab samples were openly placed on a flat sheet of plywood and their spread diameters and height changes were monitored for the purpose of observing dredged material consistency over a period of time. The height change values showed a better trend than did the spread values, and this simple test helped to achieve success for the subsequently placed sand cap by revealing when the dredged material had reached an optimum consistency.

For further application to dredged materials, the proposed cylinder slump test will provide a means to assess the selected material properties required for input into current and future physical and numerical models developed for both nearshore and contaminated dredging operations. As further tests are conducted on dredged materials, parameter correlation and predictability should be enhanced.

Dredged Material Slump Test. Figure 1 shows the sequence for the proposed dredged material cylinder slump test. The remolded material is placed as a thoroughly mixed homogenous mass into the slump cylinder, leveled off, and allowed to flow outward as the cylinder is slowly lifted upward with minimum disturbance to the sample. After the outward flow has visually stopped, the difference in height between the cylinder and the slumped material is noted. The outward flow spread diameter may also be noted.

Experimental Methods and Applicability. Numerous slump tests were conducted on different types of dredged material soils (coarse and fine-grained) using open-ended polyvinyl chloride (PVC) cylinders of various heights and diameters. Aspect ratios (cylinder height to cylinder diameter) of 1, 1.5, and 2 were evaluated, as well as slump/cylinder height, slump/cylinder diameter, slump/cylinder volume, and spread/cylinder volume ratios.

The slump cylinders were filled with remolded saturated soils at various consistencies. The water contents were varied to obtain consistencies ranging from viscous slurry to a soft soil. In situ pore water was removed or added as needed, and each sample was thoroughly mixed by hand to avoid air entrapment. The slump and spread diameter dimensions were noted, and the ASTM D2216 water content was taken from the slumped soil center to minimize excess pore pressure effects after shear failure. The best predictor was found to be the slump/cylinder height, also referred to as the normalized slump. Its applicability is discussed in more detail below.

Cylinder height dimensions ranged from 5 cm (2 in.) to 20 cm (8 in.), and diameter dimensions ranged from 5 cm (2 in.) to 15.2 cm (6 in.). Slightly better correlation between water content and normalized slump was found in cylinders with aspect ratios of 1:1 and 2:1, but many 2:1 samples had a higher tendency to topple over before slumping. The lateral spread was also measured in numerous samples, but better correlations were observed using the vertical deformation (slump) measurement. Deformations were measured to the nearest 0.32 cm (0.125 in.).

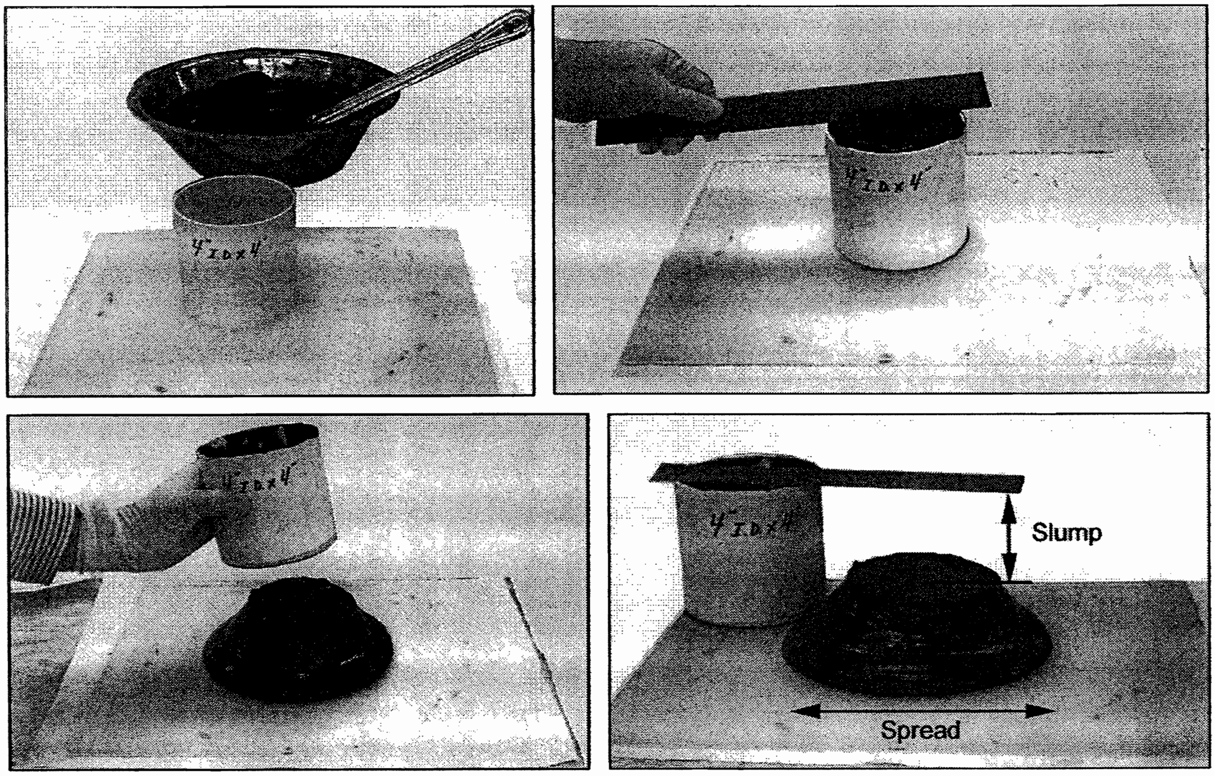


Figure 1. Dredged material slump test sequence

For each soil sample, the slump test was conducted as quickly as possible to avoid thixotropic effects, but each cylinder was lifted in a slow manner to avoid tensile failure and to prevent toppling. Pre-wetting the cylinder walls had no appreciable effect on the slump height but it helped prevent material sticking to the walls while lifting the cylinder. Each cylinder was removed in less than approximately 7 seconds after leveling off the top. Elapsed time during each test, from the sample preparation to final slump measurement, was typically less than 1 minute.

Figure 2 shows the normalized slump versus water content for various types and locations of dredged materials. Note that the test results vary as a function of soil type, and since the coarser-grained soils have less water content variability, the test is most useful for finer-grained soils.

Index property correlations for dredged materials were established by conducting other laboratory tests and identifying correlations to normalized slump. When the slump test is combined with index property correlations, it becomes a useful tool not only to rapidly monitor an individual material's properties as a function of time, but as a characterization tool for estimating an unknown dredged material's index properties.

Fine-grained materials were tested using the laboratory vane shear apparatus to determine their undrained shear strength as a function of water content. Correlation curves for slump, shear strength, water content, and other properties were then generated for each material tested. Figure 3 illustrates the laboratory vane undrained shear strength as a function of water content and liquid limit.

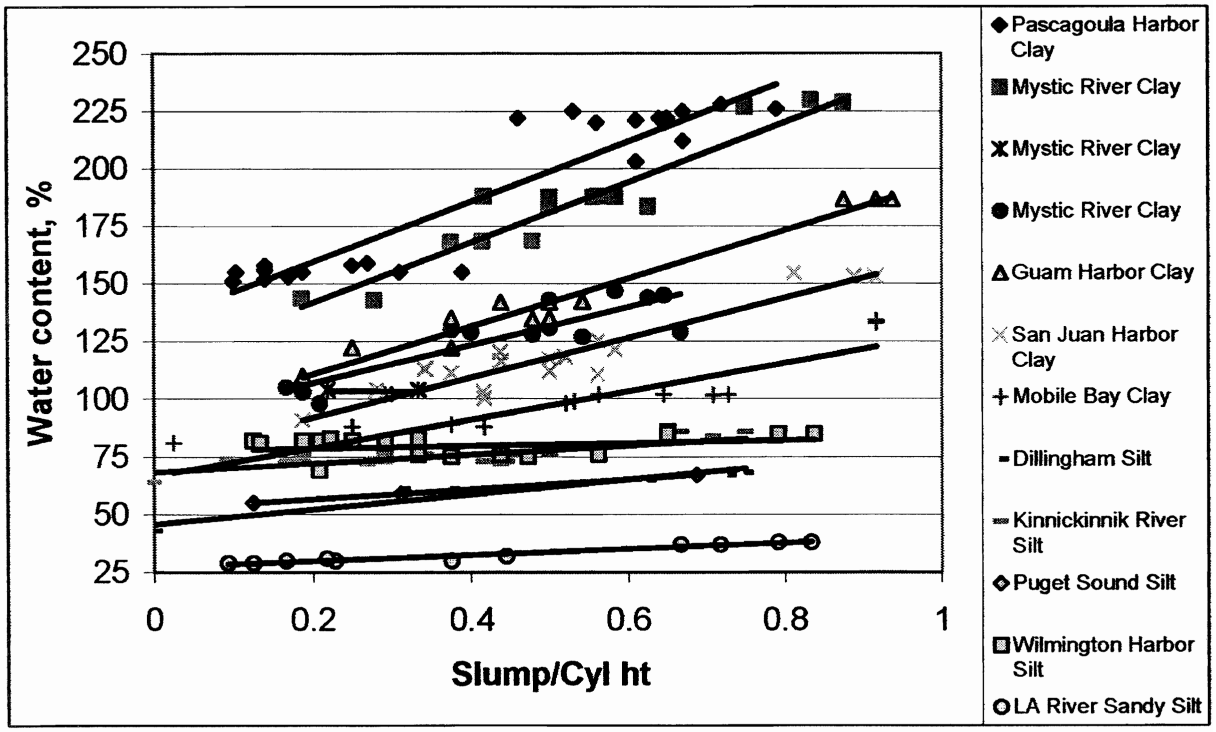


Figure 2. Normalized slump versus water content for several dredged materials

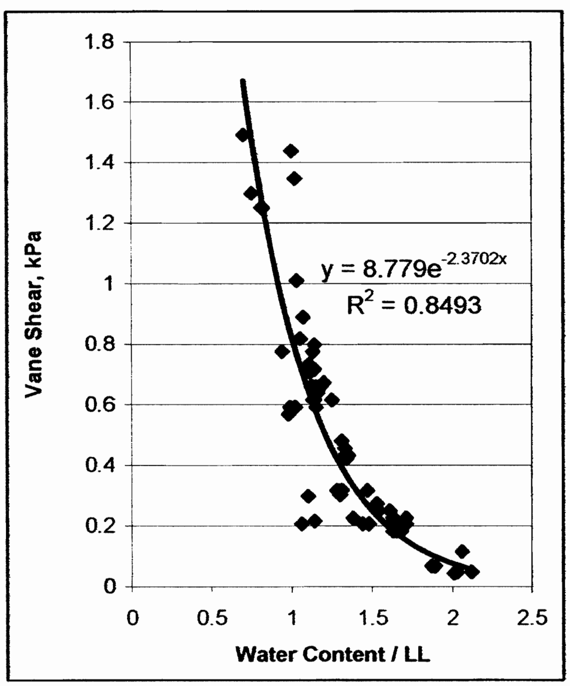


Figure 3. Plot of vane shear strength as a function of water content and liquid limit LL for Pascagoula Harbor material (to convert kPa to pounds per square foot (psf), multiply kPa by 20.8)

A set of correlation curves may be generated for any particular dredged material. The slump test method then becomes useful for monitoring changes in the remolded material properties either in the field or in the laboratory, based on the pre-generated curves. As an example, the engineering behavior properties of shear strength and self-weight consolidation stress may be monitored using a pre-generated slump test curve correlated to shear strength and consolidation. By conducting a series of simple slump tests and generating a function curve for a parameter such as water content (or void ratio, bulk density, solids content, etc.), the curve may be compared with another function containing the common parameter. Subsequent remolded material monitoring for changing shear strength or effective stress requires only a single slump test.

PREDICTING UNKNOWN MATERIAL INDEX PROPERTIES: Correlations useful for predicting unknown index properties were derived from experimental geotechnical data collected from geographically diverse fine-grained dredged materials. The correlations discussed below enable prediction of material properties including water content, wet bulk density, percent solids, void ratio, porosity, specific gravity, and Atterberg limits without conducting time-consuming and expensive standardized laboratory testing. Combining these experimental property correlations with published correlation equations enables expedient screening-level assessment of engineering behavior properties including undrained shear strength, consolidation, and permeability (saturated hydraulic conductivity) parameters without waiting for the prerequisite laboratory testing.

Method for predicting unknown water content. Given a dredged material with an unknown water content (defined as the weight of water divided by weight of dry solids), the standard procedure to determine water content involves an oven or microwave for drying to a constant mass (ASTM 1998). An alternate and much faster method is to measure the wet bulk unit weight (commonly called the bulk density) using a simple mud balance device (ASTM 1984) and apply the Equation 1 correlation (also shown in Figure 4):

$$\text{Water content \%} = 2 \times 10^{11} \gamma^{-4.7128} \qquad (1)$$

where γ = saturated wet bulk density, lb/cu ft

Equation 1 was experimentally obtained using 146 data points from fine-grained dredged material.

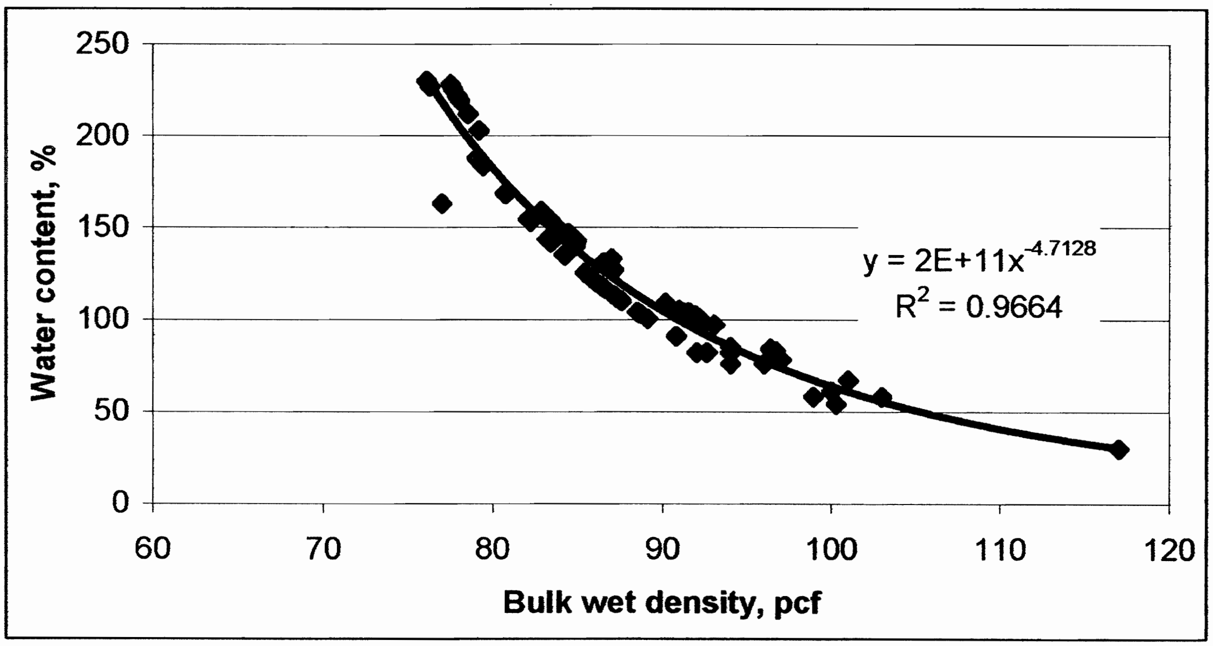


Figure 4. Dredged material water content as a function of bulk wet density (same as bulk unit weight) (to convert pounds per cubic foot (pcf) to Newtons per cubic meter, multiply by 157)

Method for predicting unknown Atterberg limits. Atterberg limits are defined by the shrinkage, plastic, and liquid limit water contents of fine-grained soils, along with the plasticity index and the liquidity index. The shrinkage limit is of little concern for dredged materials, but the plastic and liquid limits impact not only the classification but the behavior as well. As an example, knowing the Atterberg limits enables prediction of the clumping capability in mechanical dredging, which is needed for numerical models such as MDFATE. Laboratory testing (ASTM 2000b) is required to determine the Atterberg limits. An expedient prediction method is to conduct a single slump test and apply the following equations:

$$LL = 52.74 + 0.526W - 59.97N \tag{2}$$

where

LL = liquid limit percent
W = water content percent
N = normalized slump = slump / cylinder height

Equation 2 is based on a multiple linear regression of 126 data points with $R^2 = 0.86$.

$$LI = 1.601(W/LL) - 0.612 \tag{3}$$

where

LI = liquidity index
W/LL = water content percent / liquid limit percent

Equation 3 is based on a linear regression of 139 data points with $R^2 = 0.98$.

$$PL = \frac{(LI)(LL) - W}{LI - 1} \tag{4}$$

where

PL = plastic limit percent
LI = liquidity index
LL = liquid limit percent
W = water content percent

Equation 4 is the standard soil mechanics textbook equation for liquidity index (Atkinson and Bransby 1978) rearranged for determining the plastic limit. The plasticity index (PI) is then calculated as the liquid limit minus the plastic limit, or

$$PI = LL - PL \tag{5}$$

Thus by calculating the liquid limit using the slump test correlation (Equation 2), one may determine the liquidity index, plastic limit, and the plasticity index. Although Equation 2 is based on limited data to date with evident variance, there exists a strong correlation between water content, normalized slump, and the liquid limit.

For a quick assessment of a dredged material's liquid limit consistency without using the standard test method, insert the sharpened tip of a common No. 2 pencil (with the tip shaved to an approximately 60-deg angle) into the surface of the material and observe if the pencil remains in a vertical position. The maximum water content at which the pencil freely stands without toppling over is the approximate liquid limit.

Methods for predicting unknown phase relationships. Phase relationships include void ratio, percent solids, bulk density, porosity, and dry density, among others. They are calculated from parameters such as water content, percent saturation, and specific gravity, which generally require laboratory testing to determine.

To predict the saturated wet bulk density (or the bulk unit weight) of a dredged material when only the water content is known, the following equation may be used:

$$\gamma = 233.21W^{-0.2051} \tag{6}$$

where

γ = bulk unit weight (commonly called the bulk density), lb/cu ft
W = water content percent

Equation 6 is based on 146 data points with $R^2 = 0.96$.

To predict the void ratio (volume of voids / volume of dry solids) when the water content is known, but specific gravity is not, conduct a single slump test and use:

$$e = 0.028W - 0.055N - 0.065 \tag{7}$$

where

e = void ratio
W = water content percent
N = normalized slump = slump / cylinder height

Equation 7 is based on 185 data points with $R^2 = 0.99$, which is an excellent correlation.

If water content and specific gravity are both known, and the material is fully saturated, use the textbook equation:

$$e = WGs/100 \tag{8}$$

where

W = water content percent
Gs = specific gravity of solids

Combining Equations 7 and 8 allows estimation of the specific gravity, Gs:

$$Gs = 2.8 - 5.5N/W - 6.5/W \tag{9}$$

Another useful relationship is the percent solids by weight as a function of water content, illustrated in Figure 5.

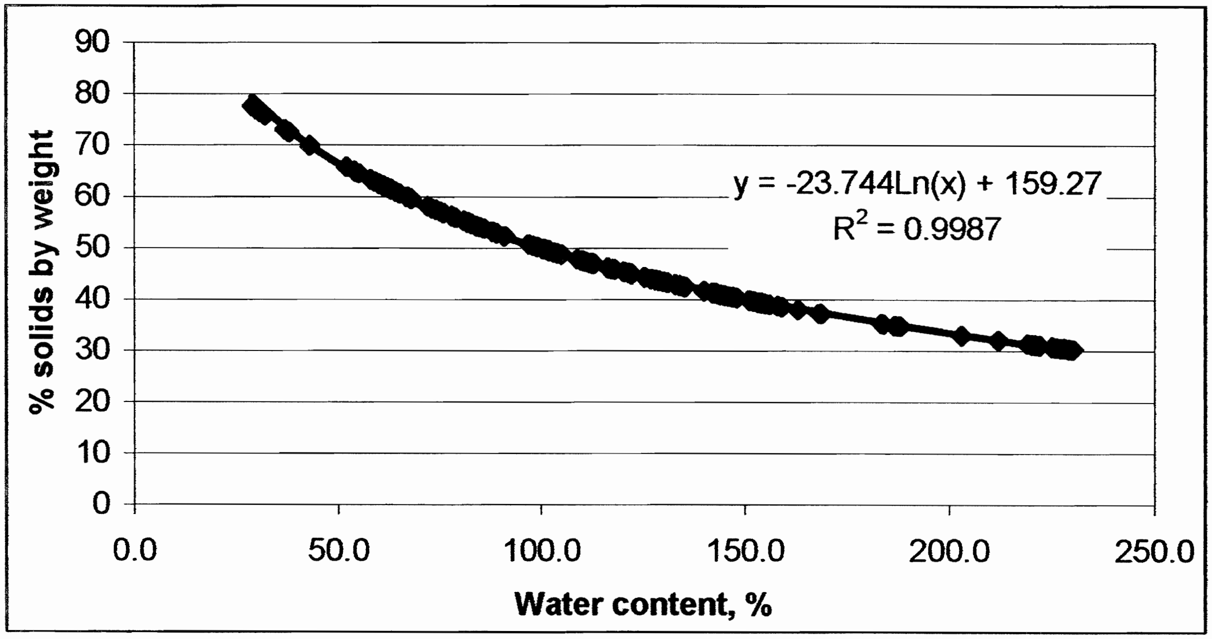


Figure 5. Percent solids by weight as a function of water content

The general equation for percent solids by weight is

$$\% \text{ solids by weight} = 10000 / (W+100) \qquad (10)$$

where W = water content percent

To convert percent solids by weight to percent solids by volume, the specific gravity needs to be known. An approximate conversion without knowing the specific gravity is

$$\text{Solids concentration by volume, grams/liter} \sim 10 \times \% \text{ solids by weight} \qquad (11)$$

Other conversions for solids content are given in EM 1110-2-5027 (Department of the Army 1987). Several geotechnical parameters may also be calculated using phase relationships found in soil mechanics textbooks such as Bardet (1997).

Methods for predicting unknown engineering behavior properties. For determining undrained shear strength knowing only the water content and liquid limit of the material, an approximate equation is:

$$\text{Vane shear strength psf} = 183\ e^{-2.3714(W/LL)} \qquad (12)$$

where

e = 2.718
W/LL = water content percent / liquid limit percent

A relatively low R^2 value of 0.85 based on 72 data points likely precludes usage of Equation 12 for anything other than general screening and rapid estimation purposes. Figure 6 shows the regression curve.

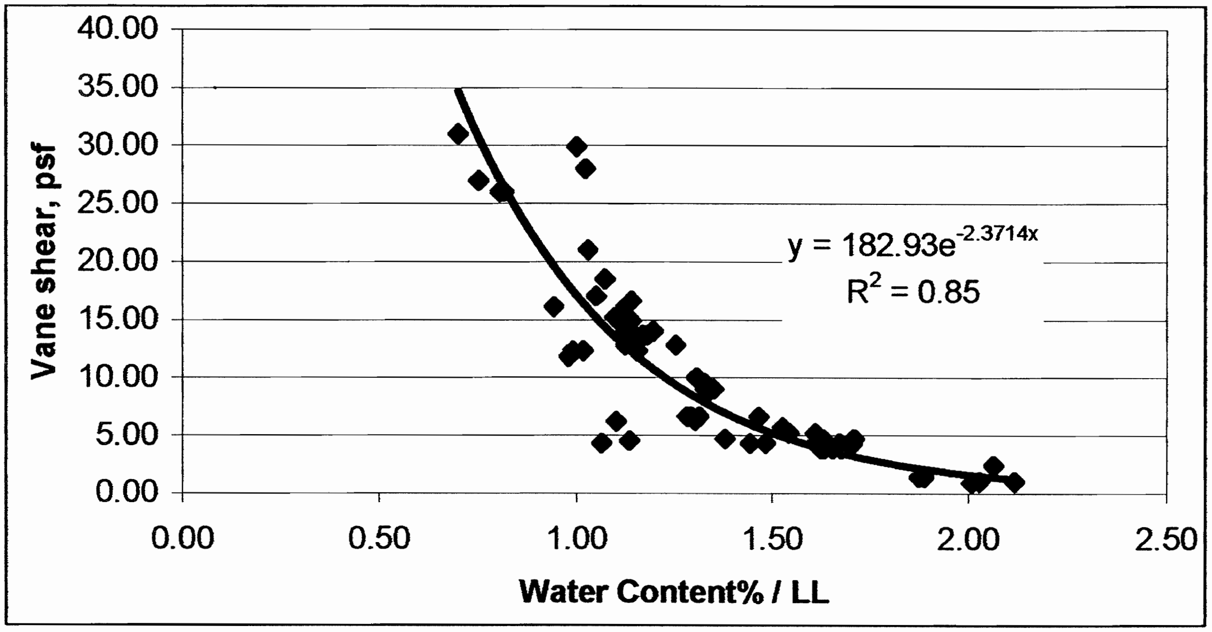


Figure 6. Vane shear strength as a function of water content and liquid limit (to convert pounds per square foot (psf) to kPa, divide psf by 20.8)

For estimating an unknown effective stress–void ratio relationship for a cohesive dredged material, Figure 7 was generated based on data from 10 self-weight consolidation tests combined with standard oedometer (fixed ring) consolidation tests. The ratio of water content to water content at the liquid limit for each material provided the best correlation to effective stress. A relatively low R^2 value of 0.83 based on 166 data points likely precludes usage of this equation for anything other than general screening and estimating purposes, similar to the vane shear equation above.

$$\sigma' = 129.77(W/LL)^{-4.7044} \tag{13}$$

where

σ' = effective stress, psf
W/LL = water content percent / liquid limit percent

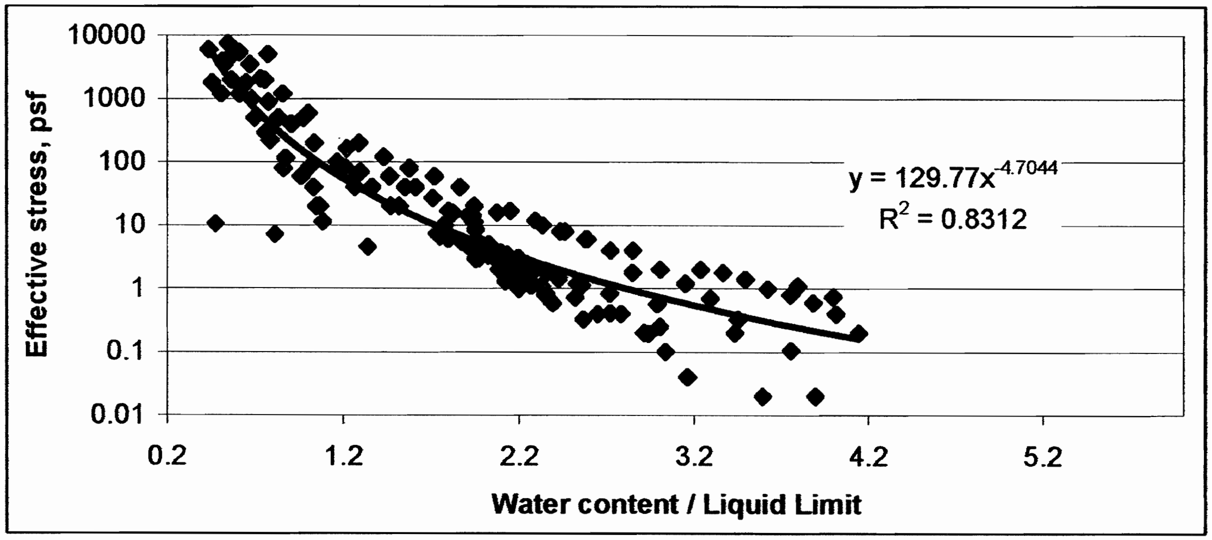


Figure 7. Predictive curve from dredged material self-weight and fixed-ring consolidation data (to convert pounds per square foot (psf) to kPa, divide psf by 20.8)

Numerous correlations between physical index properties and engineering behavior properties are available based on published data. For example, Wroth (1979) has shown that

$$LI = \log(170/c_u) / 2 \quad (14)$$

$$c_u = 170\, e^{-4.6LI} \quad (15)$$

where

LI = liquidity index

c_u = undrained shear strength, kN/m^2

e = 2.718

For the soil compression index Cc, Terzaghi and Peck (1967) showed that

$$Cc = 0.009\,(LL-10) \quad (16)$$

and Wood and Wroth (1978) showed that

$$Cc = Gs\, PI / 200 \quad (17)$$

where

Cc = compression index = change in void ratio per effective stress log cycle change

LL = liquid limit percent

Gs = specific gravity of solids

To estimate permeability (saturated hydraulic conductivity), Carrier and Beckman (1984) proposed the following equation for remolded clays:

$$k = 0.0174 \, [e - 0.027 \, (PL - 0.242PI) / PI]^{4.29} / (1+e) \quad (18)$$

where

k = permeability, m/sec
e = void ratio
PL = plastic limit percent
PI = plasticity index

SUMMARY: Geotechnical parameters required for numerical models may be easily predicted or estimated using material property correlations obtained from both standardized and innovative geotechnical tests. Both published and experimental correlation equations are presented herein for application to typical fine-grained remolded dredged materials (i.e., in a physically disturbed state such as that imposed by mechanical or hydraulic dredging operations). The following geotechnical parameters may be rapidly estimated based on dredged material test data, using one or more of the approximately 18 equations listed heretofore:

- Water content
- Bulk wet unit weight (commonly referred to as bulk density)
- Atterberg limits (liquid limit, plastic limit, plasticity index, and liquidity index)
- Specific gravity
- Void ratio and porosity
- Percent solids (by weight or volume)
- Undrained shear strength
- Effective stress
- Compression index
- Permeability

Obtaining geotechnical parameters using the above correlation equations does not substitute for standardized laboratory testing requirements. All correlations and non-standardized test methods presented herein are intended to be used as guidance for estimating purposes only, due to their empirical origins.

ADDITIONAL INFORMATION: Questions about this technical note can be addressed to Mr. Landris T. Lee (601-634-2661, Fax 601-634-3453, e-mail: *Landris.T.Lee@erdc.usace.army.mil*). This technical note and associated research work is funded by the Dredging Operations and Environmental Research (DOER) Program 12B Nearshore Focus Area Work Unit 33292 titled "Geotechnical Properties of Dredged Material." Program Manager of the DOER is Dr. Robert M. Engler (601-634-3624, *Robert.M.Engler@erdc.usace.army.mil*), and the Nearshore Focus

Area Manager is Dr. Joseph Z. Gailani (601-634-4851, *Joseph.Z.Gailani@erdc.usace.army.mil*). This technical note should be cited as follows:

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FOUNDATIONS OF ENGINEERING GEOLOGY

A. C. WALTHAM

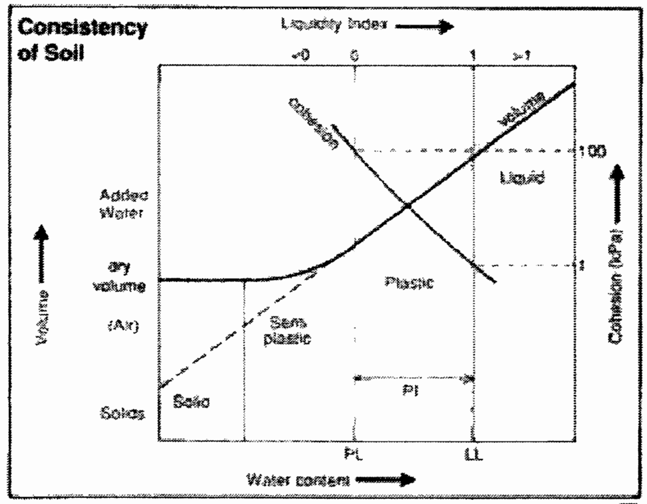
E & FN SPON

Properties of a soil depend on the grain size, mineralogy and water content, all of which are inter-related.
Clay minerals can hold high water content; for fine grained soils, critical concept is consistency related to water content.

SOIL CONSISTENCY

With varying water content, a soil may be solid, plastic or liquid. Most natural clays are plastic.
Water content (w) = weight of water as % of dry weight.
Consistency limits (Atterberg limits) are defined as:
Plastic limit (PL) = minimum moisture content where a soil can be rolled into a cylinder 3 mm in diameter.
Disturbed soil at PL has shear strength around 100 kPa.
Liquid limit (LL) = minimum moisture content at which soil flows under its own weight.
Disturbed soil at LL has shear strength around 1 kPa.
Plasticity index (PI) = LL–PL. This refers to the soil itself and is the change in water content required to increase strength 100 times; high PI soils are less stable with large swelling potential.
Liquidity index (LI) = (w–PL)/(PI). This refers to a particular water content; it is a measure of the consistency and strength.

Clay Mineral	Activity	PI	ϕ
Kaolinite	0·4	30	15
Illite	0·9	70	10
Smectite	>2	200	5
PI values are for soil with 75% clay fraction			

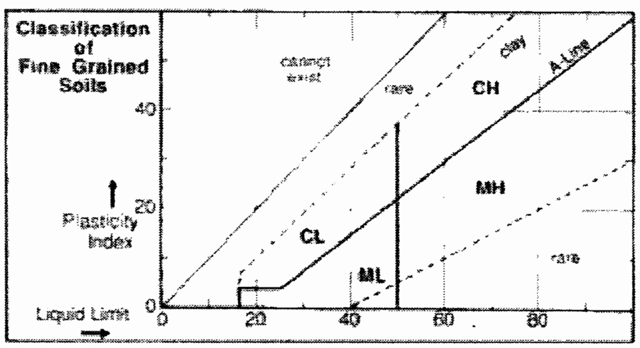


CLAY MINERALS

Plasticity and properties of clay soils depend on amount and type of clay minerals.
Soils with < 25% clay minerals are generally stronger, with low PI and ϕ < 20%.
Activity of clay = PI / % fines (< 0·002 mm diameter).
Soils with high clay fraction and high activity can retain high water content, giving them low strength, and also have low permeability.
Activity is mainly due to clay mineral type; smectite (montmorillonite) clays are the most unstable.

SOIL CLASSIFICATION

Soils are classified on grain size and consistency limits.
A-line distinguishes visually similar clays and soils.
More subdivisions exist in a full soil classification.



SHEAR STRENGTH

All soils fail in shear.
Shear strength is a combination of cohesion and internal friction; expressed by Coulomb failure envelope.
Cohesion (c) derives from interparticle bonds; significant in clays, zero in pure sands.
Angle of internal friction (ϕ) is due to structural roughness; higher in sand than in clay.

- Shear strength = cohesion + normal stress x tan ϕ

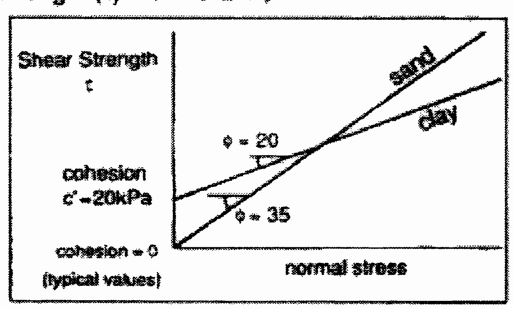
Normal stress is critical to shear strength but pore water pressure (pwp) carries part of overburden load on soil, thereby reducing normal stress.

- Effective stress (σ') = normal stress (σ) – pwp.

Shear strength is correctly defined in terms of effective stress, so that:

- Shear strength (τ) = c' + σ' tan ϕ'

Soil Classification		grainsize	typical values		
type	class	mm	LL	PI	ϕ
Gravel	G	2–60			>32
Sand	S	0·06–2			>32
Silt	ML	0·002–0·006	30	5	32
Clayey silt	MH	0·002–0·06	70	30	25
Clay	CL	<0·002	35	20	28
Plastic clay	CH	<0·002	70	45	19
Organic	O	–			<10



Properties of Cohesive Clay Soils							
Material	State	LI	SPT, N	CPT, MPa	c, kPa	m_v, m²/MN	ABP, kPa
Alluvial clays	soft	>0·5	2–4	0·3–0·5	20–40	>1·0	<75
	firm	0·2→0·5	4–8	0·5–1	40–75	0·3–1·0	75–150
Till and Tertiary clays	stiff	–0·1→0·2	8–15	1–2	75–150	0·1–0·3	150–300
	v. stiff	–0·4→–0·1	15–30	2–4	150–300	0·05–0·1	300–600
	hard	<0·4	>30	>4	>300	<0·005	>600

Cohesion (c) is equivalent to short term shear strength

ATTACHMENT 4

DEWATERING PUMP REFERENCE

MULTIQUIP
Electric Submersible Pumps

Versatile pumps with a wide variety of applications

Construction Starts Here

www.multiquip.com

Electric Submersible Pumps

MULTIQUIP

ST2037
2" — 115V
73 GPM

Multiquip Electric Submersible Pumps are ideal for removing water from confined areas. Their compact design and high performance enables them to get the job done where other pumps come up short. Submersible pumps provide several advantages over engine-driven pumps.

Models are available in sizes ranging from 1½" to 6" and provide high capacities — up to 36,600 GPH — with heads up to 125 feet. Single and three phase motor configurations are available to meet virtually any power requirement.

Versatile pumps that handle a wide range of applications:

Construction
Contractors prefer the rugged design of Multiquip pumps for removing water from well casings, construction sites, cofferdams and excavations. All pump components are designed to withstand the rigors of the job site.

Utilities
The pump of choice when dewatering manholes or transformer vaults. Service personnel value their lightweight and portability.

Municipalities
The versatility and reliability of Multiquip pumps makes them popular with state and local governments. Street and sanitation departments depend on our pumps for the removal of unwanted water.

Homeowners
Multiquip's lightweight, compact submersible pumps are the first choice for household dewatering applications such as basements and swimming pools.

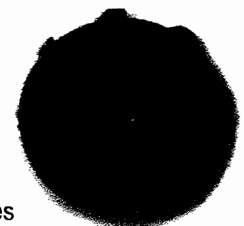
Single-Phase Models

Quiet, Unattended Operation
When you have a deadline to meet, you can't afford to have your pump stop working when your crew is done for the day. Multiquip submersibles are powered by electric motors and can be left running for hours.

Versatility
Submersibles can operate completely or partially submerged in any position. Unlike engine driven pumps, they require no priming assistance and may be used indoors.

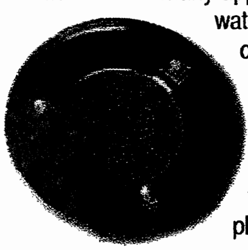
Maintenance
Since these pumps are driven by electric motors there are no concerns regarding fuel or engine oil. All wear parts are constructed of abrasion resistant material to reduce costly downtime for repairs.

Impellers
Urethane-covered impellers are made of high-chrome ductile iron to minimize wear and prolong service life.



Mechanical Seal
The mechanical seal of each pump operates within an oil-filled chamber that provides positive lubrication. This helps prevent damage in the event the pump is run dry for short periods of time. Some models have dual seals.

"Puddle Sucker"
While many applications require the removal of as much water as possible, most submersible pumps can leave as much as 1" to 2" of water. This can be very impractical when faced with a large surface area such as a basement floor. Multiquip's ST2038P "Puddle Sucker" has the ability to draw water down to a level of 1/16" or lower without having to place the pump in any type of sump.



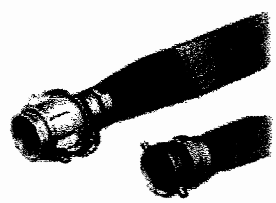
Motor Protection
All models have built-in thermal overload protection that shuts down the pump when the operating temperature becomes too high. The motor automatically restarts once the temperature returns to an acceptable level.

Hardware
All hardware is made of stainless steel to resist corrosion and simplify service.

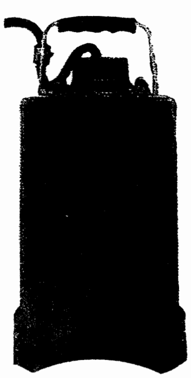
Quality and Safety
Single phase 2" and 3" Multiquip submersible pumps are certified in accordance with ISO9001 Quality Management System standard. Additionally, selected models carry the Underwriters Laboratories (UL) listing for compliance with both U.S. or Canadian electrical safety codes.

ISO 9001

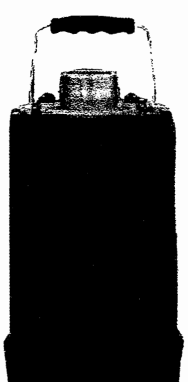
Pump Controls
Control boxes and float switches are available for all submersible pump models. These accessories enable the operator to either manually or automatically control pump operation. Features vary by model.



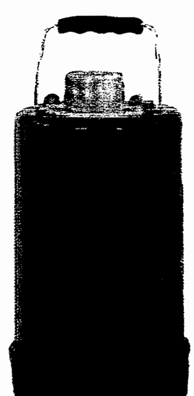
Hoses
A full line of discharge hoses with standard and quick-disconnect fittings are available to suit your application.



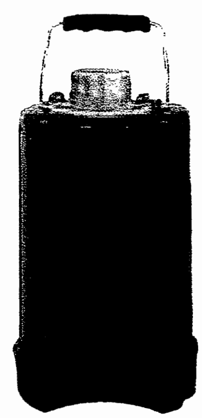
ST2038P
2" — 120V
60 GPM



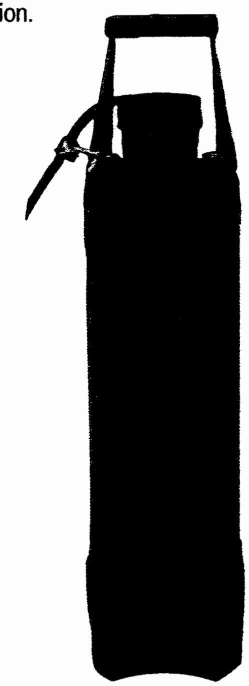
ST2037
2" — 120V
73 GPM



ST2047
2" — 120V
87 GPM



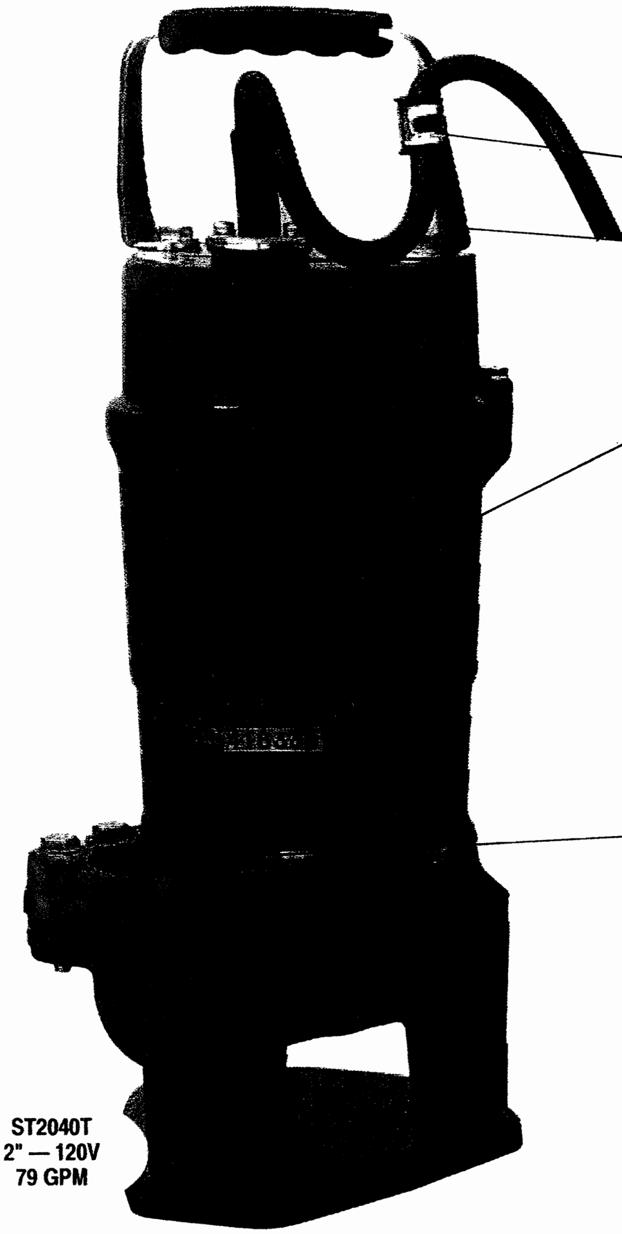
ST2047B
2" — 230V
87 GPM



ST3020BCUL
3" — 230V
170 GPM

Submersible Trash Pumps – Single Phase

Heavily debris-laden water calls for rugged pumps. Submersible trash pumps are equipped with a 2" discharge port and easily handle solids up to one inch in diameter. A vortex action discharges solids away from the cast iron multi-vane impeller to prevent clogging.



Strain relief cord protection

Carrying handle

Thermal overload protection

Cast iron pump casing for demanding environments

Oil-filled seal provides positive lubrication when running dry

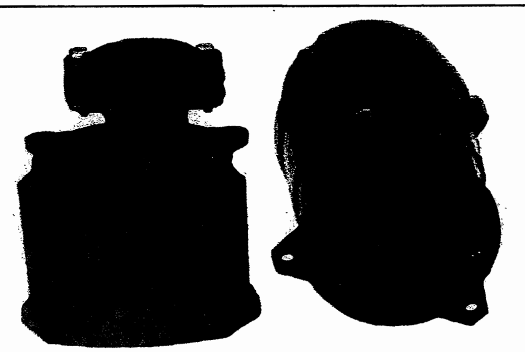
Easy cleanout

Cast iron impeller

Side discharge

ST2040T
2" — 120V
79 GPM

ST2010TCUL
2" — 120V
95 GPM



Easy Cleanout — The base of the Multiquip Submersible Trash Pumps can be quickly removed for service or inspection.

Stainless Steel Trash Pump

Pump Casing
High-strength plastic and stainless steel design for corrosive environments.

304 Stainless Steel
Resists corrosion; ideal for marine and certain chemical applications.

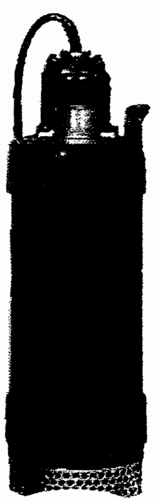
Impeller
Abrasion-resistant plastic design for long life and chemical resistance.

PX400
2" — 120V
72 GPM

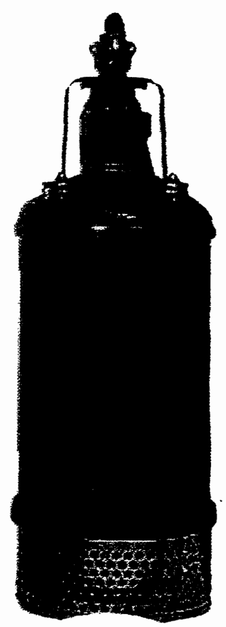
Three-Phase Electric Submersible Pumps

Multiquip 3-phase pumps are perfect for industrial dewatering applications and use with large job site generators where 3-phase power is readily available. Submersible pumps are available in 2", 3", 4" and 6" discharge sizes. All 3-phase models are available in 230/430 dual voltage, 50 or 60 Hz. Control boxes are available for all models that will also allow the use of float switches.

- The ST-2020BD is only 6.7 inches (170 mm) in diameter and can be used with 8 inch casings for dewatering applications. This pump is lightweight but durable at only 57 lbs. (26 kg).
- The ST-3050D is a very popular size for dewatering contractors and equipment rental companies. It is a good combination of flow and head: maximum flow of 145 GPM (549 lpm), maximum head of 86 feet (26 meters).
- The ST-4125D offers a threaded 4 inch discharge. It is built with a rugged cast iron casing.
- The ST-6125D features a flange discharge for pipe that can be adapted for hose. It is Multiquip's highest volume submersible pump at 610 GPM (2,309 lpm). This high-performer has a dependable cast iron casing.
- Both the ST-4125D and the ST-6125D have built in mechanical seal leak detection and come with 50 foot (15.2 meters) electrical power cables.

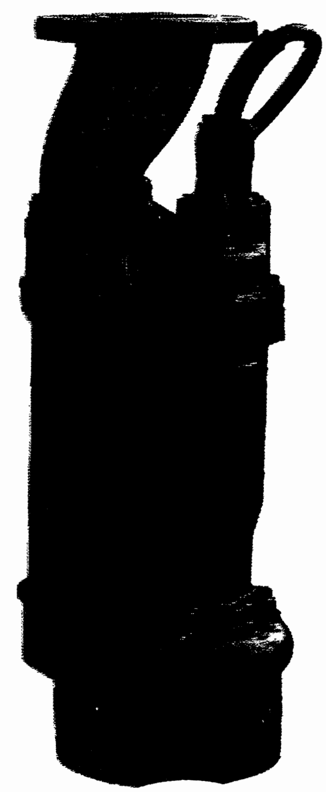


ST2020BD
2" — 230/460V
145 GPM



ST3050D
3" — 230/460V
270 GPM

ST4125D
4" — 230V or 460V
464 GPM



ST-6125D
6" — 230V or 460V
610 GPM

Note: All Multiquip 3-phase submersible pumps require a control box to provide it with all of the operation safety shut-downs and to use with float switches (if required). If these pumps are ordered to replace a unit in an existing application where a control box is already installed then the existing control box may be sufficient. If the pump is part of a new application where a control box is not already present then a control box needs to be ordered with the 3-phase submersible pump. A control box is needed specifically to provide the 3-phase submersible pump with the voltage overload and thermal overload shutdowns, as well as a connection point for the use of float switches.

MULTIQUIP

Control Boxes and Float Switches

Float Switches

SW1A Single Float Switch
■ UL and CSA listed ■ 20 foot, 14 gauge electrical cord (with piggyback plug) ■ For use with ST2037, -2038P, -2040T. *(See Figure 1)*

SW1WOPA Single Float Switch
■ UL and CSA listed ■ 20 foot, 14 gauge electrical cord, bare wire on end (no plug) ■ Use with control box applications (direct connection to control box); two each required.

SW2A Dual Float Switch
■ UL and CSA listed ■ 15 foot, 14 gauge electrical cord (with piggyback plug) ■ For use with ST2047 and -2010TCUL. *(See Figure 2)*

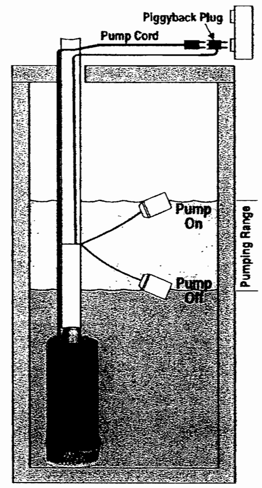


Figure 1 — Single Float Control

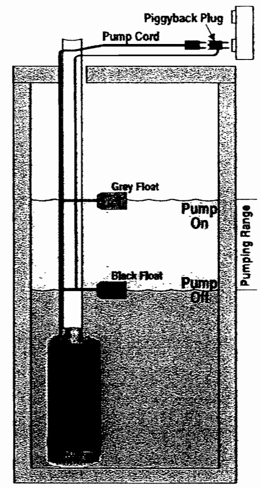


Figure 2 — Dual Float Control

Single-Phase Control Boxes

(includes two SW1WOPA Float Switches)

CB3 Single Phase Control Box
■ Water-resistant fiberglass housing ■ Running light
■ Use with any 120V model submersible pump.

CB-6 Single Phase Control Box
■ Water-resistant fiberglass housing
■ Relay, transformer, and overload protection ■ Use with any 230V 1ø pump.

Three-Phase Control Boxes

Full-featured Control Boxes (CB-series) *(float switches optional)*
■ CUL listed (UL for the USA and Canada) ■ Electronic overload guard helps prevent short circuits, single phasing, and power spikes. The overload guards have adjustable amperage settings ■ Watertight housing and cable glands prevent water from leaking into the box; an extra gland is provided in case float switches are used with the box ■ Operation switch and running lights are located on the front of the panel ■ Designed to accept float switches for automatic operation.
Model **CB101** for ST2020BD (230V applications only)
Model **CB102** for ST2020BD (430V applications only)
Model **CB200** for ST3050D (230 or 430V applications)

Basic Control Boxes (MCP-series)
■ Motor circuit protector, protects against short-circuits, single phasing, and power spikes ■ Adjustable amperage range ■ UL listed watertight fiberglass enclosure
■ Use where float switches are not required.
Model **MCP101** for ST2020BD (230V only)
Model **MCP102** for ST3050D (230V only)
Model **MCP103** for ST-2020BD (460V only)
Model **MCP104** for ST-3050D (460V only)

4" and 6" 3-Phase Sub Pump Control Boxes *(float switches optional)*
■ Water-resistant fiberglass housing ■ Magnetic starter, relay, transformer, and overload protection ■ Designed to accept float switches for automatic operation.
Model **CB-402** for ST-4125 (230V); Model **CB-404** for ST-4125 (460V);
Model **CB-602** for ST-6125 (230V); Model **CB-604** for ST-6125 (460V)

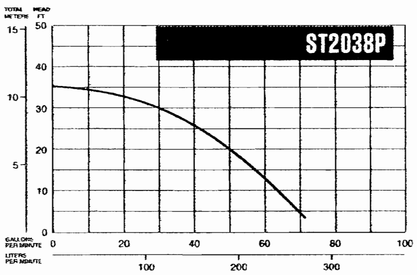
What You Should Know When Ordering a Pump

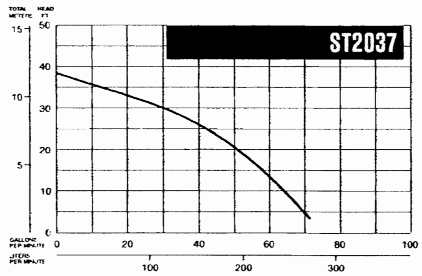
Your first concern is to pump water. Before making that telephone call to order your pump, there are a number of questions that need to be answered. The pump supplier wants to make certain that you get the pump you need. Knowing the answers to these questions will make their job easier and your ordering process much faster — and you'll know that you have the correct pump for your job.

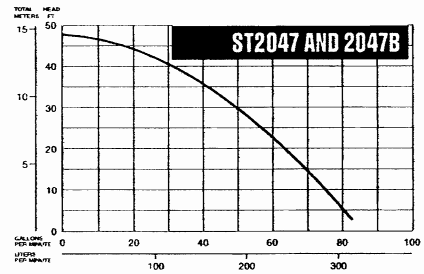
- **What is your application?** *Describe your pumping application, what is it that you need to do with the pump.*
- **How far under the water will the pump be located?**
- **What is the liquid that you are pumping?** *If it is water, then describe the condition of the water and if you are pumping any solids or sand. Is it hot water? If it is something other than water, be very specific about the liquid and its properties.*
- **Are you looking for an approximate flow?** *Gallons per minute or per hour.*
- **What is the height from the surface of the water you are pumping from to the discharge point?**
- **What is the length and diameter of your discharge hose/pipe?**
- **Is there any vertical rise in the discharge hose?** *If so, what is the vertical distance from the pump to where the water is discharging, or the highest point along the discharge hose.*
- **Are you using rubber/PVC water hoses, steel pipe, or PVC pipe?**

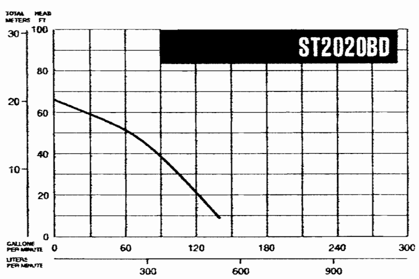
There can be more questions but these few will give you a good start in getting the correct pump for your job.

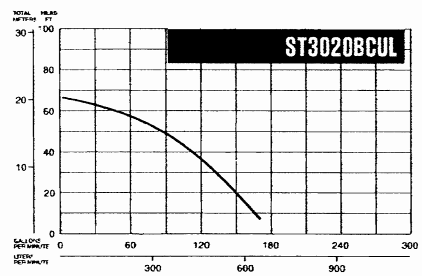
Pump Performance Curves

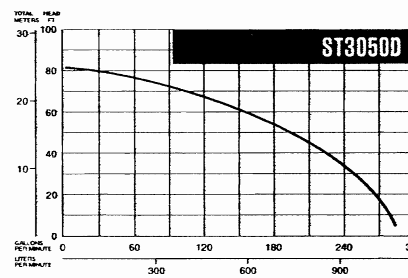


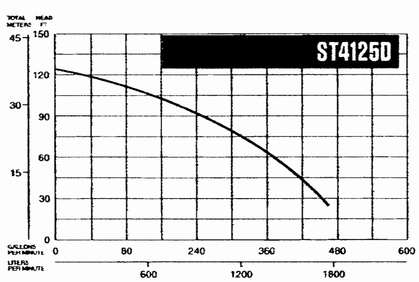


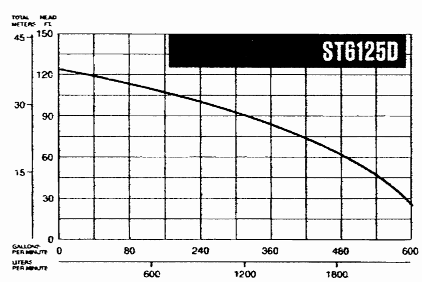


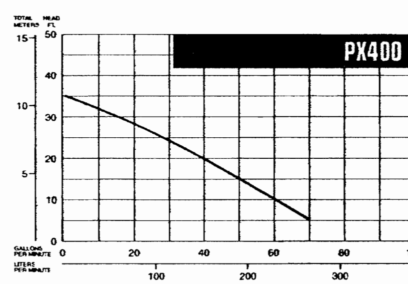


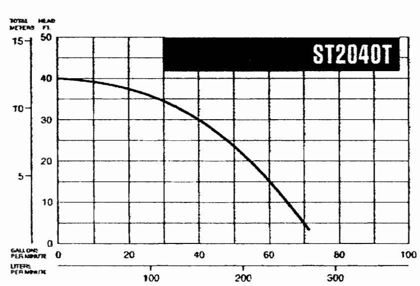


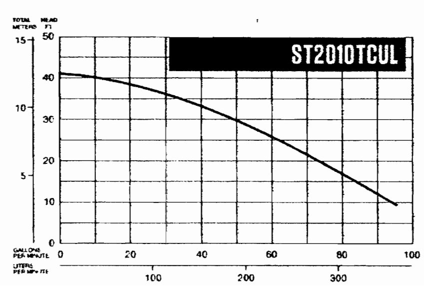












Multiquip Electric Submersible Pumps – Specifications

Model	Impeller	Disc. Size in. (mm)	Max. Solids in. (mm)	Total Head ft. (m)	Capacity GPM (lpm)	HP (kw)	Voltage; Phase	Starting Amp.	Running Amp.	Cable Length ft. (cm)	Diameter in. (mm)	Height in. (mm)	Weight lb (kg)
CENTRIFUGAL													
ST2038P*	Neoprene Rubber over Cast Iron	2 (50)	–	42 (12.8)	60 (227)	1 (0.75)	120V 1Ø	56	8	50 (15.2)	7.7 (196)	15.4 (391)	31 (14)
ST2037*	Neoprene Rubber over Cast Iron	2 (50)	–	37 (11.3)	73 (276)	1 (0.75)	120V 1Ø	34.5	6.9	50 (15.2)	7.4 (188)	15.4 (391)	31 (14)
ST2047*	Neoprene Rubber over Cast Iron	2 (50)	–	47 (14.3)	87 (329)	1 (0.75)	120V 1Ø	49	9.8	50 (15.2)	74 (188)	15.4 (391)	33 (15)
ST2047B*	Neoprene Rubber over Cast Iron	2 (50)	–	47 (14.3)	87 (329)	1 (0.75)	230V 1Ø	24.5	4.9	50 (15.2)	7.4 (188)	15.4 (391)	33 (15)
ST2020BD	Cast Ductile Iron	2 (50)	–	66 (20)	145 (549)	2 (1.5)	230/460V 3Ø	28 (230V) 14 (460V)	5.6 (230V) 2.8 (460V)	50 (15.2)	6.7 (170)	23 (580)	57 (26)
ST3020BCUL*	Cast Ductile Iron	3 (75)	–	72 (22)	170 (644)	2 (1.5)	230V 1Ø	52	10.5	50 (15.2)	6.7 (170)	28.5 (720)	67 (30)
ST3050D	Cast Ductile Iron	3 (75)	–	86 (26)	270 (1022)	5 (3.75)	230/460V 3Ø	77 (230V) 39 (460V)	14.2 (230V) 7.1 (460V)	50 (15.2)	10.2 (259)	26.8 (680)	120 (54)
ST4125D	Cast Ductile Iron	4 (100)	–	125 (38)	464 (1756)	10 (7.5)	230/460V 3Ø	149 (230V) 75 (460V)	27 (230V) 14 (460V)	50 (15.2)	14.2 (361)	32.7 (831)	330 (150)
ST6125D	Cast Ductile Iron	6 (150)	–	125 (38)	610 (2309)	15 (11)	230/460V 3Ø	215 (230V) 108 (460V)	29 (230V) 19.7 (460V)	50 (15.2)	14.2 (361)	38.8 (986)	390 (177)
TRASH PUMPS													
PX400*	Plastic	2 (50)	1 (25)	34 (10.3)	72 (273)	0.5 (0.37)	120V 1Ø	37	7	19 (5.6)	10 (254)	17 (430)	25 (11)
ST2040T*	Neoprene Rubber over Cast Iron	2 (50)	1 (25)	40 (12.2)	79 (299)	1 (0.75)	120V 1Ø	34	6.8	50 (15.2)	10.3 (267)	16.8 (427)	34 (15.4)
ST2010TCUL*	Cast Ductile Iron	2 (50)	1 (25)	45 (13.7)	95 (360)	1 (0.75)	120V 1Ø	53	9.4	50 (15.2)	10.3 (267)	22.7 (576)	77 (35)

Note: Models ST2020BD, -3050D, -4125D, and -6125D come factory-preset for operation at 230 volts. Specify when ordering if 460 volt operation is desired.

* Complies with UL and Canadian Electrical Standards.

Note: All Multiquip 3-phase submersible pumps require a control box to provide it with all of the operation safety shut-downs and to use with float switches (if required). If these pumps are ordered to replace a unit in an existing application where a control box is already installed then the existing control box may be sufficient. If the pump is part of a new application where a control box is not already present then a control box needs to be ordered with the 3-phase submersible pump. A control box is needed specifically to provide the 3-phase submersible pump with the voltage overload and thermal overload shutdowns, as well as a connection point for the use of float switches.

Your Multiquip dealer is:

MULTIQUIP®
MULTIQUIP INC.
POST OFFICE BOX 6254
CARSON, CA 90749
310-537-3700 • 800-421-1244
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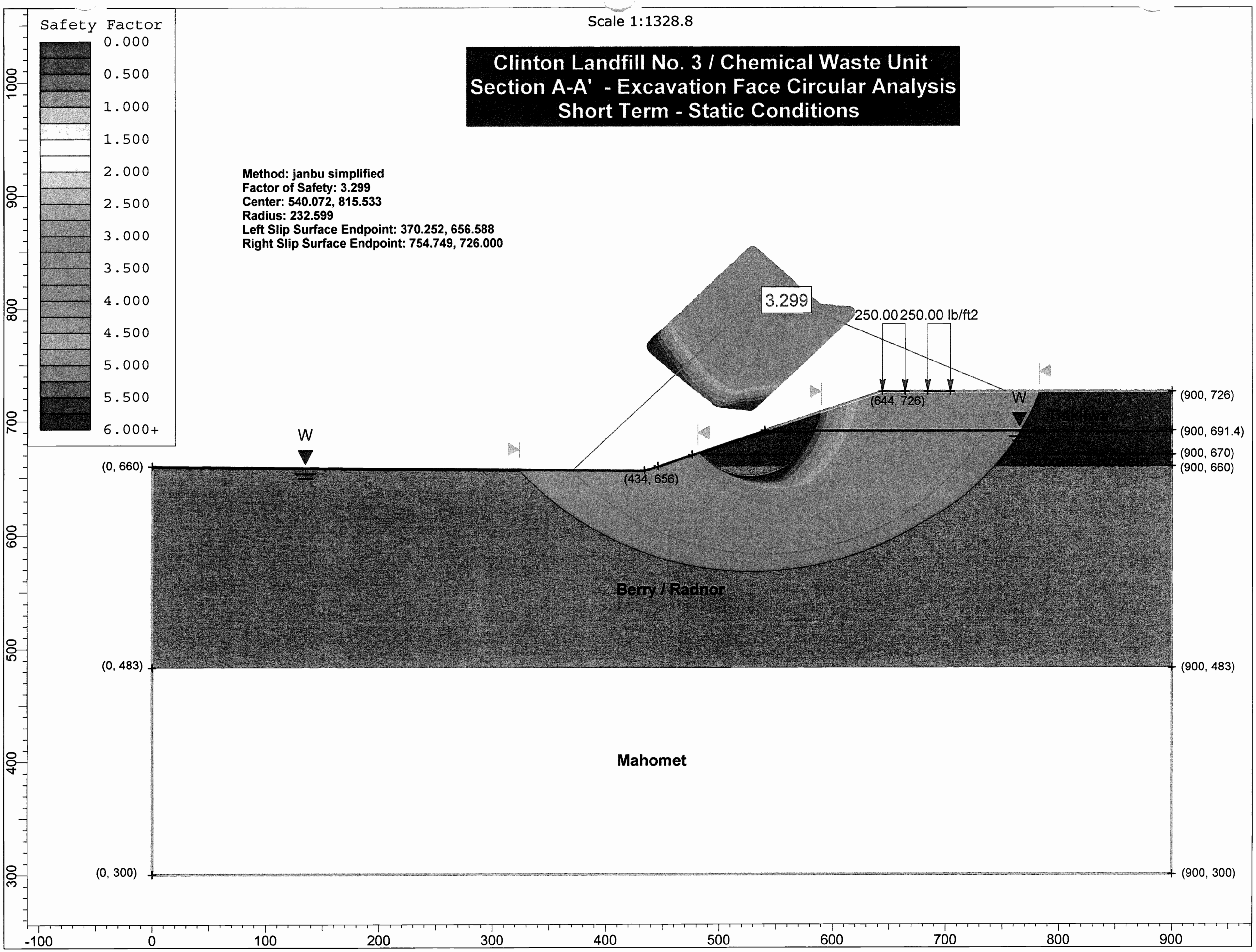
E-MAIL: mq@multiquip.com
www.multiquip.com

ATTACHMENT 5

SLIDE ANALYSIS

CROSS SECTION A-A'
EXCAVATION FACE CIRCULAR ANALYSIS
SHORT TERM / STATIC CONDITIONS



Scale 1:1328.8
Clinton Landfill No. 3 / Chemical Waste Unit
Section A-A' - Excavation Face Circular Analysis
Short Term - Static Conditions
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Method: janbu simplified
Factor of Safety: 3.299
Center: 540.072, 815.533
Radius: 232.599
Left Slip Surface Endpoint: 370.252, 656.588
Right Slip Surface Endpoint: 754.749, 726.000
3.299
250.00 250.00 lb/ft2
W
W
(644, 726)
(434, 656)
(0, 660)
(0, 483)
(0, 300)
(900, 726)
(900, 691.4)
(900, 670)
(900, 660)
(900, 483)
(900, 300)
Berry / Radnor
Mahomet

Slide Analysis Information

Document Name

File Name: A-A'_SSTAT_EC.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Slope Search
Number of Surfaces: 15000
Upper Angle: -45
Lower Angle: -45
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Normal to boundary, Magnitude: 250 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Normal to boundary, Magnitude: 250 lb/ft2

Material Properties

Material: Tiskilwa
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 135 lb/ft3
Saturated Unit Weight: 140 lb/ft3
Cohesion: 3500 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Roxana / Robein
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 100 lb/ft3
Saturated Unit Weight: 110 lb/ft3
Cohesion: 1400 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Berry / Radnor
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 140 lb/ft3
Saturated Unit Weight: 148 lb/ft3
Cohesion: 6000 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Mahomet
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 135 lb/ft3
Saturated Unit Weight: 140 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: janbu simplified
FS: 3.298560
Center: 540.072, 815.533
Radius: 232.599
Left Slip Surface Endpoint: 370.252, 656.588
Right Slip Surface Endpoint: 754.749, 726.000
Resisting Horizontal Force=2.18483e+006 lb
Driving Horizontal Force=662359 lb

Valid / Invalid Surfaces

Method: janbu simplified
Number of Valid Surfaces: 14999
Number of Invalid Surfaces: 1
Error Codes:
Error Code -111 reported for 1 surface

Error Codes

The following errors were encountered during the computation:

-111 = safety factor equation did not converge

List of All Coordinates

Material Boundary

0	483
900	483

Material Boundary

446	660
900	660

Material Boundary

476	670
900	670

External Boundary

0	300
900	300
900	483
900	660
900	670
900	726
644	726
476	670
446	660
434	656
0	660
0	483

Water Table

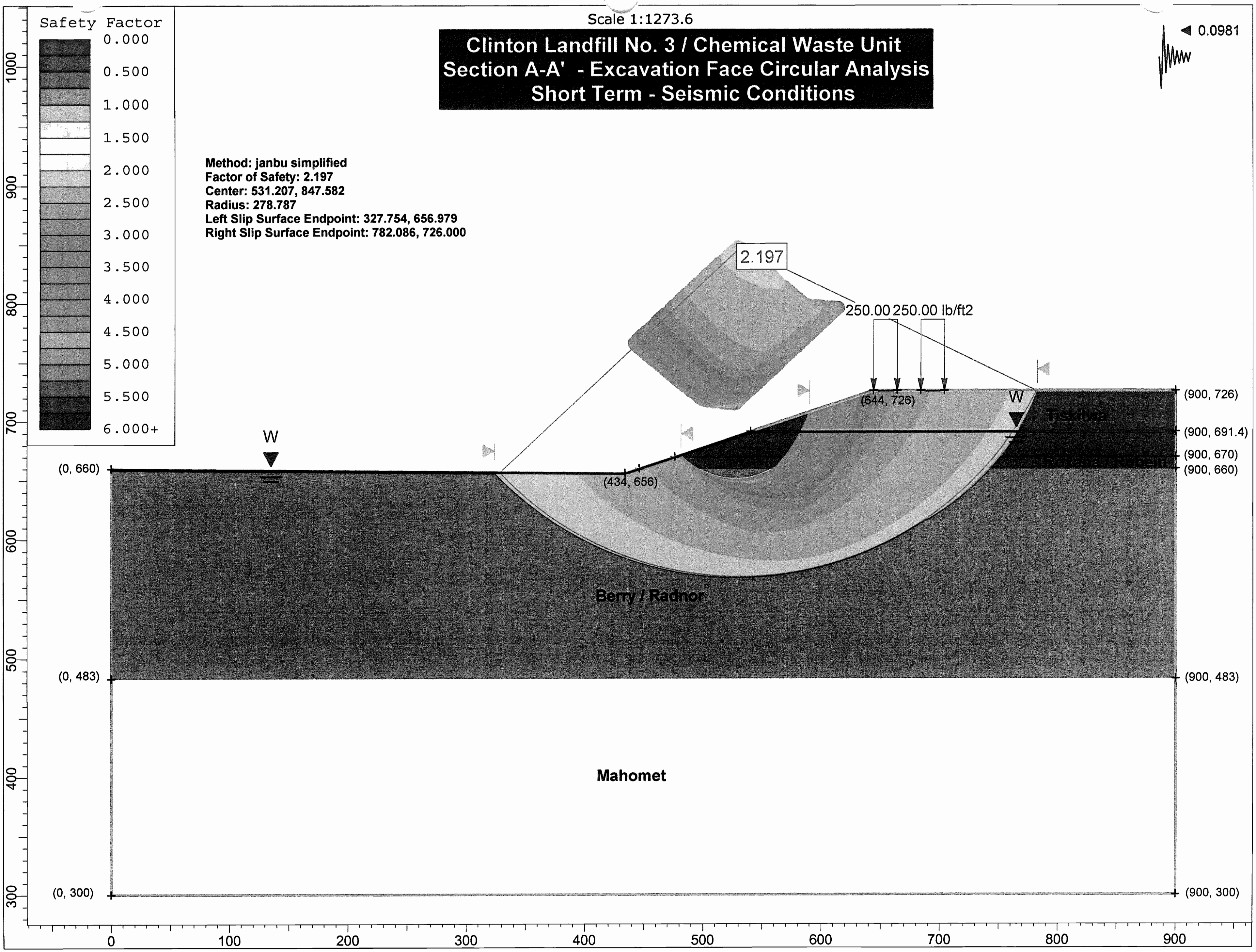
0	660
434	656
540	691
900	691

Distributed Load

664	726
644	726

Distributed Load
704 726
684 726

CROSS SECTION A-A'
EXCAVATION FACE CIRCULAR ANALYSIS
SHORT TERM / SEISMIC CONDITIONS



Scale 1:1273.6
Clinton Landfill No. 3 / Chemical Waste Unit
Section A-A' - Excavation Face Circular Analysis
Short Term - Seismic Conditions
Safety Factor
0.000
0.500
1.000
1.500
2.000
2.500
3.000
3.500
4.000
4.500
5.000
5.500
6.000+
Method: janbu simplified
Factor of Safety: 2.197
Center: 531.207, 847.582
Radius: 278.787
Left Slip Surface Endpoint: 327.754, 656.979
Right Slip Surface Endpoint: 782.086, 726.000
0.0981
2.197
250.00 250.00 lb/ft2
(644, 726)
(434, 656)
W
W
Tiskilwa
Berry / Radnor
Mahomet
(0, 660)
(0, 483)
(0, 300)
(900, 726)
(900, 691.4)
(900, 670)
(900, 660)
(900, 483)
(900, 300)
0
100
200
300
400
500
600
700
800
900
1000

Slide Analysis Information

Document Name

File Name: A-A'_SSEIS_EC.sli

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Slope Search
Number of Surfaces: 15000
Upper Angle: -45
Lower Angle: -45
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.0981
2 Distributed Loads present:
Distributed Load #1 Constant Distribution, Orientation: Normal to boundary, Magnitude: 250 lb/ft2
Distributed Load #2 Constant Distribution, Orientation: Normal to boundary, Magnitude: 250 lb/ft2

Material Properties

Material: Tiskilwa
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 135 lb/ft3
Saturated Unit Weight: 140 lb/ft3
Cohesion: 3500 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Roxana / Robein
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 100 lb/ft3
Saturated Unit Weight: 110 lb/ft3
Cohesion: 1400 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Berry / Radnor
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 140 lb/ft3
Saturated Unit Weight: 148 lb/ft3
Cohesion: 6000 psf
Friction Angle: 0 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Mahomet
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 135 lb/ft3
Saturated Unit Weight: 140 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Global Minimums

Method: janbu simplified
FS: 2.196940
Center: 531.207, 847.582
Radius: 278.787
Left Slip Surface Endpoint: 327.754, 656.979
Right Slip Surface Endpoint: 782.086, 726.000
Resisting Horizontal Force=2.59619e+006 lb
Driving Horizontal Force=1.18173e+006 lb

Valid / Invalid Surfaces

Method: janbu simplified
Number of Valid Surfaces: 15000
Number of Invalid Surfaces: 0

List of All Coordinates

Material Boundary

0	483
900	483

Material Boundary

446	660
900	660

Material Boundary

476	670
900	670

External Boundary

0	300
900	300
900	483
900	660
900	670
900	726
644	726
476	670
446	660
434	656
0	660
0	483

Water Table

0	660
434	656
540	691
900	691

Distributed Load

664	726
644	726

Distributed Load

704	726
684	726

ATTACHMENT 6

LIQUEFACTION ANALYSIS

Client: Clinton Landfill, Inc.

Project: Clinton Landfill No. 3 Chemical Waste Unit

Proj. #: 128017

Shaw® Shaw Environmental, Inc.

Calculated By: LJC Date: 11/6/08

Checked By: JWP Date: 11/12/08

TITLE: LIQUEFACTION POTENTIAL EVALUATION/

Problem Statement

Determine the potential for liquefaction in the vicinity of the landfill.

Given

- Boring logs from Application to Develop a Non-Hazardous Solid Waste Landfill for Clinton Landfill No. 3, submitted to the Illinois Environmental Protection Agency in February 2005. Borings EX-3, EX-7, and EX-27 were used to determine depth to saturated sand.
- *Liquefaction of Soils During Earthquakes,* National Revue Council Committee on Earthquake Engineering. (1985) [After Seed and Idriss]. See Attached.
- N-values for sand are typically above 30, with minimum a N-value of 15.
- Depth to saturated sand was between 17.5 feet and 50.7 feet deep, with an average depth of 31.7 feet.
- Depth of sand was between 1 foot and 7.5 feet with an average depth of approximately 5 feet.
- Saturated unit weight of granular material, γ_{sat}, = 130 pcf.
- Buoyant unit weight of granular material, $\gamma_b = \gamma_{sat} - \gamma_w$ = 130 - 62.4 = 67.6 pcf.
- maximum acceleration at the ground surface is 0.0981g (from foundation bearing capacity calcs, maximum bedrock acceleration = 0.06g, seismic coefficient = 1.2)

Calculations

$$\frac{\tau_{av}}{\sigma'_o} = 0.65 * a_{\max} \sigma_o \frac{r_d}{\sigma'_o g}$$

where,

a_{max} is the maximum acceleration at ground surface
σ_o is the total overburden stress at depth under consideration
σ'_o is the effective overburden stress at the same depth
r_d is the stress reduction factor that decreases from a value of 1 at the ground surface to a value of 0.9 at a depth of 35 ft.

Client: Clinton Landfill, Inc.

Project: Clinton Landfill No. 3 Chemical Waste Unit

Proj. #: 128017

Shaw® Shaw Environmental, Inc.

Calculated By: LJC Date: 11/6/08

Checked By: JWP Date: 11/12/08

TITLE: LIQUEFACTION POTENTIAL EVALUATION/

σ'_o = (31.7 ft)(130 lbs/ft^3) + (2.5 ft)(130 lbs/ft^3 - 62.4 lbs/ft^3) = 4,290 lbs/ft^2 (at mid depth)

σ_o = (34.2 ft)(130 lbs/ft^3) = 4,446 lbs/ft^2

a_{max} = 0.0981 g

r_d = 0.902 (interpolated, r_d = 1.0 at ground surface, 0.90 at depth 35 ft)

$$\frac{\tau_{av}}{\sigma'_o} = 0.65 * 0.0981 * 4{,}446 \frac{0.902}{4{,}290g} = 0.0596$$

Corrected N-value:

$N_c = N_{field} * C_N$

where, N_c is the corrected N value
N_{field} is the field N value
C_N is the overburden correcting factor, from figure 4-5

Nc = 15 * 0.66 = 9.9

Results

The results of τ_{av}/σ'_o vs. N_c were plotted on Figure 4-6. The results show this site is well below the lower bound for sites where liquefaction occured, therefore liquefaction is negligible.

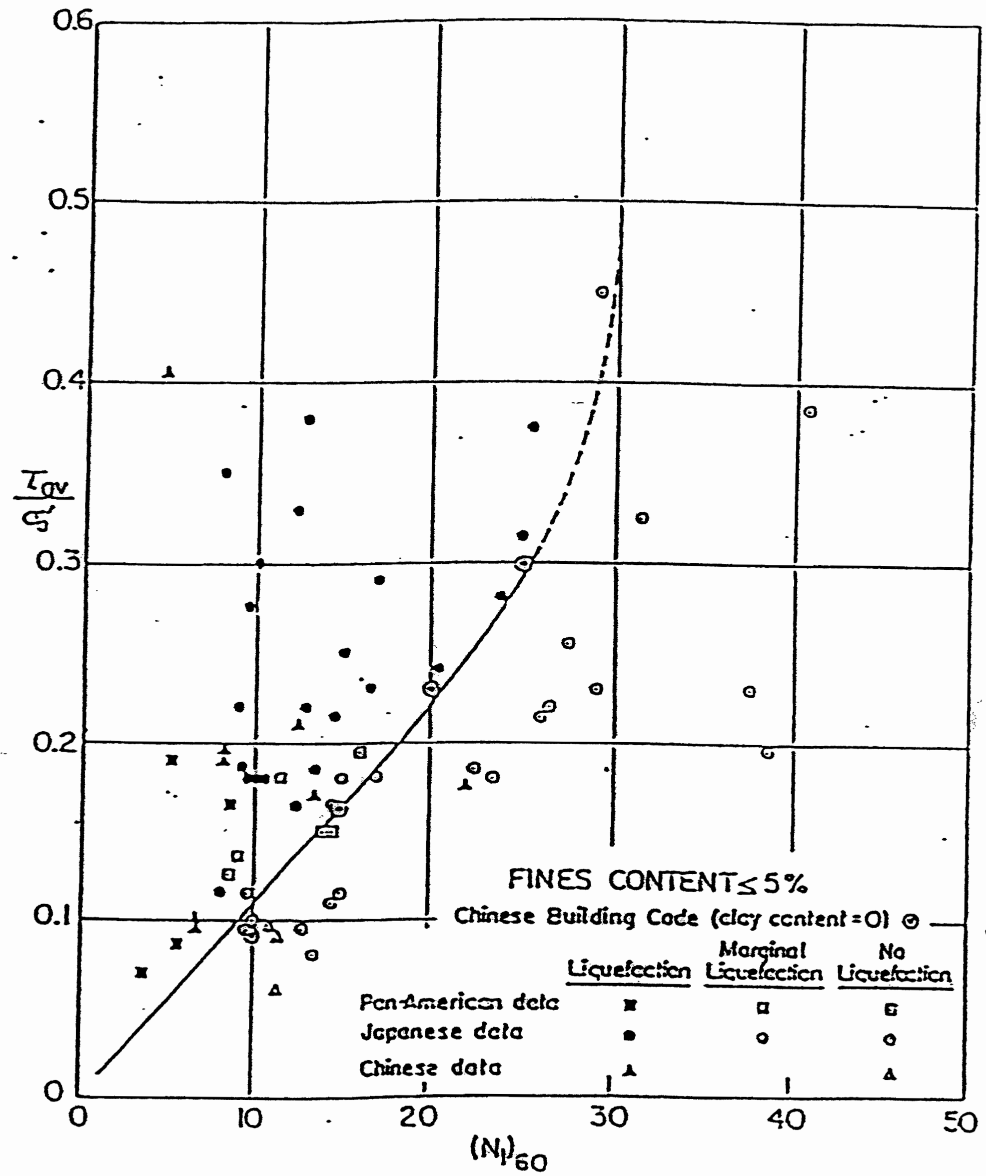


FIGURE 4-3 Relationship between stress ratios causing liquefaction and $(N_1)_{60}$ values for clean sands for magnitude 7.5 earthquakes. Source: Seed et al. (1984).

surface acceleration by a simple equation that accounts approximately for the relative importance of the many different acceleration peaks in a typical ground motion record (Seed and Idriss, 1971):

$$\tau_{av}/\sigma'_o = 0.65\ a_{max}\ \sigma_o\ r_d/\sigma'_o\ g \qquad \text{(Eq. 4-1)}$$

where a_{max} is the maximum acceleration at ground surface, σ_o equals the total overburden stress at depth under consideration, σ'_o is the effective overburden stress at this same depth, and r_d equals a stress reduction factor that decreases from a value of 1 at the ground surface to a value of 0.9 at a depth of 35 ft.

The resistance of the soil is represented by the horizontal abscissa $(N_1)_{60}$, which is the blow count in the standard penetration test (SPT), corrected (as discussed later) for the depth of overburden and for certain details in the performance of the test. Both τ_{av}/σ'_o and $(N_1)_{60}$ are evaluated at the depth in the particular deposit most critical from the standpoint of liquefaction.

The curve drawn in Figure 4-3 is intended to divide zones corresponding to liquefaction and nonliquefaction. A new site would be evaluated by plotting a point corresponding to the blow count for the site and to the design earthquake ground motion. If the point plots on or above the curve, the site would be judged susceptible to liquefaction. If the point plots below the curve with an adequate margin of safety, the site is judged to be safe.

There is no general agreement on the appropriate margin of safety, primarily because the degree of conservatism thought desirable at this point depends upon the extent of the conservatism already introduced in assigning the design earthquake. If the design earthquake ground motion is regarded as reasonable, a safety factor of 1.33 or 1.35 on τ_{av}/σ'_o is suggested as adequate. However, when the design ground motion is excessively conservative, engineers are content with a safety factor only slightly in excess of unity.

The important effect of the duration of the ground shaking can be taken into account by a correction related to the magnitude of the earthquake. Statistical studies (Seed et al., 1975c) show that the number of cycles representative of different magnitude earthquakes is typically as in Table 4-2. Using a representative shape for the relationship between cyclic stress ratio and the number of cycles required to cause liquefaction, a factor with which to correct the ordinates of

TABLE 4-2 Representative Number of Cycles and Corresponding Correction Factors

Earthquake Magnitude (M)	Number of Representative Cycles at 0.65 τ_{max}	Factor to Correct Abscissa of Curve in Figure 4-3
8.5	26	0.89
7.5	15	1.0
6.75	10	1.13
6.0	5-6	1.32
5.25	2-3	1.5

SOURCE: After Seed and Idriss (1982).

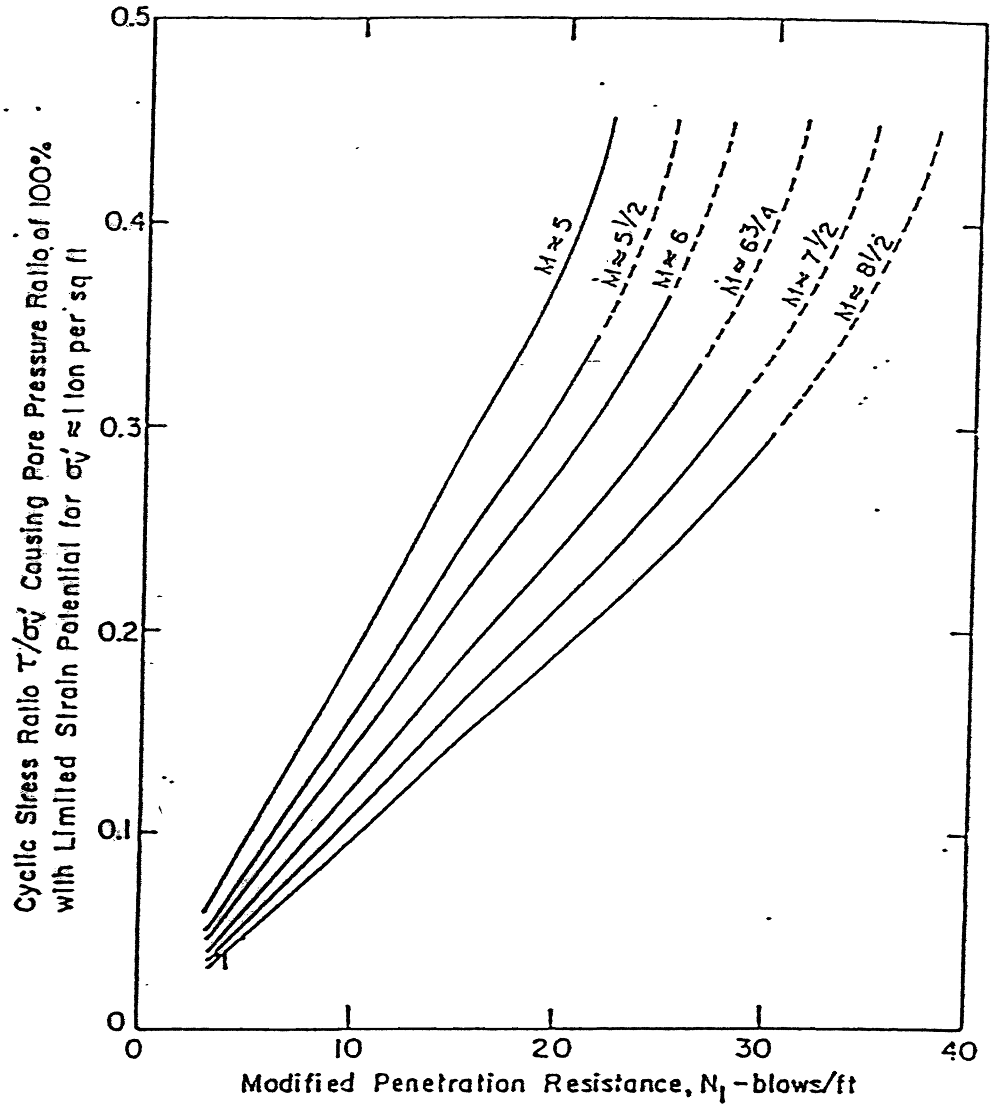


FIGURE 4-4 Chart for evaluation of liquefaction potential of sands for earthquakes of different magnitudes. Source: Seed and Idriss (1982).

Figure 4-3 can be deduced. These correction factors are also listed in the table. Using these factors leads to a family of curves such as those in Figure 4-4.*

The form of the plot in Figure 4-3 is well-grounded in theory. Laboratory tests and theoretical analyses have shown the general appropriateness of the ratio τ_{av}/σ'_o as a measure of resistance to liquefaction. Use of this ratio means that the depth of the water table

*Note that the curves for $M = 7½$ are somewhat different in Figures 4-3, 4-7, and 4-4, since the curves were based on different data sets. Figure 4-4 is included for illustrative purposes only; use of Figure 4-3 plus Table 4-2 represents the most up-to-date practice.

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is automatically taken into account. The penetration resista various factors (e.g., relative density and horizontal effec known from laboratory tests to affect susceptibility to li This figure is the latest in a gradually evolving lineage of s (Seed and Idriss, 1971; Seed and Peacock, 1971; Whit Castro, 1975; Seed et al., 1975a; Seed, 1976; Seed, 1979a; 1983; Tokimatsu and Yoshimi, 1983; Seed et al., 1984 improved as more data have become available and as the int of the data have been refined. Many eminent engineers re plots such as Figure 4-3 as the best method available fo liquefaction susceptibility. This practice avoids the diffict and questions concerning undisturbed testing and samplin the most direct use of actual experience during earthquak

Nonetheless, there are additional factors that must be

Corrections to Blow Count

It has been apparent that the standard penetration test h standardized. There are important differences between th used in different countries, and there can be significant c the practice followed within a country. It is important to and correct for these differences when preparing data su Figure 4-3, and such understanding is vital when applying to evaluation of a new site. There are several aspects of to consider: for example, the manner in which energy is the drill rod, the length of the drill rod, the effect o sampling tube, the effective stress present at the depth w count is being evaluated, and the drilling fluid (DeMello, 1 mann and Palacios, 1979; Kovacs and Salomone, 1982; 1984).

The manner of delivering energy to the drill roc important. Table 4-3 summarizes results from studies in of theoretical energy actually reaching the rod when hammer types and hammer release mechanisms. Mos difficulties can be eliminated by standardizing the test recommended by Kovacs et al. (1983, 1984) and Seed e by correcting results to this standardized procedure. using the standard conditions shown in Table 4-4 and cc to an energy ratio of 60 percent and an effective overb of 1 ton/ft².

Figure 4-5 is a chart used to correct the observed blo value, (N_1), which would be measured at an effect stress of 1 ton/ft². Thus the combined correction is:

$$(N_1)_{60} = C_N \, ER_m \, N_m / 60$$

TABLE 4-3 Summary of Energy Ratios for SPT Procedures

Country	Hammer Type	Hammer Release	Estimated Rod Energy (Percent)	Correction Factor for 60 Percent Rod Energy
Japan[a]	Donut	Free-fall	78	78/60 = 1.30
	Donut	Rope and pulley with special throw release	67	67/60 = 1.12
United States	Safety	Rope and pulley	60	60/60 = 1.00
	Donut[b]	Rope and pulley	45	45/60 = 0.75
Argentina	Donut	Rope and pulley	45	45/60 = 0.75
China	Donut	Free-fall[c]	60	60/60 = 1.00
	Donut	Rope and pulley	50	50/60 = 0.83

[a]Japanese SPT results have additional corrections for borehole diameter and frequency effects.
[b]Prevalent method in the United States today.
[c]Pilcon-type hammers develop an energy ratio of about 60 percent.
SOURCE: Seed et al. (1984).

TABLE 4-4 Recommended SPT Procedure for Use in Liquefaction Correlations

Factor	Recommended Procedure
Borehole	Four-to five-in.-diameter rotary borehole with bentonite drilling mud for borehole stability
Drill bit	Upward deflection of drilling mud (tricone of baffled drag bit)
Sampler	O.D. = 2.00 in. I.D. = 1.38 in., constant (i.e., no room for liners in barrel)
Drill rods	AW for depths less than 50 ft; N, BW, or NW for greater depths
Energy delivered to sampler (rod energy)	2,520 in.-lb (60 percent of theoretical maximum)
Blowcount rate	Thirty to forty blows per minute
Penetration resistance count	Measures over range of 6 to 18 in. of penetration into the ground

SOURCE: Seed et al. (1984).

where N_m is the measured blow count and ER_m the corresponding energy ratio in percent. Both corrections were made to all observed blow counts in Figure 4-3. Other corrections were also applied in some instances.

With respect to the overburden correction factor C_N, it has been pointed out by Liao and Whitman (1985) that discrepancies exist with

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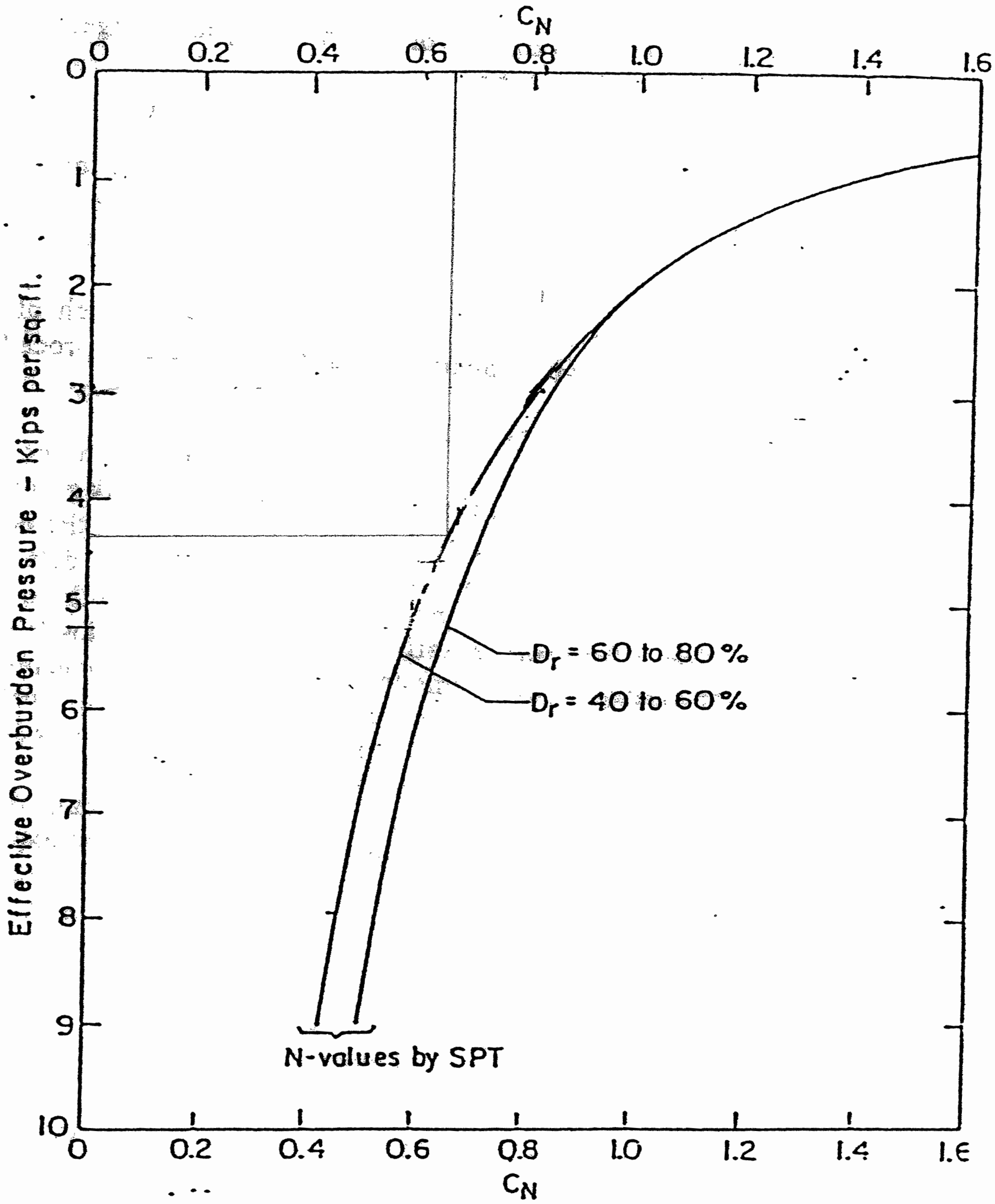

FIGURE 4-5 Charts for values of overburden correcting factor C_N. Source: Seed et al. (1984) based on data and analyses from Marcuson and Bieganousky (1977).

correction factors used in the past compared to what is the current state of practice, as represented by Figure 4-5. To some degree, this is a standardization problem in terms of SPT interpretation. As a simple useful approximation to the curves in Figure 4-5, Liao and Whitman suggest the following formula:

$$C_N = (1/\sigma'_o)^{1/2} \qquad \text{(Eq. 4-3)}$$

where σ'_o is in tons/ft² or kg/cm². They also suggest a more generalized formula of the form:

$$C_N = \{(\sigma'_o)_{ref}/\sigma'_o\}^k \quad \text{(Eq. 4-4)}$$

where $(\sigma'_o)_{ref}$ is a reference stress (nominally 1 ton/ft²) and k would be a value that depends on soil grain size, stress history, and other factors. However, more experimental measurements are needed to define k accurately.

The use of these procedures eliminates much of the uncertainty connected with nonstandardization of the SPT procedure.

Uncertainty in Interpretation of Correlation

There are several difficulties in the compilation and interpretation of field experiences. For example, the actual peak ground acceleration is not as well known in some cases as in others; the depth of the water table is not always accurate; and some of the data are from borings performed after the earthquake. There is also the question of how to choose the representative blow count for a boring (e.g., smallest value or average of three smallest). Indeed, there is some problem of deciding just which case study records are documented "well enough" to be included. Consequently, the data sets assembled by different engineers and researchers differ somewhat.

Finally, some judgment is involved in deciding where to draw the boundary curve separating liquefaction from nonliquefaction. Examination of Figure 4-3 shows that some points corresponding to liquefaction lie below the curve while some representing nonliquefaction lie above. Even more "misclassified" points appear in a data set compiled recently at the Massachusetts Institute of Technology (Liao, 1985) after an exhaustive and careful review of published catalogs, although the import of the results is not significantly different from that indicated in Figure 4-3.

There have been various attempts to use statistical techniques to aid in choosing the most proper location for the boundary curve (Christian and Swiger, 1975; Yegian and Whitman, 1978; Yegian and Vitelli, 1981a). One effort is under way at MIT (Liao, 1985) using sophisticated techniques developed in connection with other types of engineering and scientific problems. The particular class of methods selected for this purpose is called dichotomous regression (Cox, 1970; McFadden, 1974) and provides an estimate for the probability of liquefaction given a value for τ_{av}/σ'_o and $(N_1)_{60}$. A result from this analysis is given in Figure 4-6.

Effect of Fines

Thus far the discussion has focused on clean sands free of gravel and

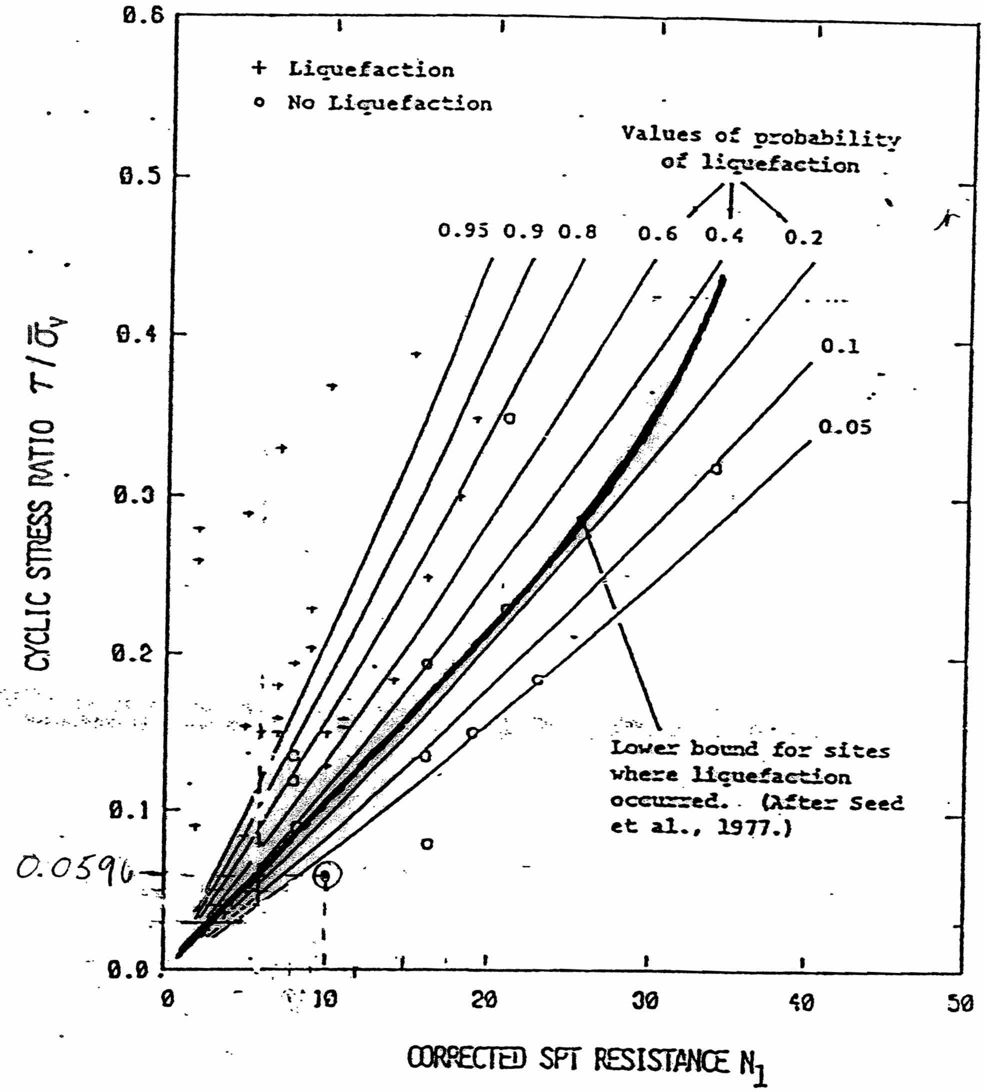

FIGURE 4-6 Preliminary results from a dichotomous regression technique showing contours of equal probability of liquefaction. Note that these results are preliminary partly because they are based on a relatively early data set from Seed and Idriss (1971). Source: Veneziano and Liao (1984).

with fines composing less than 5 percent of the soil. Deviations from these conditions require special treatment.

Figure 4-7 presents results from field observations of liquefaction or nonliquefaction involving silty sands with a content of fines greater than 5 percent. The number alongside each data point is the actual fines content. The curve labelled "≤5 percent fines" is the same curve as on Figure 4-3. Clearly there are a number of instances of nonliquefaction that lie above this curve. The curves for 15 percent and 35

...uefaction Potential

The potential for liquefaction is greatest in shallow clean sands that ...xhibit low standard penetration test N-values. Based on review of ...oring logs and geologic cross-sections, saturated sands are first encountered ...t a depth of about 22' (reference logs for borings B-22, 6385, 6390, EX-1, ...X-3, and EX-4). Review of N-value data, the N-values for sand are ...ypically above 30. The minimum N-value was 15.

Assume the following conservative geotechnical conditions for evaluating ...he potential for liquefaction:

Saturated Sand at depth 20 – 30'
$\gamma_T = 130$ pcf
$N = 15$

...eference: Liquefaction of Soils During Earthquakes – National Research Council committee on Earthquake Engineering (1985) [after Seed and Idriss]

$$\frac{\tau_{av}}{\sigma_o'} = 0.65\ \alpha_{max}\ \sigma_o\ \frac{r_d}{\sigma_o' g}$$

$\sigma_o' = 20' \times 130 + 5' \times (130 - 62.4) = 2938$ psf (at mid-depth)

$\sigma_o = 25' \times 130 = 3250$ psf

$\alpha_{max} = 0.072\ g$ (from foundation bearing capacity calcs, maximum bedrock acceleration = 0.06 g, seismic coeff. = 1.2)

$r_d = 0.93$ (interpolated, $r_d = 1.0$ @ ground surface, = 0.90 at depth = 35')

$$\frac{\tau_{av}}{\sigma_o'} = 0.65\ (0.072 g)\ (3250)\ \frac{0.93}{2938 g} = 0.05$$ ✓

ATTACHMENT 7

LINER AND LEACHATE COLLECTION SYSTEM STABILITY ANALYSIS

Shaw® Shaw Environmental, Inc.

Client: Clinton Landfill, Inc.
Project: Clinton Landfill No. 3 Chemical Waste Unit
Proj. #: 128017
Calculated By: LJC Date: 11/5/08
Checked By: JWP Date: 11/10/08

TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

Problem Statement

Determine the factors of safety against slope failure of the liner and leachate collection system prior to waste placement in accordance with the requirements of 35 Ill. Admin. Code Section 811.306 (b).

Given

❑ Edil, T.B., "Seepage, Slopes, and Dams." University of Wisconsin-Madison. (Refer to attached pages)

❑ Koerner, R.M., *Designing with Geosynthetics.* Prentice Hall, Fifth Edition. (Refer to attached pages)

❑ Landfill design specifications for layer types and thicknesses.

❑ USGS National Seismic Hazard Mapping Project (Refer to Appendix J-1).

❑ Cross-sectional sketches of liner and leachate collection system and force diagrams of analyses. (Refer to attached pages)

Assumptions

❑ Liner and leachate collection system includes (assumed to be worst case scenario), from top to bottom:

- 18-inch layer of random fill or select fill
- Geocomposite
- 60-mil HDPE textured geomembrane
- Geocomposite
- 60-mil HDPE textured geomembrane
- Minimum 3 feet of recompacted cohesive soil liner ($k \leq 10^{-7}$ cm/sec)

❑ Slope of the bottom sideslopes is 3H:1V, therefore β = 18.43 degrees.

❑ The slope of liner is conservatively assumed to be saturated. Water table follows the slope surface of the drainage layer.

❑ Saturated unit weight of select fill material, γ_{sat}, = 134 pcf.

❑ Buoyant unit weight of select fill material, $\gamma_b = \gamma_{sat} - \gamma_w$ = 134 - 62.4 = 71.6 pcf.

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TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

- Maximum horizontal acceleration = 0.0981g (reference Appendix A.1 of February 2008 application).
- Pore pressure remains unchanged during earthquake conditions.
- Critical interface assumed to be between the clay liner and the textured geomembrane, where the interface friction angle, δ = 24 degrees. (Revised Table 02650-3 in this response)
- Internal friction angle of the granular drainage material, ϕ = 30 degrees.
- Wedges analyzed are shown on attached sketch. Weight per linear foot (W) of each wedge is the cross-sectional area multiplied by the buoyant unit weight. A unit width of 1 was used to determine the cross-sectional area.
- Minimum required factor of safety (FS) = 1.3 (static), 1.0 (seismic), per 35 Ill. Admin. Code Section 811.306 (b).
- A truck load of 250 pounds per square foot (psf) over a length of 20 feet was included in the calculation to determine the factor of safety under static conditions.
- The maximum depth of excavation is conservatively assumed to be 65 feet.
- Two scenarios were analyzed — Scenario 1 assumes buoyant conditions for the granular layer; while Scenario 2 assumes saturated conditions for the granular layer.
- The following equations were used to determine the factors of safety against slope failure. (refer to attached sketches.)

Static Conditions:

$$E_A = \left[W_A \frac{\sin(\beta - \delta_m)}{\sin(90^\circ - \delta_m)} \right]$$

$$E_{NB} = W_{NB} \frac{\sin(\phi_m)}{\sin(90^\circ - \beta - \phi_m)}$$

$$\Delta E = E_A - E_{NB}$$

Client: Clinton Landfill, Inc.

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Shaw® Shaw Environmental, Inc.

Calculated By: LJC Date: 11/5/08

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TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

Seismic Conditions:

$$E_A = \left[1.0048 W_A \frac{\sin(\beta - \delta_m + \alpha)}{\sin(90^\circ - \delta_m)}\right]$$

$$E_{NB} = 1.0048 W_{NB} \frac{\sin(\phi_m - \alpha)}{\sin(90^\circ - \beta - \phi_m)}$$

$$\Delta E = E_A - E_{NB}$$

Where,

E_A = Force of Active Block
E_{NB} = Force of Neutral Block
$W_{A/NB}$ = Weight of soil blocks (active and neutral)
β = Angle of slope
δ_m = Mobilized interface friction angle, clay liner / HDPE Geomembrane
ϕ_m = Internal soil friction angle (drainage layer)
α = Resultant angle of seismic force

The factor of safety is adjusted for the next trial based on the difference of the forces acting on the wedges. As shown in the attached reference (U. of W.), if ΔE is negative, then the assumed factor of safety is too low; if ΔE is positive, then the assumed factor of safety is too high.

Scenario 1 Calculations - Buoyant Conditions Assumed for Granular Layer

Estimate the weight of the active and neutral blocks:

$$W_A = (\text{Area})\,\gamma_b$$
$$= (191.1\text{ ft})(1.5\text{ ft})(71.6\text{ pcf}) = 20{,}524\ \text{lb/ft}$$
$$W_A = (\text{Area})\,\gamma_b + (\text{truck loading})(\text{length})$$
$$= (191.1\text{ ft})(1.5\text{ ft})(71.6\text{ pcf}) + (250\text{ psf})(20\text{ ft}) = 25{,}524\ \text{lb/ft}$$
$$W_{NB} = (\text{Area})\,\gamma_b$$
$$= (0.5 * 4.74\text{ ft} * 1.58\text{ ft})(71.6\text{ pcf}) = 268.11\ \text{lb/ft}$$

Shaw® Shaw Environmental, Inc.

Client:	Clinton Landfill, Inc.		
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Proj. #:	128017		
Calculated By:	LJC	Date:	11/5/08
Checked By:	JWP	Date:	11/10/08

TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

Calculate δ_m and ϕ_m assuming FS = 1.5:

$$\tan\delta_m = \frac{\tan\delta}{FS} = \tan^{-1}\left(\frac{\tan(24)}{1.5}\right), \quad \delta_m = 16.53 \text{ deg}$$

$$\tan\phi_m = \frac{\tan\phi}{FS} = \tan^{-1}\left(\frac{\tan(30)}{1.5}\right), \quad \phi_m = 21.05 \text{ deg}$$

For Static Conditions (truck loading), calculate ΔE for a factor of safety of 1.5:

$$E_A = \left[W_A \frac{\sin(\beta - \delta_m)}{\sin(90^o - \delta_m)}\right] = \left[25{,}524 \frac{\sin(18.43 - 16.53)}{\sin(90 - 16.53)}\right] = 881.86$$

$$E_{NB} = W_{NB} \frac{\sin(\phi_m)}{\sin(90^o - \beta - \phi_m)} = 268.11 \frac{\sin(21.05)}{\sin(90 - 18.43 - 21.05)} = 124.78$$

$$\Delta E = E_A - E_{NB} = 881.86 - 124.78 = 757.08$$

For Seismic Conditions (no truck loading), calculate ΔE for a factor of safety of 1.5:

$$E_A = \left[1.0048 W_A \frac{\sin(\beta - \delta_m + \alpha)}{\sin(90^o - \delta_m}\right] =$$

$$E_A = \left[(1.0048)(20{,}524) \frac{\sin(18.43 - 16.53 + 5.60)}{\sin(90 - 16.53)}\right] = 2807.82$$

$$E_{NB} = 1.0048 W_{NB} \frac{\sin(\phi_m - \alpha)}{\sin(90^o - \beta - \phi_m)} = (1.0048)(268.11) \frac{\sin(21.05 - 5.60)}{\sin(90 - 18.43 - 21.05)} = 92.98$$

$$\Delta E = E_A - E_{NB} = 2807.82 - 92.98 = 2714.84$$

Client: Clinton Landfill, Inc.

Project: Clinton Landfill No. 3 Chemical Waste Unit

Proj. #: 128017

Shaw® Shaw Environmental, Inc.

Calculated By: LJC Date: 11/5/08

Checked By: JWP Date: 11/10/08

TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

Iterate the calculation until the correct factor of safety is achieved, as shown in the following table. The correct factor of safety will be achieved when ΔE equals zero.

SCENARIO 1 - STATIC CONDITIONS RESULTS					
FS	δ_m	Φ_m	E_A	E_{NB}	ΔE
3.0	8.44	10.89	4,475.58	58.11	4,417.47
1.5	16.53	21.05	881.86	124.78	757.08
1.4	17.64	22.41	368.47	135.11	233.36
1.3	18.91	23.95	-223.90	147.31	-371.21
1.2	20.36	25.69	-915.00	161.93	-1,076.93
1.1	22.04	27.69	-1,731.75	179.77	-1,911.52

SCENARIO 1- SEISMIC CONDITIONS RESULTS					
FS	δ_m	Φ_m	E_A	E_{NB}	ΔE
3.0	8.44	10.89	5,623.50	28.18	5,595.31
1.5	16.53	21.05	2,829.48	92.64	2,736.84
1.4	17.64	22.41	2,430.33	102.63	2,327.70
1.3	18.91	23.95	1,969.78	114.43	1,855.35
1.1	22.04	27.69	797.46	145.81	651.65
1.0	24.00	30.00	35.46	167.33	-131.87

Scenario 2 Calculations - Saturated Conditions Assumed for Granular Layer

Estimate the weight of the active and neutral blocks:

$$W_A = (\text{Area})\gamma_b$$
$$= (191.1\text{ ft})(1.5\text{ ft})(134\text{ pcf}) = 38{,}411\ \text{lb/ft}$$
$$W_A = (\text{Area})\gamma_b + (\text{truck loading})(\text{length})$$
$$= (191.1\text{ ft})(1.5\text{ ft})(134\text{ pcf}) + (250\text{ psf})(20\text{ ft}) = 43{,}411\ \text{lb/ft}$$
$$W_{NB} = (\text{Area})\gamma_b$$
$$= (0.5 * 4.74\text{ ft} * 1.58\text{ ft})(134\text{ pcf}) = 501.78\ \text{lb/ft}$$

Client: Clinton Landfill, Inc.

Project: Clinton Landfill No. 3 Chemical Waste Unit

Proj. #: 128017

Shaw® Shaw Environmental, Inc.

Calculated By: LJC Date: 11/5/08

Checked By: JWP Date: 11/10/08

TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

Calculate δ_m and ϕ_m assuming FS = 1.5:

$$\tan\delta_m = \frac{\tan\delta}{FS} = \tan^{-1}\left(\frac{\tan(24)}{1.5}\right) = 16.53 \text{ deg}$$

$$\tan\phi_m = \frac{\tan\phi}{FS} = \tan^{-1}\left(\frac{\tan(30)}{1.5}\right) = 21.05 \text{ deg}$$

For Static Conditions (truck loading), calculate ΔE for a factor of safety of 1.5:

$$E_A = \left[W_A \frac{\sin(\beta - \delta_m)}{\sin(90^o - \delta_m)}\right] = \left[43{,}411 \frac{\sin(18.43 - 16.53)}{\sin(90 - 20.28)}\right] = 1501.35$$

$$E_{NB} = W_{NB} \frac{\sin(\phi_m)}{\sin(90^o - \beta - \phi_m)} = 501.78 \frac{\sin(21.05)}{\sin(90 - 18.43 - 21.05)} = 233.51$$

$$\Delta E = E_A - E_{NB} = 1501.35 - 233.51 = 1267.84$$

For Seismic Conditions (no truck loading), calculate ΔE for a factor of safety of 1.5:

$$E_A = \left[1.0048 W_A \frac{\sin(\beta - \delta_m + \alpha)}{\sin(90^o - \delta_m}\right] =$$

$$E_A = \left[(1.0048)(38{,}411) \frac{\sin(18.43 - 16.53 + 5.60)}{\sin(90 - 16.53)}\right] = 5254.89$$

$$E_{NB} = 1.0048 W_{NB} \frac{\sin(\phi_m - \alpha)}{\sin(90^o - \beta - \phi_m)} = (1.0048)(501.78) \frac{\sin(21.05 - 5.60)}{\sin(90 - 18.43 - 21.05)} = 174.02$$

$$\Delta E = E_A - E_{NB} = 5254.89 - 174.02 = 5080.87$$

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TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

Iterate the calculation until the correct factor of safety is achieved, as shown in the following table. The correct factor of safety will be achieved when ΔE equals zero.

SCENARIO 2 - STATIC CONDITIONS RESULTS					
FS	δ_m	Φ_m	E_A	E_{NB}	ΔE
3.0	8.44	10.89	7,612.04	108.76	7,503.27
1.5	16.53	21.05	1,499.87	233.53	1,266.34
1.4	17.64	22.41	626.70	252.87	373.83
1.3	18.91	23.95	-380.80	275.70	-656.50
1.2	20.36	25.69	-1,556.22	303.06	-1,859.28
1.1	22.04	27.69	-2,945.35	336.45	-3,281.80

SCENARIO 2- SEISMIC CONDITIONS RESULTS					
FS	δ_m	Φ_m	E_A	E_{NB}	ΔE
3.0	8.44	10.89	10,511.35	52.69	10,458.40
1.5	16.53	21.05	5,281.48	173.62	5,107.86
1.4	17.64	22.41	4,534.36	192.32	4,342.04
1.3	18.91	23.95	3,672.29	214.40	3,457.89
1.1	22.04	27.69	1,477.94	273.16	1,204.79
1.0	24.00	30.00	51.62	313.45	-261.83

Results

Based on the analysis, the leachate drainage layer is expected to be stable on the 3H:1V liner sideslopes for both static and seismic conditions in accordance with the requirements of 35 Ill. Admin. Code Section 811.306 (b). In summary, the factors of safety were determined to be as follows.

Client: Clinton Landfill, Inc.

Project: Clinton Landfill No. 3 Chemical Waste Unit

Proj. #: 128017

Shaw® Shaw Environmental, Inc.

Calculated By: LJC Date: 11/5/08

Checked By: JWP Date: 11/10/08

TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

SUMMARY OF RESULTS			
Scenario / Conditions	**Calculated FS**	**Required FS**	**Compliance**
Scenario 1 - Buoyant Conditions Assumed			
Static Conditions	> 1.3	1.3	✓
Seismic Conditions	> 1.0	1.0	✓
Scenario 2 - Saturated Conditions Assumed			
Static Conditions	> 1.3	1.3	✓
Seismic Conditions	> 1.0	1.0	✓

The liner and leachate collection systems will be further stabilized by the placement of waste against the sideslope. Alternatively, an 18 inch select fill protective layer may be placed incrementally along the sideslopes prior to waste placement.

Client: Clinton Landfill, Inc.
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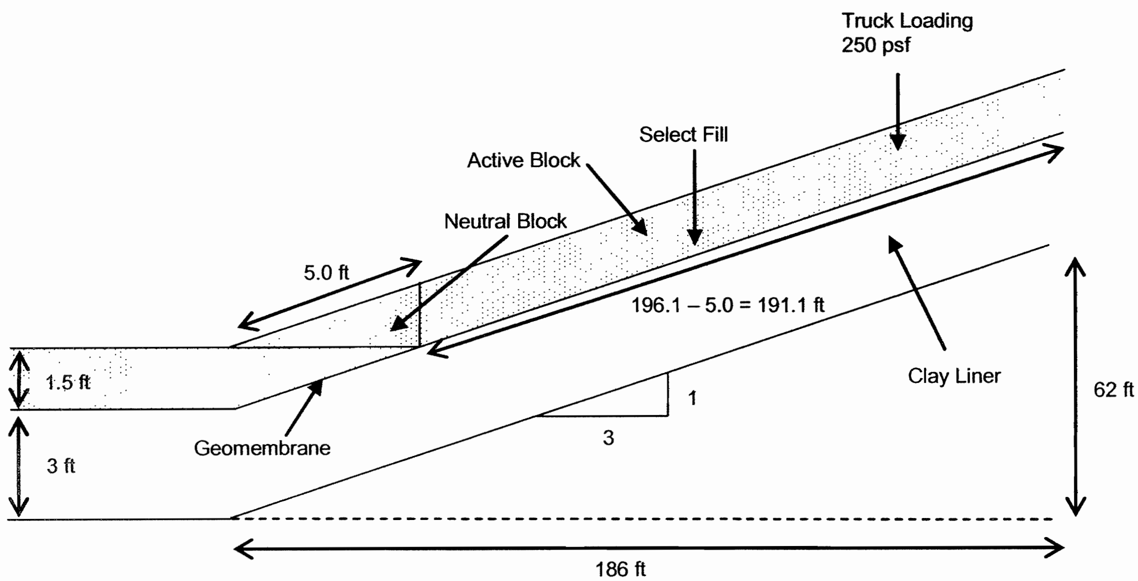
TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

Cross Section of Liner and Leachate Collection System (not to scale)



Shaw® Shaw Environmental, Inc.

Client: Clinton Landfill, Inc.

Project: Clinton Landfill No. 3 Chemical Waste Unit

Proj. #: 128017

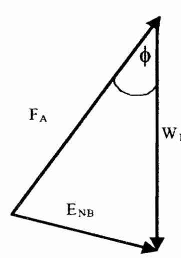
Calculated By: LJC **Date:** 11/5/08

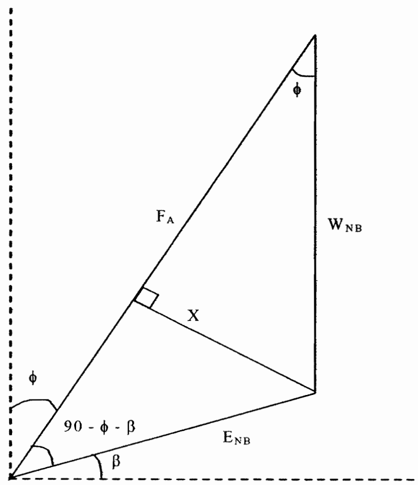
Checked By: JWP **Date:** 11/10/08

TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

Derive Force of Neutral Block

Static Conditions:



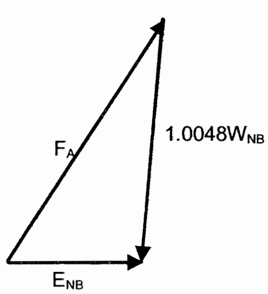


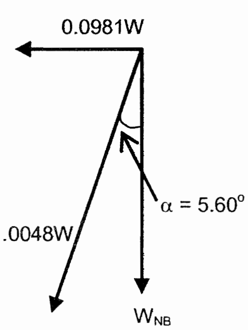
$$\sin(\phi) = \frac{X}{W_{NB}}$$

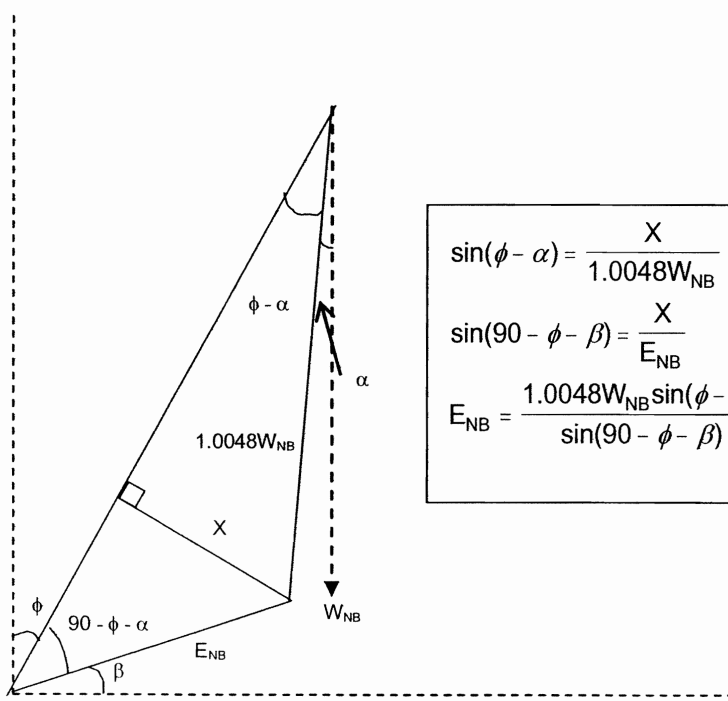
$$\sin(90 - \beta - \phi) = \frac{X}{E_{NB}}$$

$$E_{NB} = \frac{W_{NB}\sin(\phi)}{\sin(90 - \beta - \phi)}$$

Seismic Conditions:







$$\sin(\phi - \alpha) = \frac{X}{1.0048W_{NB}}$$

$$\sin(90 - \phi - \beta) = \frac{X}{E_{NB}}$$

$$E_{NB} = \frac{1.0048W_{NB}\sin(\phi - \alpha)}{\sin(90 - \phi - \beta)}$$

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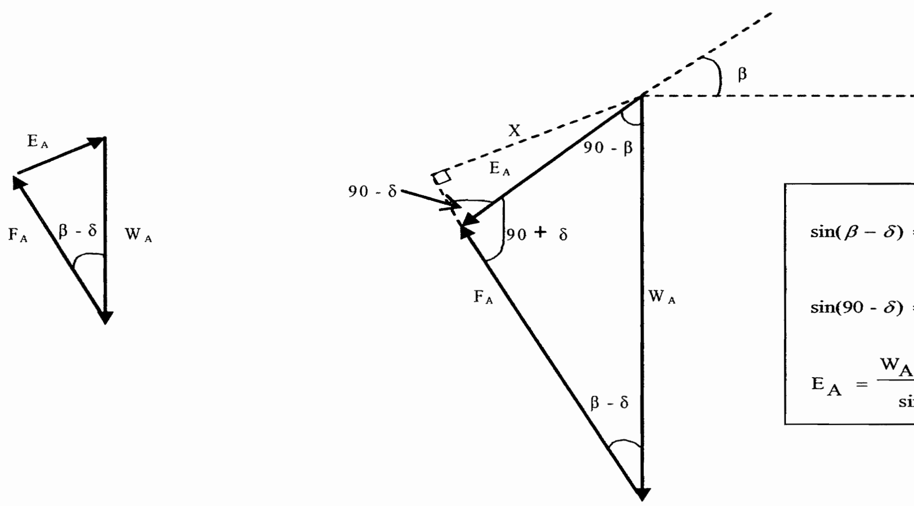
TITLE: STABILITY OF LINER AND LEACHATE COLLECTION SYSTEM

Derive Force of Active Block

Static Conditions:

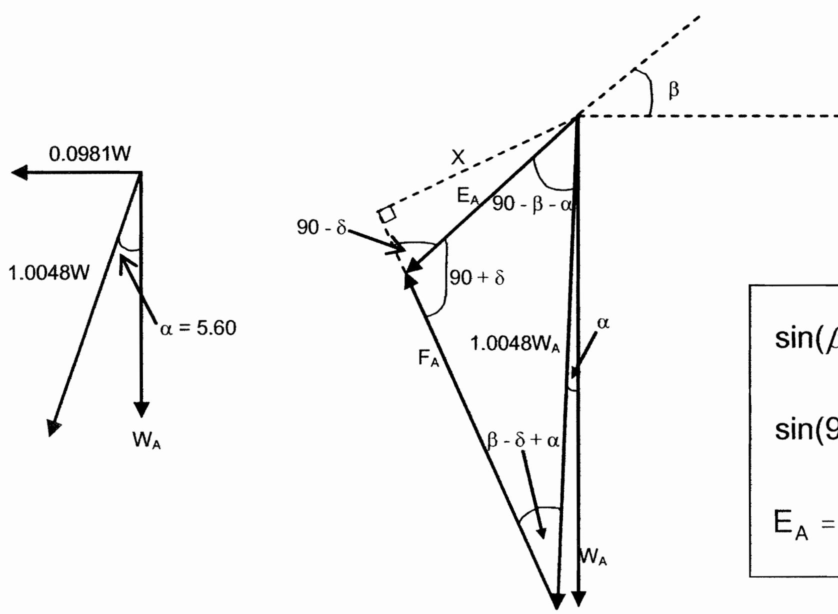


$$\sin(\beta - \delta) = \frac{X}{W_A}$$

$$\sin(90 - \delta) = \frac{X}{E_A}$$

$$E_A = \frac{W_A \sin(\beta - \delta)}{\sin(90 - \delta)}$$

Seismic Conditions:



$$\sin(\beta + \alpha - \delta) = \frac{X}{1.0048W_A}$$

$$\sin(90 - \delta) = \frac{X}{E_A}$$

$$E_A = \frac{1.0048W_A \sin(\beta + \alpha - \delta)}{\sin(90 - \delta)}$$

Clinton Landfill No. 3 Chemical Waste Unit - Leachate Collection System Stability

Scenario 1: Static Conditions - With Truck Loading & Buoyant Conditions Assumed

F.S.	β (degrees)	W_A (lbs)	W_{NB} (lbs)	ϕ_{LCS} (degrees)	$\delta_{interface}$ (degrees)	ϕ_m (degrees)	δ_m (degrees)	E_A	E_{NB}	ΔE
3.0	18.43	25,524.00	268.11	30	24.0	10.89	8.44	4,475.58	58.11	4,417.47
1.8	18.43	25,524.00	268.11	30	24.0	17.78	13.89	2,079.77	101.49	1,978.28
1.7	18.43	25,524.00	268.11	30	24.0	18.76	14.68	1,727.45	108.23	1,619.22
1.6	18.43	25,524.00	268.11	30	24.0	19.84	15.55	1,331.08	115.91	1,215.16
1.5	18.43	25,524.00	268.11	30	24.0	21.05	16.53	881.86	124.78	757.08
1.4	18.43	25,524.00	268.11	30	24.0	22.41	17.64	368.47	135.11	233.36
1.3	18.43	25,524.00	268.11	30	24.0	23.95	18.91	-223.90	147.31	-371.21
1.2	18.43	25,524.00	268.11	30	24.0	25.69	20.36	-915.00	161.93	-1,076.93
1.1	18.43	25,524.00	268.11	30	24.0	27.69	22.04	-1,731.75	179.77	-1,911.52
1.0	18.43	25,524.00	268.11	30	24.0	30.00	24.00	-2,711.86	202.03	-2,913.89

Scenario 1: Seismic Conditions - No truck loading & Buoyant Conditions Assumed

F.S.	β (degrees)	W_A (lbs)	W_{NB} (lbs)	ϕ_{LCS} (degrees)	$\delta_{interface}$ (degrees)	ϕ_m (degrees)	δ_m (degrees)	E_A	E_{NB}	ΔE
3.0	18.43	20,524.00	268.11	30	24.0	10.89	8.44	5,623.50	28.18	5,595.31
1.5	18.43	20,524.00	268.11	30	24.0	21.05	16.53	2,829.48	92.64	2,736.84
1.4	18.43	20,524.00	268.11	30	24.0	22.41	17.64	2,430.33	102.63	2,327.70
1.3	18.43	20,524.00	268.11	30	24.0	23.95	18.91	1,969.78	114.43	1,855.35
1.2	18.43	20,524.00	268.11	30	24.0	25.69	20.36	1,432.47	128.56	1,303.91
1.1	18.43	20,524.00	268.11	30	24.0	27.69	22.04	797.46	145.81	651.65
1.0	18.43	20,524.00	268.11	30	24.0	30.00	24.00	35.46	167.33	-131.87

Clinton Landfill No. 3 Chemical Waste Unit - Leachate Collection System Stability

Scenario 2: Static Conditions - With Truck Loading & Saturated Conditions Assumed

F.S.	β (degrees)	W_A (lbs)	W_{NB} (lbs)	ϕ_{LCS} (degrees)	$\delta_{interface}$ (degrees)	ϕ_m (degrees)	δ_m (degrees)	E_A	E_{NB}	ΔE
3.0	18.43	43,411.00	501.78	30	24.0	10.89	8.44	7,612.04	108.76	7,503.27
1.8	18.43	43,411.00	501.78	30	24.0	17.78	13.89	3,537.26	189.95	3,347.31
1.7	18.43	43,411.00	501.78	30	24.0	18.76	14.68	2,938.02	202.55	2,735.47
1.6	18.43	43,411.00	501.78	30	24.0	19.84	15.55	2,263.89	216.94	2,046.95
1.5	18.43	43,411.00	501.78	30	24.0	21.05	16.53	1,499.87	233.53	1,266.34
1.4	18.43	43,411.00	501.78	30	24.0	22.41	17.64	626.70	252.87	373.83
1.3	18.43	43,411.00	501.78	30	24.0	23.95	18.91	-380.80	275.70	-656.50
1.2	18.43	43,411.00	501.78	30	24.0	25.69	20.36	-1,556.22	303.06	-1,859.28
1.1	18.43	43,411.00	501.78	30	24.0	27.69	22.04	-2,945.35	336.45	-3,281.80
1.0	18.43	43,411.00	501.78	30	24.0	30.00	24.00	-4,612.30	378.11	-4,990.42

Scenario 2: Seismic Conditions - No truck loading & Saturated Conditions Assumed

F.S.	β (degrees)	W_A (lbs)	W_{NB} (lbs)	ϕ_{LCS} (degrees)	$\delta_{interface}$ (degrees)	ϕ_m (degrees)	δ_m (degrees)	E_A	E_{NB}	ΔE
3.0	18.43	38,411.00	501.78	30	24.0	10.89	8.44	10,511.35	52.95	10,458.40
1.5	18.43	38,411.00	501.78	30	24.0	21.05	16.53	5,281.48	173.62	5,107.86
1.4	18.43	38,411.00	501.78	30	24.0	22.41	17.64	4,534.36	192.32	4,342.04
1.3	18.43	38,411.00	501.78	30	24.0	23.95	18.91	3,672.29	214.40	3,457.89
1.2	18.43	38,411.00	501.78	30	24.0	25.69	20.36	2,666.55	240.86	2,425.69
1.1	18.43	38,411.00	501.78	30	24.0	27.69	22.04	1,477.94	273.16	1,204.79
1.0	18.43	38,411.00	501.78	30	24.0	30.00	24.00	51.62	313.45	-261.83

TABLE 02650-3

GEOMEMBRANE INTERFACE SHEAR STRENGTH CRITERIA

INTERFACE (by ASTM D5321)	MINIMUM TESTING FREQUENCY	MINIMUM ADHESION (psf)	MINIMUM FRICTION ANGLE (deg)[5]
Landfill Floor Liner and Sideslope System[1]			
Clay Liner vs. 60 mil HDPE Geomembrane	Once per construction season	NA	$\Phi_{secant} = 24°$
60 mil HDPE Geomembrane vs. Geocomposite	Once per construction season	NA	$\Phi_{secant} = 24°$
60 mil HDPE Geomembrane vs. GCL	Once per construction season	NA	$\Phi_{secant} = 24°$
60 mil HDPE Geomembrane vs. Leachate Collection System Material	Once per construction season	NA	$\Phi_{secant} = 24°$
Final Cover System			
Clay Liner vs. 40 mil textured LLDPE Geomembrane[24]	Once per construction season	Shear Strength = 195 psf (peak) or 165 psf (residual)	
40 mil textured LLDPE Geomembrane vs. Geocomposite[2,4]	Once per construction season	Shear Strength = 195 psf (peak) or 165 psf (residual)	

Notes:

1. Landfill liner system testing shall be performed under flooded and consolidated conditions at normal stresses of 5,000, 10,000, and 20,000 psf (2.5, 5, and 10 tsf) using a strain rate no greater than 0.04 inch/min to a maximum displacement of 2 inches.

2. Final cover system testing shall be performed under flooded and consolidated conditions at a normal stress of 400 psf (0.2 tsf) using a strain rate no greater than 0.04 inch/min to a maximum displacement of 2 inches.

3. Secant friction angle is determined from a best-fit line assuming no adhesion.

4. Final cover system component interface shear criteria apply only to material place on 4:1 (horizontal to vertical) final cover slopes.

4. Interface shear strength criteria may be revised upon approval of the design engineer. If the interface shear strength test results are less than the minimum values reported above, additional slope stability analyses can be performed by a qualified geotechnical engineer using the interface shear strength test results. The test results are acceptable if these analyses demonstrate adequate factors of safety.

5. The minimum residual shear strength criteria only apply to the interface which exhibits the lowest peak strength.

If the cut-slope is made in a cohesive material (containing clay and silt), the failure is usually deeper and like rotational slips as shown in Fig. 2. The long-term (prior to waste filling and after waste filling) and the end-of-excavation stability have to be analyzed separately. The former requires an effective stress analysis using drained (effective) strength parameters (ϕ', c') and the later a total stress analysis using undrained (total) strength parameters (c_u, usually $\phi_u = 0$) determined on undisturbed samples of the materials. Typically, a finite slope analysis using a method of slices such as the modified Bishop method is used for the stability analysis. The total stress analysis can be performed also with the simpler circular arc method. The position of the failure surface is unknown and determined by a trial and error method. There are computer programs available for slope stability analysis (Bosscher, 1990). Chart solutions for simple slopes using the finite slope analysis are provided in Appendix A.

Berm Slopes

Since berms are constructed by compacting selected earthen materials, the characterization of the materials is much simpler than the cuts. The end-of-construction and the long-term analyses can be made in a manner similar to the ones described for cut slopes. The end-of-construction stability is likely to be more critical than the long-term stability. The strength parameters are determined on compacted specimens of the borrow materials, i.e., ϕ_u, c_u and ϕ', c'.

COVER SOIL STABILITY

The usual cover soil is a relatively thin layer of soil of either uniform thickness or tapered thickness. When clay covers are placed on side slopes, they sometimes fail by slumping. The accumulated soil gathers at the toe of the slope. This same situation is even more apt to occur for cover soils placed on geosynthetics, which are invariably lower in frictional resistance than the substrate soils from which the slope itself is formed.

The failure of cover soils with uniform depth is basically a surface raveling type of failure along the interface as shown in Fig. 3 and can be analyzed by an infinite slope analysis using the following expression for a safety factor:

$$F = (\tan \delta / \tan \beta)\,[1 - (\gamma_w h_p / \gamma d) \sec^2 \beta] \tag{2}$$

where δ is the interface friction (between the geosynthetic and cover soil or the in situ soil); the other terms are as defined before in Fig. 1. The critical parameters are the interface friction angle or the shear strength between the soil and the geosynthetic, the inclination of slope, and the seepage forces (due to infiltrating water or rapid draw down of reservoir levels).

To alleviate the slumping of cover soils down slope, it is quite common to construct them with a taper, i.e., thicker at the bottom and gradually thinner going toward the top as shown in Fig. 4. The stability can be analyzed using a wedge stability method as described in Appendix B.

SLOPE LINER STABILITY

Principal sliding surfaces in landfills often coincide within the multi-layer liner system underlying the wastefill. The Kettleman Hills waste landfill slide in California occurred in this fashion in 1988. The foundation soil including the cut slopes is usually much stronger than the critical liner-system interfaces because the settlement considerations usually dictate selection of sites with competent foundation soils. There is some evidence that relatively steep slopes of high refuse fills also do not fail in deep rotational slides if they are founded on firm foundations. Therefore, the liner-system interfaces become the most critical slip zone. The interfaces may be: (1) between geomembrane liner and geotextile or geonet layer, (2) between geomembrane liner and compacted clay liner, and (3) between geotextile or geomembrane and granular layer. The interfaces between these materials are characterized by low frictional resistance. The frictional resistance is affected by various properties including degree of polishing (of geomembrane by geotextile with increasing shear displacement) and whether the interfaces are wet or dry. The interface strength properties can be evaluated by use of laboratory direct shear or pullout tests (Mitchell et al, 1990).

Failure by Sliding on Liner Interfaces

The stability analysis for sliding along planar liner interface surfaces as shown in Fig. 5 can be performed using a wedge stability method as given in Appendix B. The analysis of Kettleman Hills waste landfill slide by this approach provided a reasonable estimate of the failure based on the interface shear strengths measured in the laboratory. Three-dimensional effects were found to lower safety factors by 10 to 15% (Seed et al., 1990).

Failure with Liner Pullout or Break

In the geomembrane lined reservoirs or landfills, the liner comes up from the bottom of the pit, covering the side slopes, then running over the top a short distance. It often terminates vertically down in an anchor trench as shown in Fig. 6.

The stress generated in the geomembrane, σ, for a given length of runout, L_{TO}, and trench depth, d_t, can be obtained from the following expression:

$$\sigma = \frac{\gamma d_c \tan\delta + 2K_o \gamma d_t (d_c + 0.5\, d_t) \tan\delta + 2\gamma (d_c + d_t) b \tan\delta}{t(\cos\beta - \sin\beta \tan\delta)} \qquad (3)$$

where

t = the geomembrane thickness

β = the slope angle

δ = the interface friction angle

d_c = the depth of cover soil

b = the width of trench

γ = the unit weight of cover and trench soil

K_o = the lateral coefficient of earth in trench (it can be taken as 0.5)

The safety factor, F, against pullout or break can be computed from

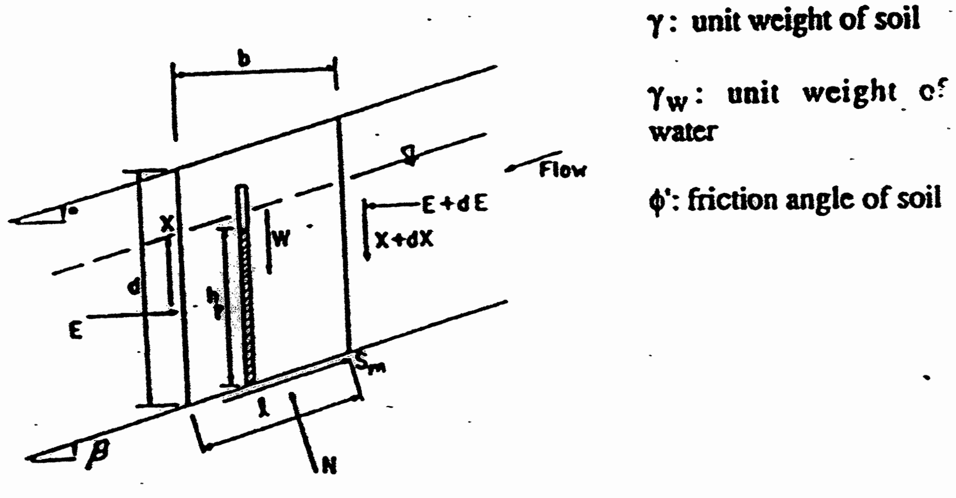


Fig. 1. Idealized Infinite Slope Analysis

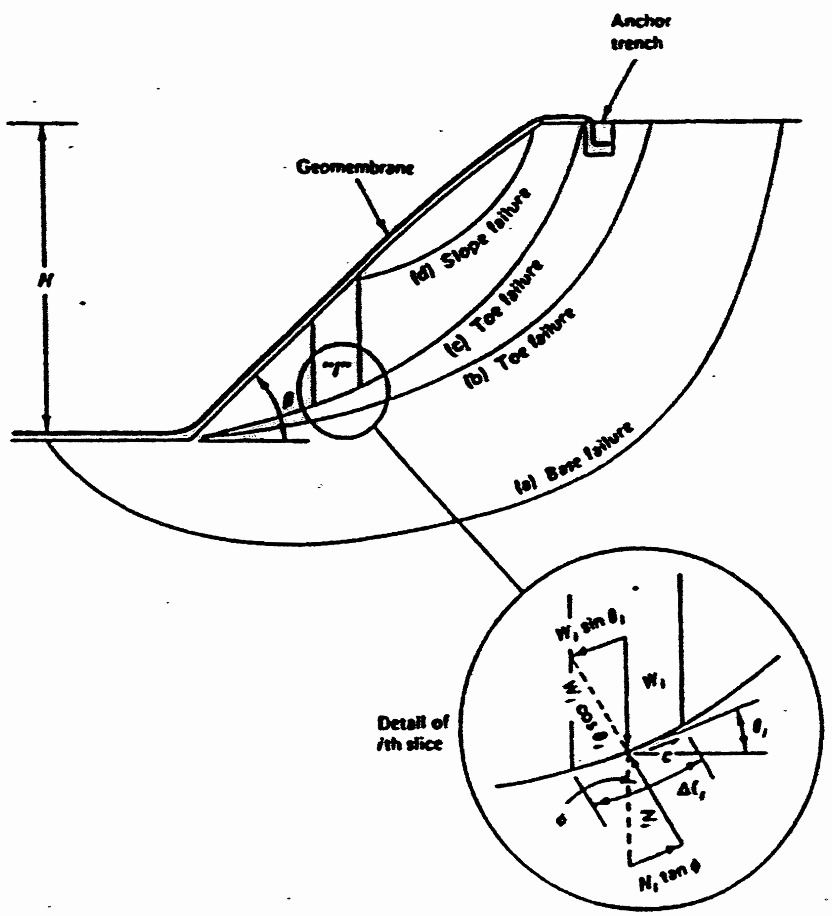


Fig. 2. Various Types of Finite Slope Failures

APPENDIX B

WEDGE METHOD OF SLOPE STABILITY ANALYSIS IN WASTE DISPOSAL

.nis method the potential sliding mass is separated into a series of wedges and the vertical and horizontal force equilibrium of each wedge is considered in turn. This method is most appropriate for conditions where the failure surface can be approximated by a series of planar surfaces. For analysis by the wedge method, the mass above the trial slip surface is divided by vertical lines into a number of wedges. The side force transmitted across the interface between any two wedges is not known but an assumption regarding its inclination must be made. The assumption that the side forces between wedges are horizontal is conservative with an error for most cases no more than 15%. Experience indicates that assuming an inclination of 10 to 15 degrees from the horizontal usually gives reasonable results. The factor of safety, F (defined as the ratio between the shear strength and the shear stress required for equilibrium), is calculated by trial-and-error. A value of F is assumed, and then checked to determine if the shear resistance along the failure surface reduced by this F satisfies equilibrium. If not, a new trial is initiated with another assumed safety factor. The analysis can be performed either graphically or numerically.

Two common cases encountered in waste disposal which can be analyzed by the wedge method are presented by use of the numerical method. These cases involve the stability along a liner and tapered depth soil cover as shown in Figure B1 and B2. The steps are as follows:

1. Define a trial slip surface. In these two cases it is primarily along the soil or waste and liner interface.

2. Divide the mass above the slip surface into wedges. In these two cases, the sliding mass is divided into an active wedge and a neutral block.

3. Calculate the weight of each wedge. This analysis is a two-dimensional analysis and the stability of a unit length of material along the slope is considered. Therefore, the weight of each wedge is its cross-sectional area (times unit length) times the unit weight of the sliding mass.

4. Assume a value of factor of safety, F and calculate the trial values of mobilized friction angle along the slip surface, δ_m (soil/waste-liner friction angle) or ϕ_m (soil-soil friction angle) using the following definitions:

$$\tan \delta_m = \frac{\tan \delta}{F} \qquad \tan \phi_m = \frac{\tan \phi}{F}$$

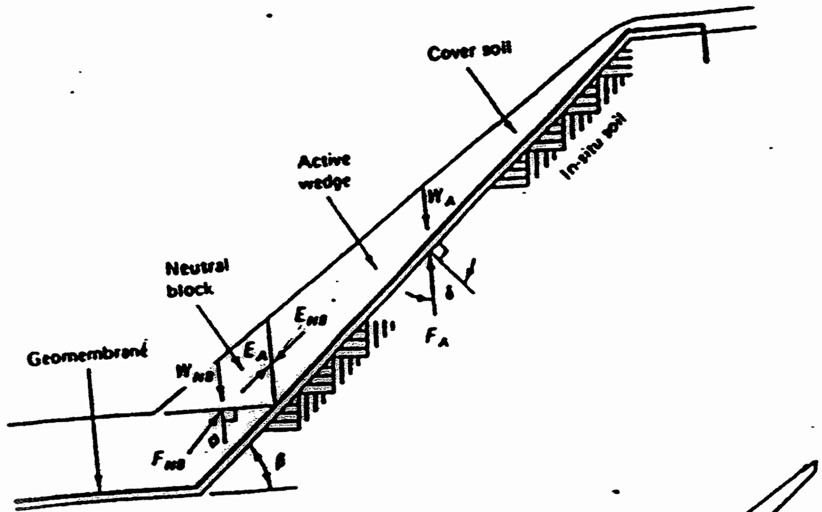
5. Assume the inclination of the force acting between the active wedge and the neutral block, α. For the tapered depth cover soil, α may be assumed parallel to cover soil slope. Otherwise, assume a value between 0 - 20°.

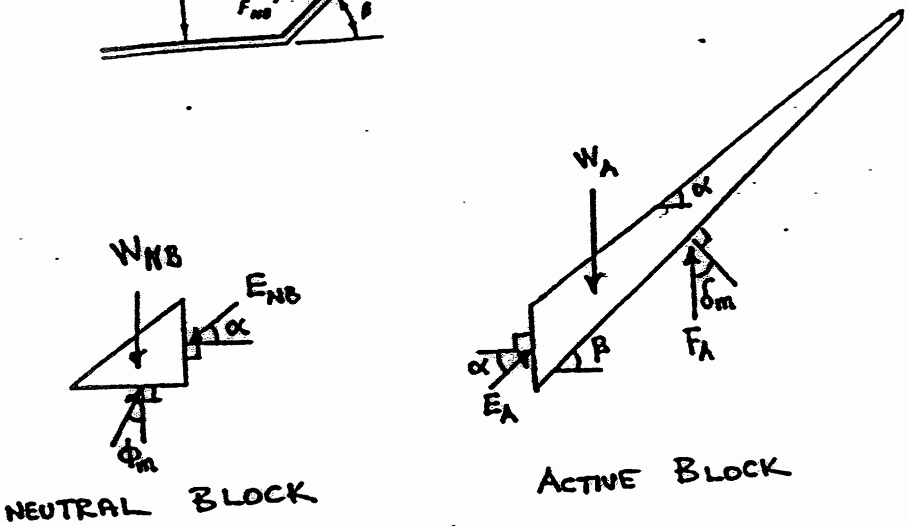
6. Using the equations given in Figures B1 and B2, calculate the force from neutral block acting on active wedge, E_A and the force from active wedge acting on neutral block, E_{NB} from the force equilibrium of each block. These forces are equal in magnitude opposite in direction at equilibrium. Note that the friction is mobilized in proportion to the assumed F along the slip surface; therefore, there may be a difference, ΔE in the calculated magnitudes of E_A and E_{NB}.

7. Plot ΔE versus assumed F.

8. Assume a new F and repeat steps 6 and 7. Try additional values of F until ΔE is negligibly small. This value of F is the correct safety factor.

TBE:kcl\wdg





$$E_A = W_A \frac{\sin(\beta - \delta_m)}{\sin(90° + \alpha - \beta + \delta_m)}$$

$$\tan \delta_M = \frac{\tan \delta}{F}$$

$$E_{NB} = W_{NB} \frac{\sin \phi_m}{\sin(90° - \alpha - \phi_m)}$$

$\alpha = \beta$ in leachate collection system (18.4°).

$$\Delta E = E_A - E_{NB}$$

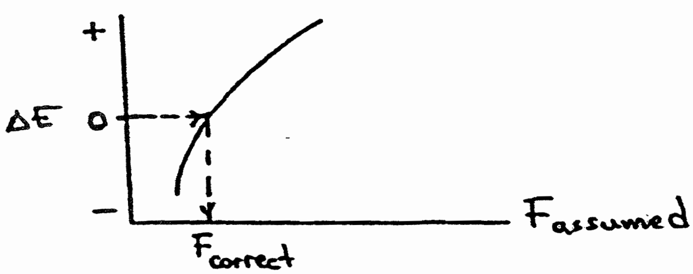


Figure B1. Wedge analysis as applied to tapered depth soil cover.

DESIGNING WITH GEOSYNTHETICS

FIFTH EDITION

ROBERT M. KOERNER

For termination of double liner systems, the designer is faced with a number of possible choices. Major considerations are to protect the integrity of both geomembranes and to keep surface water out of the leak detection system. In this regard, the two geomembranes can enter separate anchor trenches or come together in a common anchor trench. The primary geomembrane can also be cut short of the anchor trench and welded to the secondary geomembrane along the horizontal runout distance. In seismically active areas, consideration should be given to this latter approach with no vertical anchor trench at all; the logic being that geomembrane pullout is more desirable than geomembrane tensile failure somewhere along the side slope.

The terminus of the liner of a completed internal cell within a zoned landfill, with its eventual extension into an adjacent cell, is usually done by overlapping and seaming along the horizontal runout length of an intermediate berm. When waste fills the second cell, the berm is entombed and the process is then continued from cell to cell. Shear stresses on the geomembranes in both cells over this berm have been evaluated by large-scale laboratory models and found to be generally small and geomembrane-dependent (see Koerner and Wayne [79]). In high berms where higher stresses are generated, an auxiliary (or sacrificial) geomembrane rub-sheet over the crest of the berm should effectively dissipate the stresses before they propagate down to the underlying primary geomembrane.

5.6.9 Side Slope Subgrade Soil Stability

The design of the stability of the soil mass beneath the liner system of a solid-waste landfill is carried out in exactly the same manner as was discussed for liquid containment (reservoir) slopes and berms (recall Section 5.3.5). The process can include the strength of the covering liner materials, but if they are not included in the analysis, the error is on the conservative side. Interior berms, with or without geosynthetic inclusions, are also handled in the same manner as previously described.

5.6.10 Multilined Side Slope Cover Soil Stability

The situation of a liner and its leachate collection cover soil stability, or slumping, becomes quite complicated for multilined geomembrane and geonet collection systems of the type shown in Figure 5.40. Consider such a system, as shown in Figure 5.40e. The leachate collection system soil gravitationally induces shear stress through the system, thereby challenging each of the interface layers that are in the cross section. If all of the interface shear strengths are greater than the slope angle, stability is achieved and the only deformation involved is a small amount to achieve elastic equilibrium (Wilson-Fahmy and Koerner [80]). However, if any interface shear strengths are lower than the slope angle, wide-width tensile stresses are induced into the overlying geosynthetics. This can cause the failure of the geosynthetics or pullout from the anchor trench, or it can result in quasistability via tensile reinforcement. If the last is the case, we can refer to the overlying geosynthetics as acting as *nonintentional* veneer reinforcement.

If the situation consists of the double liner system shown in Figure 5.45, all of the interface surfaces can be made quite stable by proper selection of the geosynthetic

Figure 5.
CCL or C

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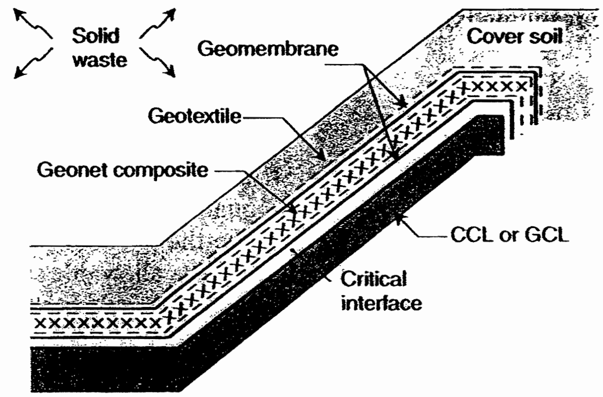


Figure 5.45 Geotextile/geomembrane/geonet composite/geomembrane above a CCL or GCL.

For example, textured geomembranes could be selected, and these together with nonwoven needle-punched geotextiles will usually result in peak friction angles in excess of 25°. Furthermore, by thermally bonding the geotextiles in the leak detection system to the geonet, these surfaces are also stable at relatively high slope angles. Thus, the critical interfaces are at the upper (leachate collection sand or gravel) and the lower (CCL or GCL) surfaces. The upper surface is analyzed exactly as described in Section 3.2.7 for the case without geogrid reinforcement. The proper selection of cover soil against a nonwoven needle-punched geotextile (acting as a protection material, recall Section 5.6.7) should also result in a peak friction angle in excess of 25°. This leaves the lower surface of the secondary geomembrane against the clay liner as being the potentially low-interface surface. If the clay liner is a CCL, the concern is with the expelled consolidation water lubricating the interface. This surface has been involved in a major failure of a hazardous waste liner system, as reported by Byrne et al. [81] with an interface friction angle of 10°. If the liner is a GCL, the concern is the hydrated bentonite being extruded out of the upper geotextile and lubricating the interface with an interface friction angle of 5 to 10°. This surface was involved in two slides of full-scale field tests both involving woven geotextiles on the GCL, by Daniel et al. [82].

The analysis of multilined slopes of the type being discussed is a direct extension of the veneer reinforcement model presented in Section 3.2.7 on geogrids. Recalling Figure 3.22b, the analysis results in equation (3.21):

$$a(\mathrm{FS})^2 + b(\mathrm{FS}) + c = 0$$

where

$$a = (W_A - N_A \cos\beta - T\sin\beta)\cos\beta,$$

$$b = -[(W_A - N_A\cos\beta - T\sin\beta)\sin\beta\tan\phi + (N_A\tan\delta + C_a)\sin\beta\cos\beta + \sin\beta(C + W_P\tan\phi)], \text{ and}$$

$$c = (N_A\tan\delta + C_a)\sin^2\beta\tan\phi.$$

The resulting FS value is then obtained from equation (3.22):

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

The variables and values of W_A, N_A, T, and W_P were defined in Sections 3.2.7 and 5.3.5. The critical parameter in the above equation is T, the allowable wide-width tension strength of the geosynthetic layers above the potential failure surface. For the cross section shown in Figure 5.45, T represents the allowable strength of all of the geosynthetic materials above the critical interface. Not only is the issue of reduction factors difficult to assess for the liner materials per se, but the issue of strain compatibility is also unwieldy. In this latter regard, the wide-width tensile strength of each geosynthetic material must be determined, plotted on the same axes, and assessed at a specific value of strain. That is, the liner system components cannot act individually and must act as an equally strained unit. Example 5.20 illustrates the situation.

Example 5.20

For a 30 m long slope at 3(H) to 1(V)—i.e., $\beta = 18.4°$ — lined with a double liner system consisting of GT/GM/GC/GM/CCL or GCL (as in Figure 5.45), the lowest friction angle is assumed to be the secondary geomembrane to the underlying clay interface, which is 10°. All other interface friction angles are in excess of 18.4°. The wide-width tensile behavior of the various candidate geosynthetics is given in the following graph. The leachate collection cover soil is 450 mm thick with a unit weight of 18.0 kN/m^3 and a friction angle of 30°. What is the factor of safety of the slope based on a cumulative reduction factor of 2.0?

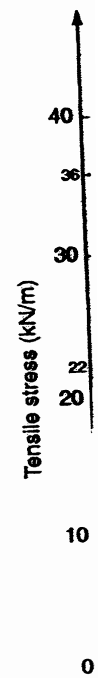
Solution:

$$\begin{aligned}
W_A &= \gamma h^2\left[\frac{L}{h} - \frac{1}{\sin\beta} - \frac{\tan\beta}{2}\right] \\
&= (18.0)(0.45)^2\left[\frac{30}{0.45} - \frac{1}{\sin 18.4} - \frac{\tan 18.4}{2}\right] \\
&= 3.65[63.3] \\
&= 231 \text{ kN/m} \\
N_A &= W_A \cos\beta \\
&= 231 \cos 18.4 \\
&= 219 \text{ kN/m} \\
W_P &= \frac{\gamma h^2}{\sin 2\beta} \\
&= \frac{(18.0)(0.45)^2}{\sin 36.8} \\
&= 6.08 \text{ kN/m}
\end{aligned}$$

T_{ult} taken at the first geosynthetic failure, which is the nonwoven needle-punched geotextile at 25 kN/m, is

$$\begin{aligned}
T_{ult} &= 25 + 2(22) + 36 \\
&= 105 \text{ kN/m}
\end{aligned}$$

Sec. 5.6 Solid-M



For a reductic

After calcula

a

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c

APPENDIX C –CHEMICAL WASTE UNIT OPERATING PLAN (revised January 2009)

OPERATING PLAN

Chemical Waste Unit

Clinton Landfill No. 3

0390055036 – DeWitt County

January 2009

Prepared for: **Clinton Landfill, Inc.**
4700 N. Sterling Avenue
Peoria, Illinois 61615

Prepared by: **PDC Technical Services, Inc.**
4349 Southport Road
Peoria, Illinois 61615

PDC Project No. 91-0118.31

OPERATING PLAN

Clinton Landfill No. 3 – Chemical Waste Unit

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OPERATING PLAN
Clinton Landfill No. 3 Chemical Waste Unit

Introduction

This Operating Plan describes how the Clinton Landfill No. 3 Chemical Waste Unit ("facility" or "unit") will be operated in order to ensure compliance with the facility's permits and applicable regulations. A separate Operating Plan describes the procedures that will be followed to properly operate and maintain the Clinton Landfill No. 3 Municipal Solid Waste Unit.

This unit will accept for disposal both RCRA-regulated non-hazardous industrial process and pollution control wastes, and TSCA-regulated wastes (collectively, "waste"). In the event of any conflict between the applicable RCRA and TSCA regulations, the more stringent requirement(s) will control.

Operating Hours And Personnel

Clinton Landfill No. 3 ("landfill"), including the proposed Chemical Waste Unit, may accept waste on Mondays through Fridays, 6 am to 6 pm, and on Saturdays from 6 am to 3 pm. Facility operations, including application of daily cover, cell development, etc. will occur until no later than 8 pm except under extreme conditions. The hours of operation may be expanded in emergency situations with notice to the Illinois Environmental Protection Agency (IEPA).

The landfill will be fully staffed with personnel to ensure efficient operations in accordance with the applicable regulations and permit conditions. The following describes the personnel that will be directly responsible for operating the landfill.

Landfill Director

The Landfill Director has overall responsibility for development and operation of the facility. The Landfill Director has substantial knowledge of all regulatory requirements pertaining to the landfill. The Facility Manager directly reports to the Landfill Director.

Facility Manager

The Facility Manager is responsible for the day-to-day operations of the facility. This includes supervising facility personnel, directing equipment and facility maintenance activities, and ensuring that the facility is operated and maintained in accordance with the permit.

Gate Control Officer

The Gate Control Officer performs load inspections and may be assigned other duties, such as that of the Scale Operator.

Scale Operator

The Scale Operator is responsible for operating the landfill scales and maintaining the scale tickets.

Equipment Operators and Laborers

Equipment Operators and Laborers operate waste and earth handling equipment, perform repairs and maintenance tasks, and conduct other activities as directed by the Facility Manager.

Facility personnel will receive training appropriate for their duties to ensure safe and compliant operation and management of the facility. An outline of the training program is provided in Appendix A.

Waste Acceptance Procedures

Clinton Landfill, Inc. (CLI) will follow all USEPA and IEPA requirements for managing waste materials. The following sections describe the waste management procedures. The facility Operator may impose additional requirements for the transportation, disposal and handling of wastes to ensure protection to the environment, facility employees, and the landfill facility itself. Certain types of non-hazardous industrial process and pollution control wastes (known as Illinois Non-Special wastes) are not subject to the Profile Identification Record and Manifest requirements discussed herein.

Signage

A prominent sign will be maintained at the entrance to the landfill stating that disposal of hazardous waste is prohibited. The sign will also state that Special Waste will be accepted only if accompanied by an identification record and a manifest.

Waste Analysis Plan

A representative sample of each waste stream to be disposed in the CWU will, at a minimum, be analyzed for the following parameters:

- Paint filter,
- Flashpoint,

- ☐ Reactive sulfide,
- ☐ Reactive cyanide,
- ☐ pH, and
- ☐ Total PCBs, with identified Aroclors used for the total calculation reported individually (applicable only to wastes regulated by the Toxic Substances Control Act due to PCBs, and Illinois Special Wastes).

In addition, a representative sample of each Special Waste[1] stream will, at a minimum, be analyzed for the following additional parameters:

- ☐ Total phenols,
- ☐ The organic and inorganic Toxicity Characteristic Constituents listed in 35 Ill. Adm. Code Parts721.124 by the Toxicity Characteristics Leaching Procedure (TCLP).

The following exceptions apply to the above analytical requirements:

- ☐ Total sulfide analysis may be substituted for reactive sulfide, only if the total sulfide concentration does not exceed 10 parts per million (ppm);
- ☐ Total cyanide analysis may be substituted for reactive cyanide, only if the total cyanide concentration does not exceed 10 parts per million (ppm);
- ☐ Total concentration analyses may be substituted for TCLP analyses except where the total concentrations exceed the TCLP limits specified in 35 Ill. Adm. Code Part 721.124;
- ☐ Analysis of the eight pesticide and herbicide Toxicity Characteristic Constituents (D012, D013, D014, D015, D016, D017, D020, and D031) can be waived if the Generator certifies that they are not expected to be present in the waste based on the nature of the waste and the generator's business;
- ☐ Petroleum-contaminated media and debris from Leaking Underground Storage Tank (LUST) sites subject to corrective action under 35 Ill. Adm. Code Parts 731 and 732 are only required to be analyzed for flash point, paint filter test, and TCLP lead;
- ☐ An MSDS for off-specification, unused or discarded commercial or chemical products may be used to determine the presence of hazardous constituents in lieu of analytical results;
- ☐ Complete TCLP analysis is not required in the case of an emergency cleanup provided: 1) the

[1] Special Waste is defined at 35 Ill. Adm. Code Part 810.103.

IEPA Emergency Response Unit (ERU) authorizes the waste stream analytical exemption, 2) the Operator obtains assurance that the Generator has received an incident number from the Illinois Emergency Management Agency, and 3) the waste was analyzed for the chemical constituents required by the IEPA ERU.

Waste streams will be reanalyzed at least once every 5 years and whenever the composition of the waste changes. A generator recertification will be obtained annually between analyses to ensure that the current analytical data continues to properly represent the waste.

Test methods employed for detailed analysis to characterize and to identify waste are provided in the following reference materials:

- ☐ EPA-600/4-79-020: "Methods for Chemical Analysis of Water and Wastes,"
- ☐ SW-846: "Test Procedures for Evaluating Solid Waste, Physical/Chemical Methods",
- ☐ "Standard Methods for the Examination of Water and Waste Water," 15th Edition, American Public Health Association, 1980, and
- ☐ The PDC Laboratories, Inc., "QA/QC Procedures for Waste Analysis".

Acceptance Criteria

These criteria are general and apply to most wastes received at the facility. If specific regulatory exemptions or variances exist or are promulgated in the future, the company Waste Acceptance Committee may modify these criteria accordingly.

Waste shall meet the following criteria prior to acceptance:

- ☐ PCB wastes must be tested as described above and determined to contain total PCB concentrations no greater than 500 parts per million (ppm).
- ☐ Contains no garbage, offal, dead animals, general household waste, commercial waste, or other wastes capable of being decomposed by microorganisms so as to cause significant malodor, gases, or other offensive conditions, or which is capable of providing food for birds and vectors (except as may be contained in remediation waste). Incidental organic debris contained in other wastes that are otherwise acceptable for disposal is allowed.
- ☐ Does not exhibit the characteristics of ignitability, reactivity, corrosivity, or toxicity as defined by 35 Ill. Adm. Code Part 721 Subpart C, and is not a listed hazardous waste as defined in 35 Ill. Adm. Code Part 721 Subpart D.

- ☐ Does not contain total phenol concentrations greater than 1,000 parts per million, unless specific information demonstrates that the material is not a threat to human health or the environment.

- ☐ Does not contain reactive cyanide concentrations greater than 250 parts per million unless specific information to show it does not present danger to human health or the environment is provided. Wastes with between 10 and 250 parts per million reactive cyanide can only be accepted if the Generator provides a signed certification that none of the following have occurred:

    1. The waste has never caused injury to a worker because of Hydrogen Cyanide (HCN) generation,

    2. That the OSHA work place air concentration limits of HCN have not been exceeded in areas where the waste is generated, stored, or otherwise handled, and

    3. That air concentrations of HCN above 10 parts per million have not been encountered in areas where the waste is generated, stored, or otherwise handled.

- ☐ Does not contain reactive sulfide concentrations greater than 500 parts per million unless specific information to show it does not present danger to human health or the environment is provided. Wastes with between 10 and 500 parts per million reactive sulfide can only be accepted if the Generator provides a signed certification that none of the following have occurred:

    1. The waste has never caused injury to a worker because of H2S generation;

    2. That the OSHA work place air concentration limits of H2S have not been exceeded in areas where the waste is generated, stored, or otherwise handled; and

    3. That air concentrations of H2S above 10 parts per million have not been encountered in areas where the waste is generated, stored, or otherwise handled.

Foundry Wastes

The following additional requirements apply to wastes generated from foundries.

Prior to first time acceptance, a CLI representative will tour the foundry facility and question knowledgeable foundry representatives to:

- ☐ Review the waste generation processes to identify all hearths where metal is melted, where dusts are generated, and identify all baghouses to ensure that hazardous wastes are not commingled with nonhazardous wastes,

- ☐ Review how waste streams are sampled at the point of generation to ensure that representative samples are collected, and

- ☐ Review the waste stream analytical data to confirm that all appropriate parameters have been analyzed.

CLI will not accept wastes that have been commingled with other wastes unless each waste stream was individually characterized and determined to be nonhazardous prior to being commingled.

RCRA Empty Containers

RCRA empty containers shall meet the following criteria:

- ☐ Have a rated capacity less than 110 gallons,

- ☐ Meet the definition of empty as provided in 35 Ill. Adm. Code Part 721.107(b), and

- ☐ For drums, at least one end must be removed and the drums must be intact, or both ends must be removed and the drums must be crushed flat prior to disposal.

Where possible, a copy of the material safety data sheet for products last contained in the drum shall be obtained and kept on file. Compressed gas cylinders will not be accepted.

Recordkeeping

The Operator will retain copies of all waste profile identification sheets, recertifications, certifications of representative sample, laboratory analyses, analysis plans, and any waivers of requirements (prohibitions, management authorization, and operating requirements) at the facility until the end of the post-closure care period, unless a document-specific requirement exists or is promulgated that requires less or more retention time.

Waste Manifests

All Special Wastes accepted for disposal shall be accompanied by a manifest. Manifests shall include the following information as a minimum:

- ☐ The name of the waste generator,

- ☐ When and where the waste was generated,

- ☐ The name of the waste hauler,

- ☐ The name of the solid waste management unit (i.e. Clinton Landfill No. 3 Chemical Waste Unit),
- ☐ The date of delivery to the landfill,
- ☐ The name, waste stream permit number, and quantity of waste delivered,
- ☐ The signature of the person who delivered the waste to the hauler, acknowledging such delivery,
- ☐ The signature of the waste hauler, acknowledging receipt of the waste, and
- ☐ The signature of the person who accepted the waste at the landfill, acknowledging acceptance of the waste.

Clinton Landfill No. 3 Chemical Waste Unit will be designated on the manifests as the final destination point. Any subsequent delivery of the waste or any portion or product thereof to a waste hauler will be conducted under a manifest initiated by Clinton Landfill No. 3.

All deliveries of Special Waste must be accompanied by three copies of the manifest. The hauler shall retain one copy of the manifest. Facility personnel will send one copy of the completed manifest to the person who delivered the waste to the hauler (typically the generator). Facility personnel will maintain one copy of the completed manifest on file for at least three years. Completed manifests will be made available to the IEPA at reasonable times for inspection and photocopying pursuant to Section 4(d) of the Illinois Environmental Protection Act.

Profile Identification Record

Generators of Special Waste must obtain the facility's written agreement to accept the waste prior to transporting the Special Waste to the facility.

The first step in Special Waste acceptance consists of the generator providing to the Operator a Special Waste profile identification sheet. The Special Waste profile identification sheet shall be supplied by the generator and certify the following:

- ☐ The generator's name and address,
- ☐ The transporter's name and telephone number,
- ☐ The name of the waste,

- ☐ The process generating the waste,
- ☐ Physical characteristics of the waste (e.g. color, odor, solid or liquid, and flashpoint),
- ☐ The chemical composition of the waste,
- ☐ The metals content of the waste,
- ☐ Absence of hazardous characteristics, including identification of wastes deemed hazardous by the USEPA or the IEPA,
- ☐ Absence of 2,3,7,8-tetrachlorodibenzodioxin (2,3,7,8-TCCD) above regulated concentrations, and
- ☐ Any other information, such as the results of tests performed in accordance with 35 Ill. Adm. Code Part 811.202, that can be used to determine whether 1) the Special Waste is regulated as a hazardous waste as defined by 35 Ill. Adm. Code Part 721, 2) the Special Waste is of a type that is permitted for, or has been classified in accordance with 35 Ill. Adm. Code Part 809, for disposal at the facility, and 3) whether the method of disposal at the facility is appropriate for the waste.

Each subsequent shipment of a Special Waste from the same generator must be accompanied by a transportation record in accordance will 35 Ill. Adm. Code Part 811.403(b), a copy of the original Special Waste profile identification sheet, and either:

- ☐ A Special Waste recertification by the generator describing whether there have been changes in the following: laboratory analysis (copies to be attached), raw material in the waste-generating process, the waste-generating process itself, the physical or hazardous characteristics of the waste, and new information on the human health effects of exposure to the waste, or
- ☐ Certification indicating that any change in the physical or hazardous characteristic of the waste is not sufficient to require a new Special Waste profile.
- ☐ Load Inspection Procedures

Load Inspection Procedures

All loads of wastes destined for the CWU will be inspected for the presence of unacceptable materials. The Gate Control Officer will:

- ☐ Inspect the manifest (as required) and the load to confirm that the waste appearance is similar to that described on the Waste Material Data Sheet, and perform fingerprint analysis consisting of a pH measurement, radioactivity scan, volatile organic vapor scan, and water reactivity screen.

Some waste streams undergo additional, more extensive gate control testing prior to acceptance, as may be required by regulations or deemed necessary by the Waste Acceptance Committee.

- ☐ Evaluate whether the load is acceptable and conforms to the USEPA and/or IEPA permit and facility pre-authorization.

- ☐ Notify the Administrative Compliance Manager if the load is suspected to be unacceptable, and obtain authorization to reject the load. The generator is notified and arrangements are made to return the load to the generator. Information regarding rejected Special Waste loads will be reported to the IEPA on a quarterly, or more frequent basis.

- ☐ If the load is deemed acceptable, direct the waste load to the appropriate landfill destination. Sign the manifest. The manifests are then distributed appropriately.

Waste Segregation

PCB wastes will be segregated from other wastes that are not compatible with PCBs throughout the waste receipt, handling and disposal operations. Wastes which are presumed to be not compatible with PCBs include MGP remediation wastes and wastes which exhibit an elevated temperature. Organic solvents and other RCRA hazardous wastes will not be accepted at the facility.

PCB Articles, PCB Article Containers and PCB Containers

PCB Articles, PCB Article Containers and PCB Containers are defined at 40 CFR Part 761.3. Generally, PCB Articles are any manufactured article, other than a PCB Container, that contains PCBs and whose surface(s) has been in direct contact with PCBs. PCB Articles include capacitors, transformers, electric motors, pumps, pipes, etc. A PCB Article Container is any package, can, bottle, bag, barrel, drum, tank, or other device used to contain PCB Articles or PCB Equipment, and whose surface(s) has not been in direct contact with PCBs. A PCB Container is any package, can, bottle, bag, barrel, drum, tank, or other device that contains PCBs or PCB Articles and whose surface(s) has been in direct contact with PCBs.

CLI will only accept for disposal PCB Articles, PCB Article Containers and PCB Containers that have been prepared in accordance with the requirements at 40 CFR Part 761.60(b) and (c). PCB Articles, PCB Article Containers and PCB Containers will be carefully handled and placed in the landfill to prevent damage to the containers and articles. These items will then be positioned in the landfill so as to not come into contact with the landfill liner or cover system, and so as to not create voids between adjacent items. To accomplish this, PCB Articles, PCB Article Containers and PCB Containers will be:

- Placed no closer than 5 feet from the landfill floor and sidewall liner systems,
- Buried at least 5 feet below the bottom of the final cover barrier soil, and
- Positioned at a distance (horizontally and vertically) from each other so as to allow waste or soil to be placed and compacted between the items to ensure voids do not result.

Waste Solidification

CLI plans to accept liquid wastes for solidification prior to disposal. Liquids accepted for solidification from incidental sources, such as precipitation, condensation, leachate, or load separation that are associated with PCB Articles or non-liquid PCB will exhibit less than 500 parts per million (ppm) PCBs. All other liquids accepted for solidification will exhibit less than 50 parts per million (ppm) PCBs. In any instance of conflict between the RCRA and TSCA regulations governing the acceptability of liquids, the more stringent requirement(s) will control.

The liquid wastes will be transported to CLI by licensed Special Waste haulers and will be subject to the Special Waste management requirements described in 35 Ill. Adm. Code Part 812.318.4.

Wastes to be solidified will be transported to a designated solidification area near the active face. The designated solidification area will be within an area that is developed and permitted (including Operating Permit) to accept waste. Because of the in-place environmental controls, the permitted landfill area is suitable for use as a site to conduct waste solidification. The solidification area location will vary, but will be at least 10 feet above the landfill floor, and at least 30 feet from the landfill sidewall liner system. Berms will be constructed around the solidification area to prevent storm water run-off from the area.

Testing Requirements

Prior to acceptance for solidification, each waste stream will be analyzed for the following:

- ☐ Total organic halogens (TOX) using the test method specified in 35 Ill. Adm. Code Part 729. Any waste containing 10,000 parts per million (ppm) or more TOX will be analyzed for volatile organic compounds,
- ☐ Total PCBs,
- ☐ pH, and

- ☐ Bench-scale reactivity (wastes to be solidified using a reagent only), in general conformance with the following procedures:

    1. Weigh and place approximately 100 grams of waste into a stainless steel mixing bowl. For TSCA-regulated PCB liquids, record the initial temperature in degrees Fahrenheit.

    2. Slowly mix in the reagent to be used to solidify the waste until the mixture becomes crumbly, record the amount of reagent used.

    3. Observe for evidence of reactivity, such as fumes, vapors, smoke, excessive temperature rise, etc. Immediately discontinue the test if excessive reactivity is noted. For TSCA-regulated PCB liquids, record the temperature of the mixture in degrees Fahrenheit. A temperature increase of more than 10oF is unacceptable and an alternative quantity of reagent or different reagent must be utilized.

    4. Allow the mix to set for at least 6 hours, then weigh the final mix and perform a paint filter test.

    5. Record the initial weight of the waste, the weight of reagent used, the weight of the final waste/reagent mix, observations for reactivity, and paint filter test results. Calculate the percentage of reagent used to solidify the waste (reagent weight/initial waste weight).

    6. Solidified waste will be tested for liquids (paint filter test) prior to disposal.

Waste Solidification Containers and Methods

Wastes will be solidified in liquid-tight and structurally sound containers, such as steel drums, roll-off containers, or larger steel containers. Solidification containers will be adequately spaced to allow inspections and equipment access. Up to 10 drums and 10 containers will be used at any one time. A process flow diagram and conceptual plan of the treatment area are provided as Figures 1 and 2, respectively. The goal of the treatment is to solidify the waste such that the waste passes the paint filter test.

The wastes will be directly dumped or pumped from the waste transport trucks into the solidification containers. Alternatively, solidification will occur in the drums in which the wastes are transported (provided adequate freeboard is available for the solidification adsorbents/reagents and mixing operations). Solidification agents (reagents and/or adsorption materials) will be placed in the containers and thoroughly mixed with the wastes. The amount of solidification agent will vary, but is expected to typically range from 5 to 10 percent by weight.

When solidifying non-TSCA-regulated wastes, adsorbents (e.g. soil, "Oil-Dry", sawdust, and/or corn cobs) will primarily be used for the solidification process. However, depending upon waste characteristics, reagents might also be used. Reagents may include lime, pozzalime, fly ash, bottom ash, and/or other appropriate, lime-based materials. Fly ash and bottom ash that are to be used as reagents may only originate from coal combustion. Pozzalime is simply a mixture of lime and a pozzalanic material. Market conditions, availability, and waste characteristics will dictate which solidification agents will be used.

When solidifying TSCA-regulated PCB liquids, adsorbents (e.g. soil, "Oil-Dry", sawdust, and/or corn cobs) will primarily be used for the solidification process. However, depending upon waste characteristics, reagents might also be used. Reagents may include cements, bentonite, lime, pozzalime, fly ash, bottom ash, and/or other appropriate, lime-based materials. Reagents will be demonstrated during the bench-scale study to not increase the waste temperature by more than 10° Fahrenheit to maintain worker protection and ensure that any reduction in PCB concentrations correlates directly with the reagent quantity added and not from volatilization.

Adsorbents and reagents will be stockpiled on site in accordance with the facility's Storm Water Pollution Prevention Plan (SW3P). The facility's SW3P specifies sediment controls for the site. Adsorbent stockpiles are expected to contain less than 500 cubic yards of adsorbent materials. Reagent stockpiles will be protected from storm water run-on, and will be covered to protect the reagents from precipitation. Reagent stockpiles will contain no more than 120 cubic yards of reagents.

Up to about 50 percent (by weight) of reagent could be required to solidify some anticipated wastes. It is unlikely that more than five batches per day will require solidification using a reagent. Therefore, it is currently estimated that, at most, 75 cubic yards of reagent will be used in a day.

The waste/solidification agent mix will be allowed to cure as required. Following curing, the waste will be tested for free liquids using the paint filter test. Wastes that pass the paint filter test will be removed from the containers using a backhoe or excavator. Material that cannot be removed using the mechanical equipment will be manually removed using shovels. The waste will be direct-loaded into a transport vehicle for delivery to the landfill's active face and disposed.

Wastes that do not pass the paint filter test will be allowed to cure longer and/or additional solidification agent will be mixed in with the waste.

It is currently estimated that up to 10 loads per day will be solidified. Wastes requiring solidification will be solidified on the day received. Solidified wastes are intended to be disposed the same day; however, depending upon the length of curing time that is required and the time of day that the waste was solidified, in some instances solidified waste may have to remain in the solidification container until the next business day. In these instances, such waste will be covered before the end of the day and disposed during the next business day. The solidification process is not expected to result in residual waste that cannot be properly managed at the facility.

Phasing Of Operations

The Chemical Waste Unit will be developed in phases in order to minimize the open disposal area footprint and to minimize leachate generation. The initial phase will be constructed in the southwestern corner of the unit as illustrated on the facility drawings. Each subsequent phase will be immediately adjacent to, and tied into, a previously developed phase.

Manner Of Waste Placement

Waste will be landfilled in lifts, each having a thickness of approximately 5 to 10 feet. Prior to waste placement, previously placed daily or intermediate cover will be at least partially removed to allow leachate to drain into the leachate collection system. Waste placement will generally occur in the lowermost portion of the active cell. However, higher tiers within the landfill may be designated for waste placement during inclement weather in order to ensure operating safety and efficiency.

Waste will generally be placed at the toe of the active face and pushed upwards in relatively thin lifts using a compactor, bulldozer, or other appropriate heavy equipment. Heavy equipment will not be allowed to operate directly above the liner and leachate drainage and collection system until at least 5 feet of waste covers the landfill floor in order to not overstress these landfill components. Therefore, the initial lift of waste over the landfill floor will be pushed over the top of the active face.

The first 5 feet of waste on the landfill floor will be free of debris that could damage the underlying geotextile. Nominally 18-inches of soil or select waste consisting of soil-like wastes containing no particles greater than 12 inches in any dimension will be placed against the sidewall liner system. The first lift will be carefully placed in order to prevent tears and excessive wrinkles in the geotextile.

PCB waste will not be placed in direct contact with incompatible wastes, such as MGP remediation wastes, wastes containing organic solvents or wastes that exhibit a temperature greater than ambient.

The waste may be compacted using compactors or bulldozers to minimize void space and settlement. The steepness of the waste slopes has a significant impact on overall landfill stability. In order to provide the required factors of safety against slope instability, waste slopes greater than 40 feet high will be maintained no steeper than 3 horizontal to 1 vertical (3:1), other waste slope will be maintained no steeper than 2:1.

Daily and Intermediate Cover

The waste will be covered with daily cover, consisting of at least 6-inches of clean soil, and/or an alternative daily cover (ADC) at the end of each operating day. Areas with daily cover will be graded to prevent storm water runoff from the active area.

Daily cover soil will be derived from onsite excavations and/or stockpiles and will primarily consist of fine-grained silty and clayey soils (e.g. ML, CL, CH, SM, and SC). Daily cover soils will be compacted using a bulldozer or compactor. The compacted hydraulic conductivity of daily cover soils is expected to range from about 10^{-5} to 10^{-7} centimeters per second. Daily cover soil will be partially removed prior to subsequent waste placement to facilitate leachate drainage.

Commercially available polypropylene non-woven or woven geotextile such as Fabrisoil, Typar 3601, Amoco 2002 or their equivalents may be used at suitable times as determined by the Site Manager. At any one time, no more than 2,500 square yards of waste will be covered by ADC. ADC will not serve as daily cover at a specific area for more than 6 consecutive days.

ADC will only be used when weather conditions are conducive to its ability to prevent blowing litter, odors and access of waste materials to vectors. Geotextile ADC will be adequately anchored to prevent wind damage and ADC displacement. Any damage to the geotextile ADC will be repaired prior to continued use, or the damaged area will be covered with at least 6 inches of soil. ADC materials previously used as daily cover will not be reused for any purpose outside the waste boundaries.

A written record of ADC usage will be maintained. The record will include the date, weather conditions, ADC material used, and a description of its performance. A summary of this information will be included in the Facility's annual reports.

Areas which have been filled, but which have not reached final grade, and which will not receive additional waste deposits for more than 60 days, will receive an intermediate cover of at least 12 inches of clean soil. At least 18 inches of intermediate cover will be placed on perimeter slopes that are susceptible to erosion, such as those which are steeper than 20% and have uninterrupted drainage lengths longer than 200 feet. Furthermore, erosion control measures, such as temporary vegetation, drainage terraces, erosion control blankets (ECB), turf reinforcement mats (TRM), or other appropriate methods shall be incorporated as necessary on perimeter intermediate cover slopes that are susceptible to erosion and that remain in place longer than 12 months.

The intermediate cover soil will be graded and compacted to facilitate drainage of runoff, minimize standing water, and minimize infiltration. Intermediate cover soil will be derived from onsite excavations, and will primarily consist of fine-grained silty and clayey soils (e.g. ML, CL, CH, SM, and SC). The intermediate cover soils are expected to exhibit a hydraulic conductivity in the range of 10^{-5} to 10^{-7} centimeters per second. All or a portion of previously placed intermediate cover soils may be removed immediately prior to placing additional waste in the previously covered area.

The intermediate cover will be periodically inspected. All cracks, rills, gullies, and depressions will be repaired as necessary to maintain positive drainage and the minimum 12-inch thickness.

Liner Freeze Protection

The liner system shall be covered with at least 5 feet of solid waste, or a suitable thickness of other material (soil, straw, etc.) prior to onset of freezing weather in order to prevent the Earth Liner from freezing. Earth Liner suspected of being damaged by freezing temperatures shall be tested in accordance with sampling and laboratory hydraulic conductivity testing requirements provided in the Construction Quality Assurance (CQA) Plan to demonstrate that the Earth Liner retains its specified maximum hydraulic conductivity and/or shall be reconstructed in accordance with the specifications. Such reconstruction shall be subject to the requirements of the CQA Plan. Floor liner covered by at least 2 feet of waste (above the 12-inch sand drainage layer) may be presumably assumed to be sufficiently protected from freeze damage. Considering the insulating effects of the sidewall geotextile and geonet, sidewall liner covered with at least 18-inches of soil or select waste may be presumably assumed to be sufficiently protected from freeze damage.

Operating Equipment

Appropriate and sufficient numbers of equipment will be stationed at the site to ensure compliance with the facility permit and applicable regulations. The following equipment is expected to be stationed at the site on a routine basis:

- ☐ Waste compactor, such as Caterpillar 836,
- ☐ Bulldozer, such as Caterpillar D8,
- ☐ Excavator or backhoe,
- ☐ Scrapers or articulated trucks, and
- ☐ Pick-up truck.

Additional equipment will be mobilized to the site as needed.

Operation Controls

Boundary Control

Access to the facility for vehicles hauling waste and/or construction equipment and vehicles shall be limited to the gated entrance off U.S. Route 51. At least one other facility access point may be constructed to provide emergency and other limited access from Ethal Road to the east. This access is limited to specifically authorized small vehicles (e.g. automobiles and pick-up trucks) and emergency vehicles. All entrances will be locked at all times that the facility is not open.

A six-foot woven mesh fence or similar device will be constructed around the perimeter of the Chemical Waste Unit prior to accepting PCB wastes which can only be disposed in a landfill regulated as a Chemical Waste Landfill in accordance with 40 CFR Part 761.

Facility personnel will direct landfill customers, vendors, and visitors to the appropriate areas during operating hours. Unauthorized access to the open face and other areas within the facility boundary will be prevented at all times. Salvaging will not be allowed.

A permanent sign will be posted in a conspicuous location near the facility entrance with the following, and/or other information as required by the USEPA or IEPA:

- ☐ A statement that disposal of hazardous waste is prohibited,

- ☐ A statement that Special Wastes must be permitted and must be accompanied by a manifest,
- ☐ The facility permit number issued by the IEPA Bureau of Land and the USEPA,
- ☐ The facility hours of operation,
- ☐ The prohibition of unauthorized dumping and trespassing,
- ☐ The name and telephone number of who to call in case of an emergency, and
- ☐ The name, address and telephone number of the Landfill Operator.

Survey Control

A grid coordinate system has been established at the facility for horizontal control as shown on the facility drawings. Vertical control references established elevation control benchmarks. Survey monuments will be established as appropriate to maintain the onsite horizontal and vertical control. Permanent survey monuments will be inspected annually, and resurveyed no less frequently than once every five years by a Licensed Surveyor.

Air Quality, Dust, and Odor Control

The facility will be operated in a manner that minimizes the impact to air quality by:

- ☐ Prohibiting open burning of waste,
- ☐ Watering access roads, adding dust palliatives, and sweeping paved roads as necessary to control dust,
- ☐ Confining the active face to the smallest practical area,
- ☐ Covering all waste by the end of the day that the waste is received,
- ☐ Promptly covering odorous waste (i.e. before the end of the day if necessary), and
- ☐ Implementing an effective dust control program to minimize dust emissions and migration.

Road Maintenance

Facility roadways will be maintained such that they support the operation and maintenance of the site without causing safety or nuisance problems or hazardous conditions. All weather roads will provide truck access directly to the landfill active face. Trucks will discharge waste at the edge of designated unloading area, and heavy equipment will grade the waste into the active face as described elsewhere in this Operating Plan. At no time will waste hauling trucks enter the active face or travel directly on landfilled waste.

Mud Tracking

CLI will maintain a paved road from the Route 51 entrance to the scales. The road beyond this point to the landfill boundary will be either paved or gravel to provide all-weather access. Although the travel distance from the active face to the Route 51 entrance (1/2 mile, minimum) is expected to eliminate potential mud tracking onto Route 51, CLI will inspect the entrance road each day for excessive mud and dust accumulation. Accumulated mud and dust will be promptly removed to prevent potential tracking onto the public highway.

Noise Control

The facility will be operated in accordance with the noise restrictions imposed by 35 Ill. Adm. Code Part 900. Noise will be controlled by using equipment with functional mufflers and confining landfill operations to normal working hours. The unit is located in a rural area and surrounded on all sides by farmland, timber, or municipal solid waste landfills (Clinton Landfill No. 2 and Clinton Landfill No. 3 Municipal Solid Waste Unit). Therefore, noise from facility construction and operations is not expected to negatively affect the surrounding population.

Vector Control

Application and maintenance of daily cover will serve as the primary means for controlling vectors. Should a vector problem occur, the services of a professional pest control firm will be utilized.

Fire Protection

The facility Hazard Prevention and Emergency Response Plan, provided in Appendix B describes the equipment and activities that will be implemented to provide adequate fire protection for the facility and surrounding areas.

Leachate Management System

Extraction System Operations

The landfill is designed to include a system for collecting, monitoring, extracting, and storing leachate.

System details are provided on the facility drawings.

The leachate extraction pumping system is designed to operate automatically. Electrical controls will automatically active the extraction pump within each leachate collection sump when the liquid level within the sump rises to the design elevation (i.e. no more than 12-inches above the liner system). The system will rely upon mechanical and electrical components that will require routine system checks and maintenance to ensure satisfactory performance. Routine checks will include recording the volume of leachate extracted and pump diagnostics (pressure head, flow rate, etc.). This information will be used to ensure that the leachate pumps and controls are operating properly and forewarn of the need for pump cleaning and/or replacement. Other specific checks and maintenance will depend upon the specific components that are selected, but will be performed in accordance with the manufacturers' recommendations.

Extracted leachate will be transmitted to the underground storage tank via double-wall pipe. The interstitial space between the primary and secondary containment pipe will be routinely monitored for evidence of leakage. In the event a leak in the primary pipe is detected, the piping system will be immediately repaired and/or replaced.

Response Plan to Potential Leachate Seeps

The Operator shall immediately respond to leachate seeps to prevent leachate from commingling with storm water runoff. Response procedures shall include the following as appropriate:

- ☐ Identify the source of the leachate and take action to prevent additional leachate from escaping.
- ☐ Contain leachate runoff prior to being discharged beyond the site boundary. Containment can consist of placing earthen berms, constructing diversion ditches, adsorbing the leachate with soil or other adsorbents, etc.
- ☐ Remove and properly dispose soil contaminated by leachate. Released materials containing PCBs at concentrations 50 parts per million or greater will be cleaned up in accordance with the USEPA Spill Cleanup Policy at 40 CFR 761, Subpart G.

Leachate Storage and Disposal

Leachate from the Chemical Waste Unit will be pumped directly to an underground storage tank(s) that is/are dedicated for storing leachate from the Chemical Waste Unit.

The Operator will check the liquid level within, and evidence of leakage from, the leachate storage tank each operating day. Automatic leak detection systems will be checked for proper function at least annually.

Leachate will be transferred from the underground storage tank into tank trucks that are positioned on a concrete containment pad (Leachate Load-out Facility). The following procedures shall be followed during each transfer of leachate from a storage tank into a tank truck:

- ☐ Position the tank truck such that the fill is at least 10 feet from the ends of the containment pad and, insert the fill nozzle into the fill port,
- ☐ Properly ground the truck as appropriate,
- ☐ Ensure that the containment pad storm water drain valve is closed, and the leachate tank return valve is open,
- ☐ Pump leachate into the tank truck,
- ☐ Continuously monitor the pumping and liquid level within the tank truck to ensure that the tank truck is not overfilled,
- ☐ Upon completion of the transfer, inspect the containment pad for any spills or overfills. Report any spills or overfills to the Facility Manager for proper cleanup, and
- ☐ Once spills or overfills are confirmed to not have occurred, or have been properly remediated, close the leachate return valve and open the storm water drain valve.

Leachate containing less than 50 ppm PCBs that is generated from a CWU cell following the disposal in that cell of MGP source material or PCB wastes which can only be disposed in a landfill that is permitted as a Chemical Waste Landfill pursuant to 40 CFR Part 761, shall either be: 1) solidified in accordance with this Operating Plan and disposed in the CWU or other landfill that is permitted to accept such waste, or 2) transported offsite to a properly licensed wastewater treatment plant for treatment and discharge under a National Pollutant Discharge and Elimination System (NPDES) permit. Leachate that is generated from a CWU cell prior to disposal in that cell of either MGP source material or PCB wastes which can only be disposed in a landfill that is permitted as a Chemical Waste Landfill pursuant to 40 CFR Part 761, shall either be: 1) recirculated into Clinton Landfill No. 2 or the Clinton Landfill No. 3 MSW Unit in accordance with previously approved permits, 2) solidified in accordance with this Operating Plan and disposed at a properly permitted landfill, or 3) transported offsite to a properly licensed wastewater treatment plant for treatment and discharge under a NPDES permit. The selected offsite leachate treatment/disposal facility shall meet the requirements of 35 Ill. Adm. Code Part 811.309(e)(1) and (3). Leachate shall not be recirculated in the CWU. Leachate containing more than 50 ppm PCBs shall be managed as required by 40 CFR Part 761.60(a).

Landfill Gas Collection and Control System

Significant landfill gas is not anticipated at the CWU as a result of the types of wastes that will be accepted. Regardless, CLI will monitor for the presence of landfill gas at two monitoring wells installed within the CWU.

A portion of the Chemical Waste Unit will be overlain with municipal solid waste (MSW) as depicted on the drawings. A landfill gas collection and control system will be installed in the MSW Unit to safely control landfill gas migration. Landfill gas collection and control system operational requirements are provided in the approved Clinton Landfill No. 3 MSW Unit Operating Plan.

Inspection and Maintenance Plan

The Operator will maintain the facility to ensure efficient operations and compliance with the applicable regulations and permits. For instance, mechanical equipment, such as earthmoving equipment, landfill compactors, and pumps, will be subjected to a preventative maintenance program that will include routine inspections and scheduled maintenance items. In addition to maintaining mechanical equipment, the Operator will routinely inspect and maintain the access roads and boundary control, storm water management system, landfill cover, liner protective cover, leachate management systems, groundwater monitoring wells, landfill gas control system, waste stabilization area, and survey monuments to proper operating conditions. The inspection and maintenance plan for these features is provided in Appendix C.

Personnel Monitoring and Protection

The primary routes of exposure for PCBs are via skin contact and ingestion, for which appropriate Personal Protective Equipment (PPE) and work practices will be established. Airborne exposure is not considered to be a significant risk due to the low vapor pressure of PCBs. However, exposure monitoring will be conducted to verify airborne levels of concern are not present and to determine the appropriate level of PPE, if any.

Personal air monitoring will be performed to measure the exposure of site workers to airborne PCBs to ensure the exposure levels do not exceed the published occupational exposure limit (i.e., OSHA PEL). Personal exposure levels will be determined by conducting sampling and analysis in accordance with NIOSH Method 5503. Sampling will be conducted utilizing glass fiber filter and florisil sampling media and portable, personal sampling pumps capable of maintaining the recommended flow rate. Sample analysis will be conducted by an accredited laboratory.

Initial exposure determination will be conducted during the initial receipt of PCB-contaminated waste materials. Additional or ongoing exposure monitoring will be conducted if warranted by initial sample results, a significant change (increase) in waste PCB concentrations, or if indicated by on-site observations (e.g., dust conditions, employee complaint, etc.). Likewise, additional evaluations to determine the appropriate level of PPE, if any, will be performed in conjunction with each monitoring event. Employees will be notified in writing of all exposure monitoring results.

Operating Record

The Operator will maintain at the facility, or in an alternative location specified by the USEPA or IEPA, an Operating Record. The Operating Record will include a copy of all information detailed below.

The Clinton Landfill No. 3 Operating Record will include all information submitted to, and received by, the IEPA pursuant to 35 Ill. Adm. Code Parts 812 and 813 as it becomes available. At a minimum, the Operating Record will contain the following information, even if such information is not required by 35 Ill. Adm. Code Parts 812 or 813:

- ☐ Any location restriction demonstration required by 35 Ill. Adm. Code Parts 811.302(e), 812.109, 812.110, 812.303, and 812.305,
- ☐ Inspection records, training procedures, and notification procedures required by 35 Ill. Adm. Code Parts 811.323,
- ☐ Gas monitoring results and any remediation plans required by 35 Ill. Adm. Code Parts 811.310 and 811.311,
- ☐ Documentation of the design of the leachate extraction system,
- ☐ Any demonstration, certification, monitoring results, testing, or analytical data relating to the groundwater monitoring program required by 35 Ill. Adm. Code Parts 811.319, 811.324, 811.325, 811.326, 812.317, 813.501, and 813.502,

- ☐ Closure and post-closure care plans and any monitoring, testing, or analytical data required by 35 Ill. Adm. Code Parts 811.110, 811.111, 812.114(h), 812.115 and 812.313, and
- ☐ Any cost estimates and financial assurance documentation required by 35 Ill. Adm. Code Parts 811 Subpart G.

In addition to the above, the information described in the following paragraphs will also be maintained in the facility's Operating Record upon disposal of PCB wastes which can only be disposed in a landfill that is permitted as a Chemical Waste Landfill pursuant to 40 CFR Part 761.

At a minimum, the following information will be maintained, as required by 40 CFR 761.75:

- ☐ Records of the PCB concentrations in liquid wastes, and
- ☐ The three dimensional burial coordinates for PCBs and PCB items.

The written annual records required by 40 CFR 761.180 will be maintained at the facility for at least 20 years after the Chemical Waste Unit is no longer used for the disposal of PCBs and PCB items, and contain the following information:

- ☐ All signed manifests generated or received at the facility during the calendar year,
- ☐ All Certificates of Disposal generated or received by the facility during the calendar year, and
- ☐ Records of inspections and cleanups performed in accordance with 40 CFR 761.65.

The written annual document log required by 40 CFR 761.180 will be prepared each year by July 1 for the previous calendar year, maintained at the facility for at least 20 years after the Chemical Waste Unit is no longer used for the disposal of PCBs and PCB items, and contain the following information:

The name address, and USEPA identification number of the facility and the calendar year covered;

- ☐ For bulk PCB waste, its weight in kilograms, the first date PCB waste placed in the tanker or truck was removed from service for disposal, the date it was placed in transport for off-site disposal, and the date of disposal;
- ☐ The serial number (if available) or other means of identifying each PCB Article not in a PCB Container or PCB Article Container, the weight in kilograms of the PCB waste in the PCB Article, the date it was removed from service for disposal, the date it was placed in transport for off-site disposal, and the date of disposal; and

- ☐ A unique number assigned by the generator identifying each PCB Container, a description of the contents of each PCB Container, such as liquid, soil, cleanup debris, etc., including the weight of the material in kilograms, the first date the material was removed from service for disposal, the date the PCB Container was placed in transport for off-site disposal, and the date of disposal.

The facility will submit an annual report to the USEPA Region V Administrator. The annual report will summarize the annual records and annual document log and be submitted each year by July 15 for the previous calendar year. The annual report will contain the following information:

- ☐ The name address, and USEPA identification number of the facility;
- ☐ A list of the numbers of all signed manifests of PCB waste generated or received at the facility during the calendar year;
- ☐ The total weight in kilograms of bulk PCB waste, PCB waste in PCB Transformers, PCB waste in PCB Large High or Low Voltage Capacitors, PCB waste in PCB Article Containers, and PCB waste in PCB Containers disposed of at the facility during the calendar year; and
- ☐ The total number of PCB Transformers, PCB Large High or Low Voltage Capacitors, PCB Article Containers, and PCB Containers disposed of at the facility during the calendar year.

For purposes of the annual report, PCB Voltage Regulators will be recorded and reported as PCB Transformers.

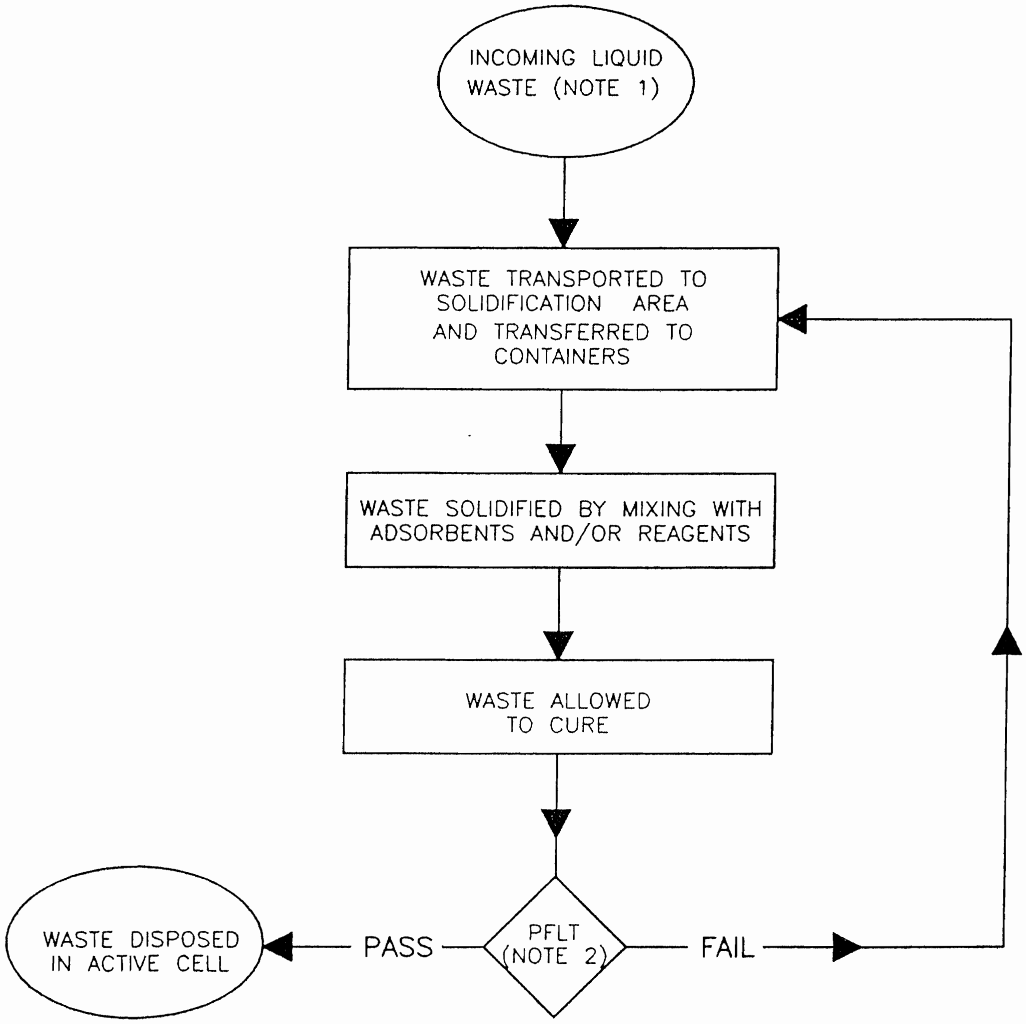
Annual report submittals will continue until the submission of the annual report for the calendar year during which the facility ceases PCB disposal operations.

In addition to the above recording and reporting requirements, the facility will collect and maintain for 20 years after the facility is no longer used for the disposal of PCBs and PCB Items, the following information:

- ☐ All documents, correspondence, and data that have been provided to the facility by any State or local government agency and that pertain to the disposal of PCBs and PCB Items at the facility;
- ☐ All documents, correspondence, and data that have been provided by the facility to any State or local government agency and pertain to the disposal of PCBs and PCB Items at the facility;
- ☐ Any applications and related correspondence sent by the facility to any local, State, or Federal authorities in regard to waste water discharge permits, solid waste permits, building permits, or other permits or authorizations such as those required by 40 CFR 761.75(c).
- ☐ Electrical equipment reclassification will not be conducted at the facility.

FIGURES

CAD DWG NO: 911181004R1 EMPLOYEE NO: 9834 DATE/TIME: 09/20/07 15:49 ACAD-16.



NOTES:
1. INCOMING WASTE IS SUBJECT TO PRE-APPROVAL PROCEDURES DESCRIBED IN OPERATING PLAN.
2. TCLP TESTING MAY ALSO BE REQUIRED – SEE OPERATING PLAN.

PFLT = PAINT FILTER LIQUIDS TEST

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PDC Technical Services, Inc.

Peoria, Illinois

FIGURE 1

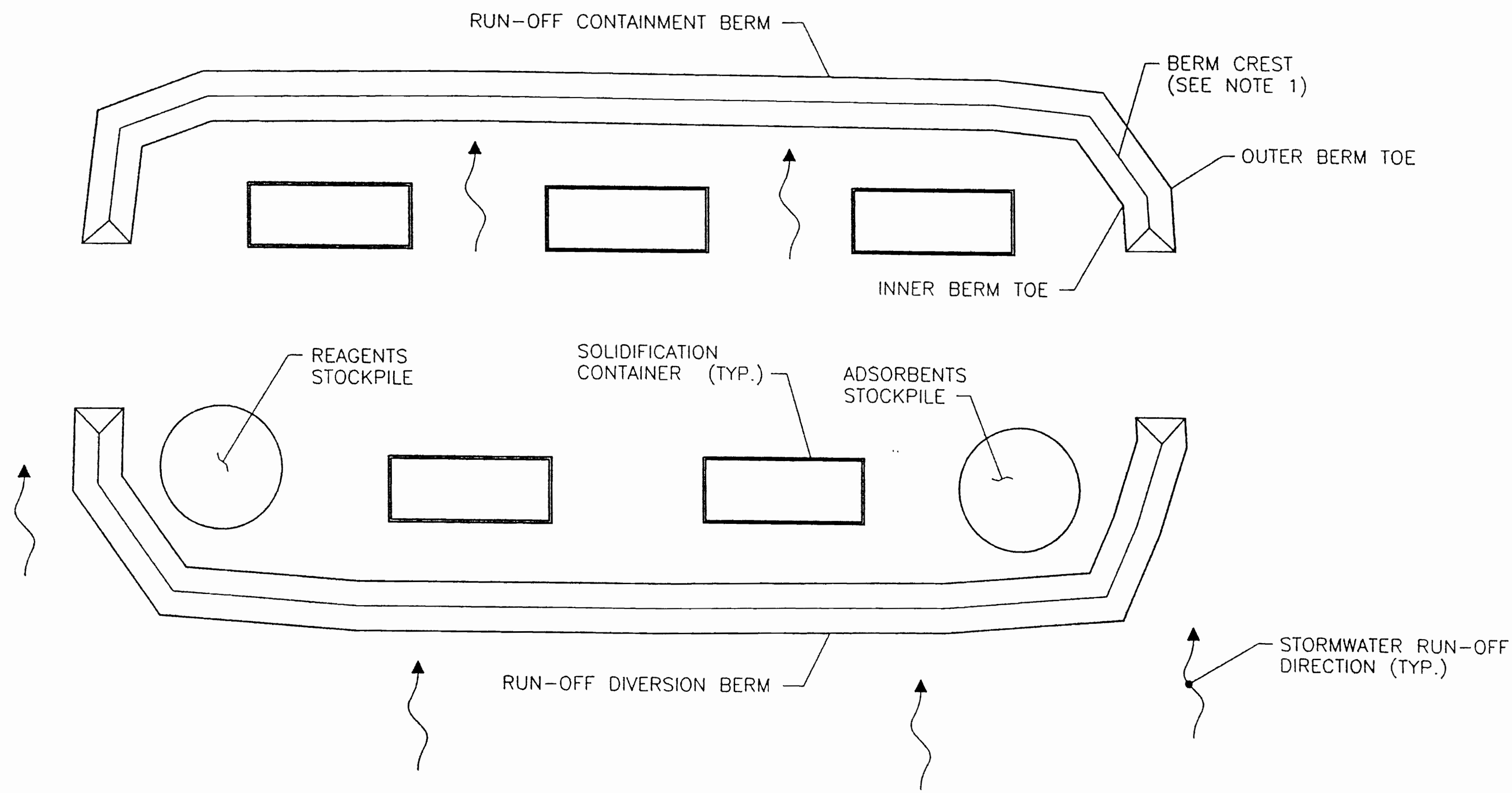
PROCESS FLOW DIAGRAM WASTE SOLIDIFICATION

CLINTON LANDFILL NO. 3

CLINTON, ILLINOIS

PROJECT NO. 91-118

CAD DWG NO. 1181005R1 EMPLOYEE NO: 9834 DATE/TIME: 09/20/07 15:37 ACAD-16.



NOTES:

1. TEMPORARY EARTH BERM WITH 18" HIGH CREST AND 2:1 SLOPES FOR SECONDARY CONTAINMENT AND STORMWATER RUN-ON DIVERSION.
2. SOLIDIFICATION CONTAINERS TO BE WATERTIGHT PLATE STEEL REINFORCED WITH TUBE STEEL FRAMES OR DOT-APPROVED DRUMS.
3. SOLIDIFICATION CONTAINERS, REAGENT/ADSORBENT STOCKPILES AND BERM LOCATIONS ARE SHOWN CONCEPTUALLY. ACTUAL LAYOUT WILL DEPEND ON NO. OF CONTAINERS/STOCKPILES, NEEDED AND SITE CONDITIONS.

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PDC Technical Services, Inc.
Peoria, Illinois

FIGURE 2

PROPOSED SOLIDIFICATION AREA LAYOUT

CLINTON LANDFILL NO. 3

CLINTON, ILLINOIS

PROJECT NO. 91-118

APPENDICES

APPENDIX A: PERSONNEL TRAINING PROGRAM OUTLINE

PERSONNEL TRAINING PROGRAM OUTLINE

Facility personnel involved in waste management activities complete a comprehensive program of classroom and on-the-job instruction to ensure that the landfill is operated in compliance with all applicable regulations, including those enforced by the Illinois Environmental Protection Agency and the Occupational Safety and Health Administration. The major elements of the training program, as applicable to specific positions, include the following:

Waste Management Regulations, Policies and Procedures

- Regulatory Requirements
- Review of Site Operating Practices
- Use of Protective Equipment
- Load Checking Procedures
- Hazard Prevention and Response Plan Review
- Storm Water NPDES Permit Requirements

OSHA Hazard Communication Program

- OSHA Hazard Communication Standard
- Material Safety Data Sheets
- Emergency Phone Numbers for All Vendors of Hazardous Chemicals
- Hazardous Chemicals Safety Training

Safety and Health

- Employee Safety and Health Program
- Hazardous Energy Control Program
- Confined Space Entry
- Hearing Conservation Program
- Respiratory Protective Program
- PCB Waste Handling

On-The-Job Training

- Equipment Operation
- Load Inspection
- Field Inspection

Training is conducted as new employees are hired and as employees perform new duties. Classroom reviews of the initial training and other pertinent training issues are conducted annually.

APPENDIX B: HAZARD PREVENTION AND EMERGENCY RESPONSE PLAN

HAZARD PREVENTION AND EMERGENCY RESPONSE PLAN

Clinton Landfill No. 3 - Chemical Waste Unit
DeWitt County, Illinois

February 2008

Prepared for: **Clinton Landfill, Inc.**
P. O. Box 9071
Peoria, Illinois 61612

Prepared by: **PDC Technical Services, Inc.**
4349 Southport Road
Peoria, Illinois 61615

PDC Project No. 91-0118

TABLE OF CONTENTS

INTRODUCTION

This Hazard Prevention and Emergency Response Plan (Plan) provides a plan of operations to ensure that the properties and populations surrounding Clinton Landfill No. 3 will be protected from danger in the event of fires, spills, or other operational accidents at the facility.

This Plan is divided into five main sections. Section 2 provides an overview of the organization, responsibilities, training, and health and safety considerations of the facility Hazard Prevention and Emergency Response Team. Section 3 identifies and provides an evaluation of the hazards that could threaten properties and populations surrounding the facility. Section 4 describes the procedures to be followed to prevent threatening hazards from occurring. Section 5 describes response procedures in the event an emergency. Section 6 identifies organizations and facilities that are available to provide outside assistance in the event of an emergency.

This Plan is not intended to fully address all safety and health issues related to onsite personnel. These issues, which include hazardous energy control (i.e. lockout/tagout), confined space entry, hearing conservation, and respiratory protection programs, are the subjects of other Corporate health and safety policy programs.

HAZARD PREVENTION AND EMERGENCY RESPONSE TEAM

Team Organization

Hazard prevention and emergency response require the cooperation and teamwork of all people who are granted access to the facility. Although specific Clinton Landfill, Inc. (CLI) employees are responsible for developing and implementing this Plan, all people who are granted access to the facility, including employees, vendors, truck drivers disposing waste at the facility, and visitors are expected to follow good work practices to minimize hazards and abide by this Plan.

CLI's Hazard Prevention and Emergency Response Team is comprised of the following:

> Landfill Director: The Landfill Director has the overall responsibility for hazard prevention and emergency response. The Landfill Director's responsibilities include ensuring that the facility is adequately constructed, staffed and equipped to minimize hazards. The Landfill Director is also responsible for ensuring that the proper regulatory agencies are notified in the event of a release of a reportable quantity of a toxic or hazardous material.

> Corporate Health and Safety Officer: The Corporate Health and Safety Officer is responsible for reviewing, modifying, and approving this Plan and for confirming through audits that this Plan is implemented. The Corporate Health and Safety Officer periodically meets with the Landfill Director and Landfill Manager to discuss any potential hazards or safety-related issues noted during audits.

> Landfill Manager: The Landfill Manager is responsible for implementing the Plan on a day-to-day basis. The Landfill Manager is also responsible for ensuring that a designated Emergency Response Coordinator is onsite at all times that the facility is accepting waste.

Emergency Response Coordinator: The Emergency Response Coordinator is responsible for coordinating CLI's response to emergencies that have the potential to present a danger to human health or the environment.

Personnel Training

All CLI employees whose responsibilities include active involvement in load checking or waste disposal activities are trained to recognize and mitigate hazardous conditions in accordance with this Plan. Training occurs at the time of employment and prior to the employee being assigned new responsibilities for which they have not been trained. Refresher training is conducted annually.

HAZARD IDENTIFICATION

Based on review of the proposed facility design and operating procedures, CLI concludes that the proposed facility presents very little danger to the surrounding area due to fire, spills, or other operational accidents. There are a few routine operational hazards, however, that, if left unchecked, could possibly present a danger to the properties or populations surrounding the facility. These operational hazards are described below.

Fires and Explosions

Grass and Forest Fires

A grass or forest fire is probably the most likely hazard that could endanger the surrounding properties. Considering the relative remoteness of the facility, a grass or forest fire does not substantially threaten surrounding populations.

A grass or forest fire could start as a result of careless open flames, smoking, or hot work. Vehicle and equipment fires could also cause a fire. Section 4 of this Plan describes operational procedures that will be followed to minimize these hazards.

A threatening grass or forest fire could only occur during extremely dry and/or windy conditions. Even then, the lack of potential fuel during the periods when surrounding agricultural land is fallow would limit its spread.

Waste Fires

Two types of waste fires are considered. The first type is a fire occurring in waste prior to the waste being covered. The second type is a subsurface fire occurring in the buried waste. Both types of fires are relatively rare.

A fire in uncovered waste would be confined to a relatively small area since waste is covered each day. Although such a fire could release noxious smoke, the limited amount of fuel that would be available, lack of the presence of hazardous waste, and the distance to offsite populations would limit the danger to surrounding populations.

A waste fire could start as a result of careless open flames, smoking, or hot work. Vehicle and equipment fires could also cause a fire. Section 4 of this Plan describes operational procedures that will be followed to minimize these hazards.

Subsurface landfill waste fires can occur when significant aerobic biodegradation is allowed to occur in an uncontrolled manner within the waste mass. Such a fire would be entirely self-contained and emit very little smoke. A subsurface landfill fire could theoretically damage the landfill's liner system and thus should be considered.

Methane Explosions

Explosive concentrations of methane are generated as the waste degrades anaerobically. Within the landfill itself, the risk of explosion is extremely remote because of the absence of oxygen. However, explosions can occur if methane is allowed to migrate outside the landfill boundaries and collect in enclosed areas such as utility vaults, basements, buildings, etc.

Chemical Reactions

A chemical reaction could occur when non-compatible materials contact each other. For instance, acidic wastes mixed with caustic reagents could result in a chemical reaction. Chemical reactions can result in toxic fumes, vapors, and/or a fire or explosion. The proposed landfill will not accept hazardous wastes; therefore, the risk of a hazardous chemical reaction is very low.

Toxic or Hazardous Material Spills

Toxic or hazardous materials that could potentially be spilled in significant quantities are landfill leachate (including landfill gas condensate), industrial waste, PCB liquids, fuels, and lubricants.

A surface spill of toxic or hazardous materials could endanger water quality and aquatic life if it were to escape the site. A large subsurface release of leachate/condensate could threaten groundwater.

HAZARD PREVENTION

CLI's priority is to prevent hazards from occurring. The following sections describe design and operational procedures that CLI will perform in order to minimize the chance that hazards will occur.

Fires and Explosions

The first defense against fires and explosions is to prevent their occurrence. The second line of defense is an effective response. This section describes procedures to be followed to prevent fires and explosions from occurring. CLI's response to fires and explosions is described in Section 5.

The primary threat of fires result from careless smoking, careless welding or other hot work, improper equipment maintenance, disposal of burning or hot waste loads, and improper landfill gas control system operations. The primary threat of explosions is migration of methane (landfill gas) into an enclosed area. The following sections describe the preventative procedures that are to be enforced to prevent fires and explosions.

Open Flames, Smoking and Hot Work

Open flames, smoking and hot work (e.g. welding, use of a cutting torch, and HDPE fusion/welding) are prohibited at the following locations:

- ☐ Within the waste boundaries where the waste is covered by less than 1 foot of cover soil unless monitoring demonstrates that the atmosphere at the work zone does not contain hazardous levels of combustible gas,
- ☐ Within 10 feet of the landfill gas collection and control system (except flames that are intended as part of the control system), leachate/condensate storage tank(s), leachate sump risers, condensate lift stations, and flammable material storage areas unless monitoring demonstrates that the atmosphere at the work zone does not contain hazardous levels of combustible gas, and
- ☐ Within 20 feet of fuel storage tanks and equipment refueling operations.

Equipment Maintenance

Equipment shall be routinely cleaned to ease identification of leaks and damaged electrical components, and to ensure that oil and other flammable materials do not accumulate on hot engine and exhaust components. Equipment with fuel and/or excessive lubricant leaks is not to be used until repaired. All electrical components shall be properly maintained, well insulated and grounded as appropriate.

Waste Material Fires

Waste material fires are best prevented by not accepting hot or burning waste, and by properly operating the landfill gas collection and control system to prevent uncontrolled aerobic biodegradation of the waste mass.

The facility Operating Plan describes the load inspection procedures that will minimize the chance of accepting waste materials that do not conform to the facility waste acceptance criteria. In addition to load inspection, the equipment operators will be trained to identify reactive wastes that were undetected and allowed to be dumped. Response procedures are provided in Section 5 of this Plan.

A portion of the Chemical Waste Unit will be overlain with municipal solid waste (MSW). An earthen separation layer, as shown on the drawings, will separate the Chemical Waste Unit from the MSW. Although significant quantities of landfill gas will not be generated by the wastes that will be disposed in the Chemical Waste Unit, significant quantities of landfill gas might be generated in any overlying MSW. Therefore, landfill gas collection and controls might be required for this "piggybacked" MSW fill. The landfill gas collection and control system will be routinely monitored for methane, oxygen or nitrogen, and temperature at each active gas extraction wellhead. Elevated oxygen and/or nitrogen levels indicate air intrusion which can result in aerobic biodegradation activity and, therefore, must be properly managed. Proper management typically consists of improving the seals around the gas extraction wells or other cover penetrations, placing additional cover soils, or reducing gas extraction rates within the areas exhibiting high oxygen and/or nitrogen levels. Additional gas extraction wells might be required to provide adequate landfill gas control in areas where individual well extraction rates are lowered to reduce oxygen and/or nitrogen levels.

Methane Explosions

Methane shall be monitored in the subsurface, ambient air, and in onsite buildings as required by the Facility's permits issued by the Illinois Environmental Protection Agency Bureaus of Land and Air. The landfill gas collection and control system shall be expanded as necessary to properly eliminate excessive emissions and subsurface migration. Onsite buildings exhibiting excessive methane shall be properly ventilated to reduce methane levels. Buildings with methane concentrations approaching its lower explosive limit shall immediately be evacuated. Natural gas or propane to such buildings shall be turned off. Electrical power shall also be turned off only if the point at which power is to be switched off if free of explosive gas and vapors.

Chemical Reactions

As detailed in the facility Operating Plan, the facility conducts waste analysis and a pilot waste/reagent compatibility test prior to solidifying new liquid waste streams with a reagent. This testing minimizes the potential for chemical reactions.

Toxic or Hazardous Material Spills

Leachate

Leachate (including landfill gas condensate) spills will be prevented by the following design and/or operational procedures:

- ☐ The leachate storage tank(s) shall be resistant to corrosion and be properly engineered to withstand internal pressures due to the weight of the leachate and external pressures due to wind and snow loads.

- ☐ The leachate storage tank(s) shall include secondary containment designed to contain the full volume of the tank(s) in the event of a primary tank rupture.

- ☐ Below ground leachate/condensate transmission pipes and lift stations shall be constructed of non-corrosive materials (e.g. high density polyethylene), be double-walled, and incorporate leak detection.

- ☐ The tank, piping and lift stations leak detection systems shall be routinely monitored for evidence of leakage. Identified leaks shall be immediately repaired.

- ☐ All leachate transfers from the leachate storage tank(s) into tank trucks shall occur within a concrete spill containment pad. Personnel conducting leachate transfers shall continuously monitor the transfer process and be capable of quickly stopping the transfer in the case of a spill or overfill condition.

- ☐ Landfill slopes shall be routinely inspected for evidence of leachate seeps. Seeps shall immediately be repaired. Impacted soils shall be excavated and disposed in the landfill.

Leachate recirculation in areas with chronic seeps shall be reduced as necessary to prevent additional seeps.

PCB Liquids and Industrial Wastes

PCB liquids and industrial wastes are contained within the waste-hauling vehicles and, therefore, are not likely to be released to the environment unless a waste-hauling vehicle overturns. In order to minimize the risk of this occurring, CLI will properly construct access roads with sufficient width, supporting capacity and grade to provide safe onsite travel. The roads will also be properly maintained to ensure adequate vehicular traction. Furthermore, CLI will establish and enforce an appropriate speed limit.

Fuels and Lubricants

The person performing the refueling shall attend all refueling operations. All maintenance, and most repairs will be conducted within the maintenance building. Lubricants and fuels that must be drained in the field shall be captured and properly disposed.

RESPONSE TO EMERGENCY CONDITIONS

The Emergency Response Coordinator shall be immediately notified in the event of a threatened, or actual emergency condition. The Emergency Response Coordinator shall assess the magnitude of the incident, evaluate the threat to human health and the environment within and outside the facility, and coordinate the response. In coordinating the response, the Emergency Response Coordinator shall identify and summon the appropriate response team. If the response team includes Clinton Landfill, Inc. employees, the Emergency Response Coordinator shall ensure that the employees are properly trained and equipped (e.g. personal protective equipment) to respond to the emergency. In some cases, the only safe response is to evacuate the area.

Fires and Explosions

Response Equipment and Materials

Type A-B-C fire extinguishers shall be located in each onsite building, each piece of heavy equipment, and the Landfill Manager's vehicle. The fire extinguishers shall be properly inspected and maintained.

Communications equipment, such as telephones and/or two-way radios shall be provided in each building that is continuously occupied. Portable communications equipment, such as a cellular telephone and/or two-way radio shall also be provided to the Emergency Response Coordinator, Landfill Manager, and the employee supervising the active face.

As described in the following section, the Clinton Fire Department is to be notified when onsite personnel cannot readily extinguish a fire. The Clinton Fire Department is equipped to transport and store (using portable reservoirs) adequate volumes of water to the site for fire fighting purposes. Their nearest "filling station" is a fire hydrant located at U. S. Route 51 and Kleeman Drive, approximately 1.7 miles north of the facility entrance. The Clinton Fire Department Fire Commissioner has informed CLI that this supply of water is sufficient to fight any reasonably anticipated fires at the facility.

Response to Fires and Explosions

Employees who are properly trained may fight incipient-stage fires using appropriate fire extinguishers, soil, fire blankets, and, when appropriate, water. CLI employees may also build firebreaks, containment berms to prevent spreading of flammable liquids, etc. as safe conditions allow. In no case shall employees risk injury or life fighting a fire.

Careful consideration shall be given to fires involving waste materials. If possible, burning wastes shall be isolated from other wastes, then smothered using soil. Water should be used only as a last resort.

The Emergency Response Coordinator shall request fire-fighting assistance from the Clinton Fire Department under the following conditions:

- ☐ A fire that cannot be easily and thoroughly extinguished by onsite personnel within a few minutes of discovery,
- ☐ A fire that extends, or threatens to extend, offsite,
- ☐ A fire affecting the structural components of a building,
- ☐ An explosion that causes structural damage,
- ☐ A fire or explosion that could possibly reoccur,
- ☐ A fire or explosion of unknown origin,
- ☐ A fire that may expose people to toxic vapors, smoke, fumes, etc., and
- ☐ A fire involving buried waste that cannot be readily exhumed and extinguished.

Chemical Reactions

The first step in controlling a chemical reaction is to segregate the incompatible materials, if this can be done safely. The second step is to cover and/or mix the incompatible materials with soil. Water should not be used by onsite personnel to control chemical reactions.

The Emergency Response Coordinator shall contact the Clinton Fire Department if a chemical reaction occurs that cannot be readily controlled by facility employees, or if fumes, vapor, smoke, etc. from a chemical reaction threatens to migrate beyond the facility boundary.

Toxic or Hazardous Material Spills

Spills of toxic or hazardous materials (including leachate, landfill gas condensate, PCB liquids, industrial waste, fuels, and lubricants) occurring outside the waste boundary shall be responded to as follows:

- ☐ Don appropriate personal protective equipment (PPE),

- ☐ Stop the source of the release (e.g. turn off pumps),
- ☐ Contain the spread of materials using earthen berms, booms, etc.
- ☐ Remove and place the material into containers and properly dispose the leachate,
- ☐ Remove and properly dispose soil that is grossly contaminated (i.e. saturated) with the spilled toxic or hazardous material, and
- ☐ Identify the material that was spilled and estimate the volume that was spilled. Immediately report the spill to the Landfill Director if industrial waste of any quantity was spilled, or if more than 25 gallons of leachate, landfill gas condensate, fuel, or lubricants were spilled. The Landfill Director will notify the proper regulatory agencies within 24 hours of the incident, as required.

In the event of a leak being detected within the leachate storage tank(s), leachate/condensate transmission piping system, or condensate lift station, CLI shall immediately investigate the source of the leak and make the necessary repairs. Leachate released to the environment shall be addressed as indicated above. The Landfill Director is to be immediately notified if leachate or condensate is released to the environment.

The Landfill Director shall assess the spill area and coordinate further remediation as required.

OUTSIDE ASSISTANCE

The following agencies and facilities are available to assist in emergency response.

CLINTON FIRE DEPARTMENT

118 West Washington
Clinton, Illinois
Emergency Telephone No.: 911
Non-Emergency Telephone No.: 935-3159

DEWITT COUNTY SHERIFF

101 West Washington
Clinton, Illinois
Emergency Telephone No.: 911
Non-Emergency Telephone No.: 935-3196

JOHN WARNER HOSPITAL (including ambulance service)

422 West White Street
Clinton, Illinois
Emergency Telephone No.: 911
Non-Emergency Telephone No.: 935-9571

APPENDIX C: INSPECTION AND MAINTENANCE PLAN

FACILITY INSPECTION AND MAINTENANCE PLAN

Clinton Landfill No. 3 – Chemical Waste Unit

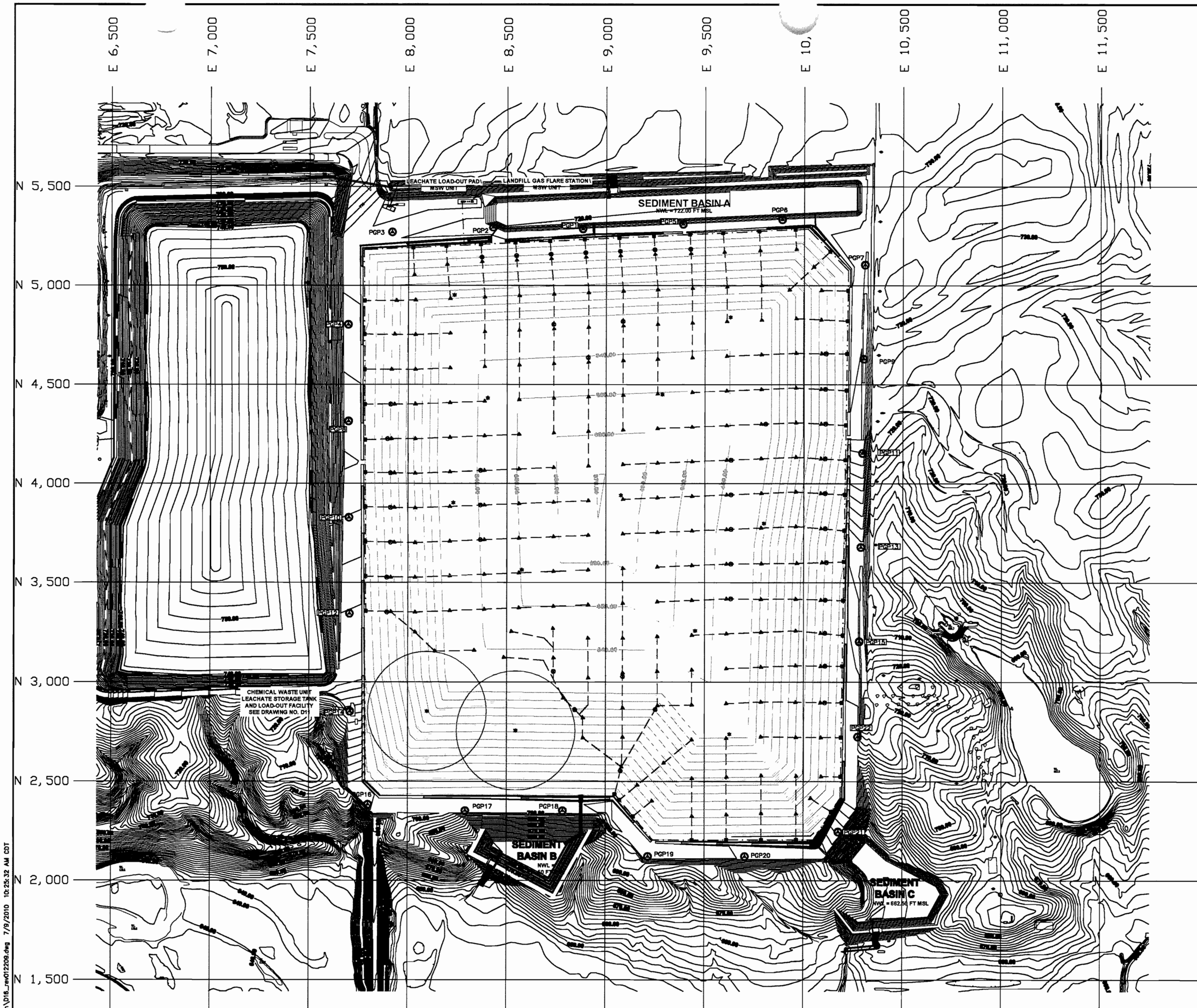
FEATURE	INSPECTION FREQUENCY	ACTIONS
Access Roads		
Entrance gate security	Each operating day	Repair gate as necessary to maintain security
Dust control	Continuously each operating day	Add water or dust suppressant as necessary Sweep / clean paved entrance road
Mud tracking at the entrance	Each operating day	Clean tracked mud and accumulated dust Identify source and remedy as appropriate
Storm Water Management System		
Perimeter ditches and diversion berms	Quarterly and after 2-inch rains	Repair erosion and vegetation Remove accumulated silt
Letdown pipes and culverts	Quarterly and after 2-inch rains	Clear entrance of obstructions Check energy dissipaters
Evidence of leachate contamination	Continuously each operating day	Manage as leachate, remedy source
Sedimentation basin berms	Quarterly and after 2-inch rains	Repair erosion and vegetation Eliminate burrowing animals
Sedimentation basin siltation	Quarterly	Remove silt as necessary to maintain adequate storm water run-off storage
Landfill Cover		
Erosion, rills and gullies	Monthly and after 2-inch rains	Repair erosion extending 4-inches deep
Leachate seeps	Each operating day	Repair as required
Vegetation (final cover)	Monthly and after 2-inch rains	Repair in accordance with Post-Closure Care Plan
Liner Protective Cover		
Minimum 18 inches on sidewall liner prior to waste placement	Prior to waste placement	Add protective soil as required
Proper freeze protection: 3 feet cover/waste on floor 18 inches cover on sidewalls	Each operating day during freezing weather	Add protective cover as required

FACILITY INSPECTION AND MAINTENANCE PLAN

Clinton Landfill No. 3 – Chemical Waste Unit

FEATURE	INSPECTION FREQUENCY	ACTIONS
Leachate/Condensate Management Systems		
Leachate tank and leachate force main leak detection	Weekly	Inspect for leaks
Leachate level in tank	Each operating day	Empty as required
Leachate spills on truck loading containment pad	After each use	Clean pad of spills and drain to tank
Leachate extraction system	Weekly	Volume of leachate extracted
Leachate collection piping system	As necessary	Clean using high-pressure water jets
Leachate extraction pumps	Quarterly	Check proper operation, repair and/or replace as needed to achieve desired performance
Automatic leak detection systems	Annually	Check for proper operation
Groundwater Monitoring Wells		
Check security	Quarterly	Repair as required
Check surface seal	Quarterly	Repair as required
Waste Solidification Area		
Damaged / leaking containers	Each operating day	Repair or replace as necessary
Spilled waste	Each operating day	Remove and dispose in active face
Run-off control berms	Each operating day	Repair as required
Survey Monuments		
Check integrity	Annually	Replace as necessary
Resurvey by Licensed Surveyor	Every 5 years	
Perimeter Security		
Check integrity	Weekly	Repair as necessary

APPENDIX D – DRAWING D16 – LANDFILL GAS MANAGEMENT SYSTEM (revised January 2009)



GRAPHIC SCALE

200' 0 200'

LEGEND

— · · — · · —	APPROXIMATE CLINTON LANDFILL NO.3 FACILITY BOUNDARY
— — —	APPROXIMATE EXISTING PERMITTED CLINTON LANDFILL NO.3 WASTE BOUNDARY
—— 680.00 ——	TOP OF FINAL GRADE CONTOUR
▲	PROPOSED LANDFILL GAS EXTRACTION WELL
●	DRIPLEG
■	GAS HEADER VALVE
▲*	EXTRACTION WELLS ALSO SERVING AS INTERIOR GAS MONITORING WELLS
*	INTERIOR GAS MONITORING WELLS
— — —	PROPOSED LANDFILL GAS HEADER PIPE
— — —	PROPOSED LANDFILL GAS PIPE
PGP6	PROPOSED PERIMETER GAS PROBE

NOTES

1. FINAL GRADES DEVELOPED FROM DRAWING NO. P-LFG1, DATED 6\7\06, FROM SIGNIFICANT MODIFICATION PERMIT APPLICATION LOG NO. 2005-070.
2. FOR CLARITY, NOT ALL SITE FEATURES MAY BE SHOWN.
3. CURRENT TOPOGRAPHY MAY DIFFER FROM THAT SHOWN.
4. THE NEED FOR FLEXIBILITY TO ACCOMMODATE ADJUSTMENTS AND MODIFICATIONS IS ANTICIPATED CONSIDERING THE SIZE, COMPLEXITY, AND LIFE OF THE PROJECT.
5. THE PEAK ELEVATION OF THE LANDFILL IS APPROXIMATELY 871 FEET MSL.
6. STUCTURES TO REMAIN DURING POST-CLOSURE CARE PERIOD: MAINTENANCE BUILDING, LEACHATE LOAD-OUT PAD, LEACHATE STORAGE TANK, AND FLARE STATION
7. ALL RELATED LFG DETAILS ARE SHOWN ON PDC TECHNICAL SERVICES, INC. DRAWINGS P-LFG1 AND P-LFG2, AS APPROVED BY ILLINOIS EPA PERMIT.

REV. NO.	DATE	DESCRIPTION
1	1/22/09	ADDITIONAL GAS MONITORING WELLS WITHIN TSCA UNIT

area Clinton Landfill, Inc.

Shaw® Shaw Environmental, Inc.

CLINTON LANDFILL NO. 3 CHEMICAL WASTE UNIT
DEWITT COUNTY, ILLINOIS

LANDFILL GAS MANAGEMENT SYSTEM

PROJ. NO.:	128017	DATE:	FEBRUARY 2008
DESIGNED BY:	EJD	DRAWING NO.	
DRAWN BY:	TDS	**D16**	
CHECKED BY:	JPV		
APPROVED BY:	DAM	16 OF 21 SHEETS	

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APPENDIX E – GENERAL INFORMATION REGARDING RENTAL LEACHATE STORAGE TANKS AND SECONDARY CONTAINMENT

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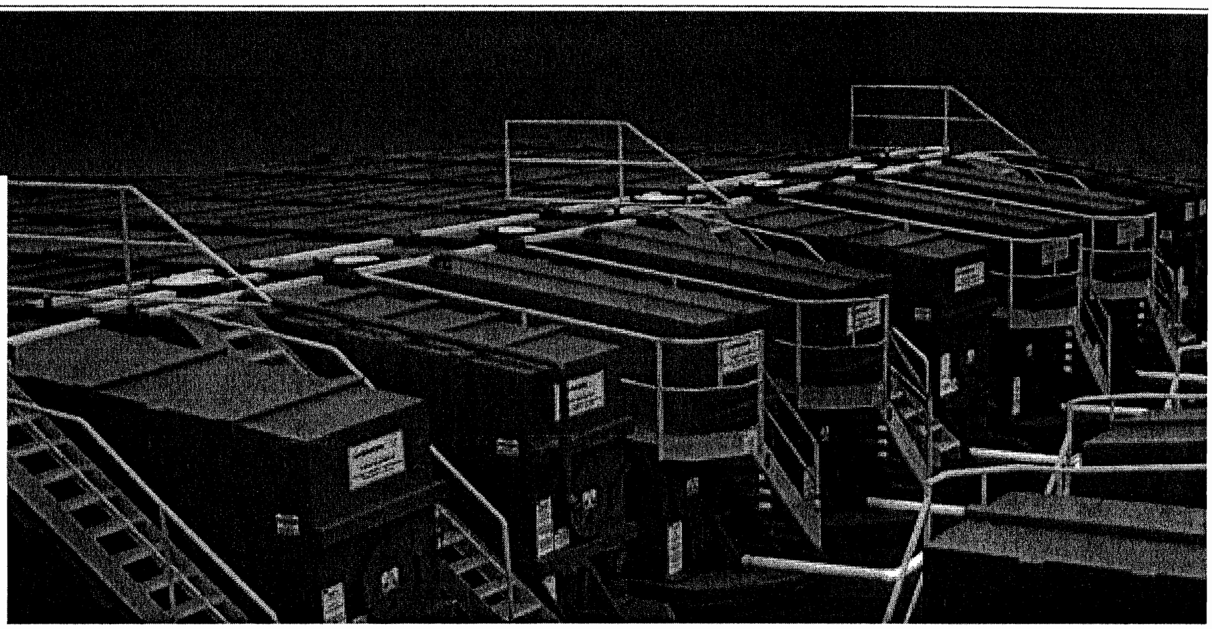
PRODUCTS APPLICATIONS ABOUT NEWS/EVENTS FAQ

CONTACT

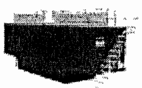
TANKS



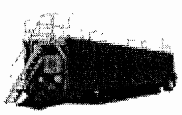
Steel Tanks

Fixed Axle

Safety Vapor



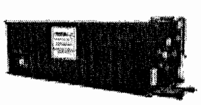
EZ Access



Mix Tank Systems

Open/Closed/Safe Top

Double Wall



10K Roll-off Tank

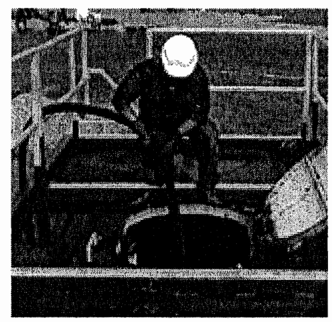
BAKER STEEL TANKS.

Steel tanks from BakerCorp provide flexible liquid containment capacity for large and small projects. With the largest and most diverse selection of steel tanks available in the industry, Baker's application experts know how to match the right steel tank for your specific job requirements. What makes steel tanks from Baker an even better choice is our ability to modify them for your special needs. Replacing nozzles, reconfiguring valves or adding weirs are all examples of the unique value Baker can bring to your projects.

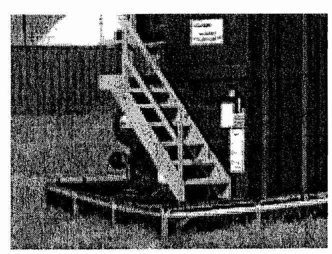
Baker can store up to a million gallons of liquid in portable rental tanks, on the smallest footprint possible. Refineries, chemical plants, municipalities and construction sites have all put BakerCorp steel tanks to use for temporary liquid containment.

THE BAKER ADVANTAGE

- **Unmatched Selection** - From frac tanks to mix tanks, Baker inventories 17 varieties of steel tanks alone. We know how to choose the best tank for your project.
- **Efficient Project Site** - Baker steel tanks require the industry's smallest footprint. Our highly-trained drivers know how to position them for maximum usability.
- **Attention to Detail** - Guardrails, staircases and pressure/vacuum valves are all common on Baker steel tanks.
- **Increased Productivity** - If a steel tank is all your project requires,



EASY CLEANING
Many BakerCorp steel tanks are available with smooth-walled interiors, and "V" or round botton which makes them easier to clea In addition, all steel tanks are equipped with oversized hatches giving you maximum access.



SECONDARY CONTAINMENT BERMS
For projects that require an additional level of spill protection particularly in environmentally

we'll match the best one. If you need a pump, filter or shoring system additionally, BakerCorp is your best choice for a turnkey solution.

sensitive situations, BakerCorp offers secondary containment berms.

PRODUCT DATA SHEET

January, 2007

420 BBL FIXED AXLE DOUBLE WALL TANK (WADE)

GENERAL INFORMATION

All four walls and the rounded bottom of this tank are double-skinned. The open area between the walls (interstitial area) will contain leakage from the primary (inner) wall, should that occur, preventing liquid from leaking to the environment. There are interstitial drains to check for leaks.

WEIGHTS AND MEASURES

» Capacity:	420 BBL @ overflow (17,640 gal.)
» Height:	9'-6" (to top of tank roof steel) 10'-3" (to handrails when folded down) 13'-0" (to handrails in upright position)
» Width:	8'-0"
» Length:	46'-4" (overall)
» Weight:	33,960 lbs.

STRUCTURAL DESIGN

» Outer Floor:	3/16" ASTM A36 carbon steel
» Inner Floor:	1/4" ASTM A36 carbon steel
» Outer Skin: (Sides/ends)	3/16" ASTM A36 carbon steel
» Inner Skin: (sides/ends)	1/4" ASTM A36 carbon steel
» Roof Deck:	1/4" ASTM A36 carbon steel
» Interstitial Framing:	1/4" x 5" x 3" carbon steel channel iron

FEATURES

» Valves:	(2)Front & (1)Rear: 4"- wafer butterfly valve. Cast iron body, Buna-N seat & seals, 316 SS stem, Nylon 11 coated ductile iron disk, with plug and chain.
» Relief Valve:	16 oz./in^2 pressure setting, 0.4 oz./in^2 vacuum setting; Buna-N seal
» Front Drain:	4" flange w/butterfly valve along centerline bottom of floor
» Rear Drain:	4" flange w/butterfly valve along centerline bottom of floor

FEATURES – cont.

» Front Fill Connection:	4" flange w/butterfly valve on passenger side
» Interstitial Drains:	Two (2) – 1" @ bottom center, front and rear of tank with ball valve
» Fill Line:	3" stub at rear driver side on roof top
» Overflow:	3" collar at front driver side
» Manways:	Three (3) – 22" round manways on rear, center and front of roof, made of flat 1/2" flat plate with 5/8" bolts and nuts; 1/2" x 1/2" square Buna-N spliced ring gaskets
» Stairway:	At rear of tank with OSHA handrail
» Guardrails:	Self locking, 1" square tubing on top of tank
» Internal Ladder:	One (1) located below rear hatch, constructed of ¾" round bar
» Level Gauge:	Ball float style, 2-8" 304 SS floats
» Misc. Piping Connections:	One (1) – 4" top vent (blinded) Two (2) – 1" nipples & plugs at top rear into interstitial area
» Tires:	11R x 22.5
» Axles:	22,500 Spicer – Dana D-22

SURFACE DETAILS

» Exterior Coating:	High gloss polyurethane
» Interior Coating:	Chemical resistant lining
» Safety Paint:	Safety yellow – handrails, hatch covers and trip hazard surfaces

TESTS/CERTIFICATIONS

» Test Performed:	3 psi air test; scheduled Level 1, 2 & 3 QMS inspections

BAKERCORP

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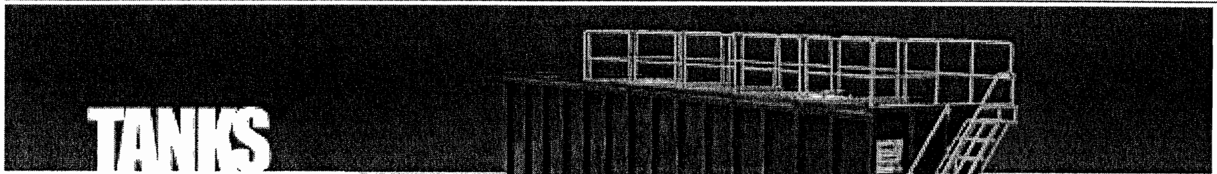
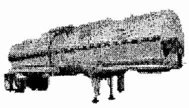
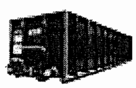


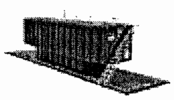
Specialty



Stainless Steel Tanker Trailers

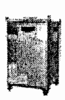


220 Barrel Tanks



Berms - Steel Tank

Berms - Poly Tank



Intermediate Bulk Containers

SECONDARY CONTAINMENT STEEL TANK BERMS

IDEAL USAGE

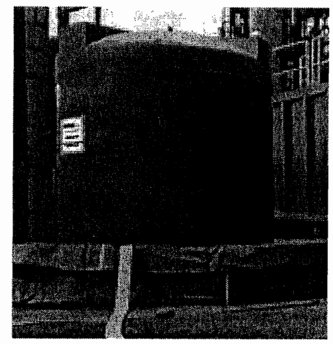
Projects that require an additional level of containment, particularly environmentally sensitive situations.

BENEFIT

Convenient and easy to set up. Excellent chemical compatibility. Sturdy walls on berms easily handle draped hoses.

SPECIFICATIONS AND ADDITIONAL INFO

- Rigid sidewall supports
- Chemical resistant liner material
- Underlayment for liner protection
- Easy to set up
- Smaller sizes available for pump protection
- Collapsible walls provide easy access when required



ON THE JOB

> REQUEST A QUOTE

PRODUCT DATA SHEET

January, 2007

EASY ACCESS TANK

GENERAL INFORMATION

Hinged deck lid sections form a permanent catwalk yet permit visual inspection of all internal surfaces. Lid sections are torsion bar counterbalanced for easy lifting. This style of tank is not vapor tight.

WEIGHTS AND MEASURES

» Capacity:	Standard tank – 500 BBL. (21,000 gal.) Short tank – 475 BBL. (19,950 gal.)
» Height:	Standard – 12'-6" Short – 11'-10"
» Width :	Standard – 8'-0" Short – 8'-0"
» Length:	Standard & Short – 35'-0" (36'-0" including rear ladder or 37'-6" with stairway)
» Weight:	Standard – 21,000 lbs. (approx.) Short – 20,500 lbs. (approx.)

STRUCTURAL DESIGN

» Floor:	¼" thick ASTM A36 carbon steel
» Sides/Ends:	¼" thick ASTM A36 carbon steel
» Roof Deck:	¼" thick ASTM A36 carbon steel
» Wall Frame:	Structural steel channel/angle on interior
» Floor Frame:	6" carbon steel I-beam on exterior side
» Roof Frame:	4" steel channel
» Internal Cross Bracing:	15 – 3"x3"x¼" angle iron

FEATURES

» Valves:	May be fitted with a combination of 4" and 6" butterfly valves.
» Relief Valve:	None
» Front Collar:	4" threaded nipple extension, plugged or capped
» Bottom Sump:	One on each end of tank, either flat bottomed, 12" diameter, 3" deep, or domed, 14" diameter, 4" deep
» Top Access Doors:	4 - 186" x 32" x 1/8" thick steel plate with torsion bars
» Internal Ladder:	1 – 16" wide x 140" long
» Manways:	None
» Roof Access:	Ladder or stairway mounted on rear of tank
» Guardrails:	Around top deck, fold-down, 1" x 1½" tubing
» Level Gauge:	None
» Rear Wheels:	Removable dolly (not a fixed axle)

SURFACE DETAILS

» Exterior Coating:	High Gloss Polyurethane
» Interior Coating:	None

TESTS/CERTIFICATIONS

» Test Performed:	New construction and skin repairs: hydrotest Scheduled: Level I, II & III inspections

BAKERCORP

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APPENDIX F – LETTER FROM PEORIA DISPOSAL COMPANY REGARDING LEACHATE DISPOSAL

Peoria Disposal Company

January 2, 2009

Mr. Ron L. Edwards
Vice President
Clinton Landfill, Inc.
RR #2, Box 216L
Clinton, Illinois 61727

Re: Leachate from the Clinton Landfill No. 3 Chemical Waste Unit

Dear Mr. Edwards:

This confirms that subject to receiving the necessary approval from the Greater Peoria Sanitary District (GPSD), the Peoria Disposal Company Wastewater Treatment Plant (WWTP) would accept leachate from the Clinton Landfill No. 3 Chemical Waste Unit (CWU) for pretreatment prior to discharge to the GPSD publicly owned treatment works. PDC has capacity to pretreat over 100,000 gallons of wastewater per day and 375,000 gallons of available on-site storage. Our influent volume during 2008 was about 12 million gallons.

The WWTP does not discharge effluent regulated by an NPDES permit or 35 Ill. Adm. Code (35 IAC) 309. The WWTP Manager and I are both certified as Industrial Wastewater Treatment Works Operators as required by 35 IAC 312. The WWTP operates by authority of pretreatment discharge permit No. 01-1655 issued by the GPSD and meeting the requirements of 35 IAC 310.

The PDC WWTP currently accepts landfill leachate from a number of other MSW landfills, as well as the PDC #1 RCRA Subtitle C landfill. The PDC #1 RCRA Subtitle C landfill has historically accepted similar types of MGP wastes and PCB wastes as those anticipated to be accepted at the Clinton Landfill No. 3 CWU. Due to our familiarity with the physical and chemical characteristics of the leachate generated by similar landfill operations, we anticipate no difficulties in securing the required approval from the GPSD. Prior to requesting GPSD approval, a waste stream profile form must be completed and a representative sample submitted for analysis.

Our price for treatment of the subject leachate would be about $0.15 per gallon.

If you have any questions or if any additional information is desired, please contact me.

Sincerely,
Peoria Disposal Company

Ronald J. Welk
Facility Director

c: George L. Armstrong

P.O. Box 9071
Peoria, IL 61612-9071
(309) 688-0760

100% recycled paper

4700 N. Sterling Ave.
Peoria, IL 61615-3647
Fax: (309) 688-0881

APPENDIX G – LEACHATE TRANSPORTATION AND DISPOSAL UNIT COST ESTIMATE

PDC Technical Services, Inc.

Project: Clinton Landfill No. 3 Chemical Waste Unit   Computed By: G.L. Armstrong

Project No: 91-0118.31   Task No.: 42000   Checked By: ______   Date: 1-21-09

UNIT COST ESTIMATE - CWU LEACHATE TRANSPORTATION AND DISPOSAL

Assumptions:

1. Leachate is transported to Peoria Disposal Company commercial wastewater treatment facility for treatment and discharge to Greater Peoria Sanitary District sanitary sewer system.
2. Leachate is transported using 5,000 gallon tanker truck based at Peoria Disposal Company's Peoria Terminal (Swords Avenue).

	Hours
Drive from terminal to Chemical Waste Unit:	1.50
Tanker loading:	1.00
Drive from CWU to PDC WWTF:	1.50
Tanker offloading:	1.00
Drive from PDC WWTF to terminal:	0.25
TOTAL:	5.25

Hourly Truck Rate: $100

Total Cost per Load: $525.00

Tanker Capacity: 5,000 gallons

Transportation Cost per Gallon: **$0.11**

Treatment and Disposal Cost per Gallon: **$0.15** (from 1-2-2009 letter from PDC)

TOTAL COST PER GALLON: **$0.26**

APPENDIX H – REVISED CLOSURE / POST-CLOSURE CARE COST ESTIMATES

CLOSURE COST ESTIMATES
CLINTON LANDFILL NO. 3
January 2009

	PREMATURE CLOSURE	ROUTINE CLOSURE
CLOSURE ACTIVITIES		
MSW and CWU Landfill Units	$3,828,720	$4,243,641
Rail Off-Loading Facility	$115,315	$115,315
Waste Processing Facility	$49,411	$49,411
POST CLOSURE CARE	$4,549,092	$6,629,763
TOTALS:	$8,542,538	$11,038,130

CLOSURE COST ESTIMATES - LANDFILL UNITS
CLINTON LANDFILL NO. 3

WORK ACTIVITY	UNITS	UNIT COST	PREMATURE CLOSURE						ROUTINE CLOSURE	
			MSW UNIT		CHEMICAL WASTE UNIT		TOTAL			
			NO. OF UNITS	COST	NO. OF UNITS	COST	NO. OF UNITS	COST	NO. OF UNITS	COST
Landfill Operations Decommissioning										
Equipment Decontamination	*lump sum*	$400	1	$400	1	$400	2	$800	1	$400
Equipment Demobilization	*lump sum*	$400	1	$400	1	$400	2	$800	1	$400
Scales Removal	*lump sum*	$1,500	1	$1,500	0	$0	1	$1,500	1	$1,500
				$2,300		$800		$3,100		$2,300
Gas Collection System										
Mob/Demob	*lump sum*	$5,500	1	$5,500	0	$0	1	$5,500	1	$5,500
Extraction Wells	*each*	$4,000	14	$56,000	0	$0	14	$56,000	80	$320,000
Piping	*lin. ft.*	$9.00	10,000	$90,000	0	$0	10,000	$90,000	17,000	$153,000
Condensate Lift Stations	*each*	$10,000	2	$20,000	0	$0	2	$20,000	2	$20,000
Driplegs	*each*	$1,000	5	$5,000	0	$0	5	$5,000	20	$20,000
Flare Station	*each*	$100,000	1	$100,000	0	$0	1	$100,000	1	$100,000
Perimeter Monitoring Wells	*each*	$1,000	6	$6,000	0	$0	6	$6,000	0	$0
				$282,500		$0		$282,500		$618,500
Final Cover Barrier Soil										
Mob/Demob	*lump sum*	$14,000	1	$14,000	1	$14,000	2	$28,000	1	$14,000
Intermediate Cover / Foundation	*cubic yards*	$2.20	66,000	$145,200	20,000	$44,000	86,000	$189,200	90,500	$199,100
Compacted Soil Cover Placement	*cubic yards*	$2.20	66,000	$145,200	20,000	$44,000	86,000	$189,200	90,500	$199,100
				$304,400		$102,000		$406,400		$412,200
Geomembrane & Drainage Layer										
Mob/Demob	*lump sum*	$4,900	1	$4,900	1	$4,900	2	$9,800	1	$4,900
Subgrade Preparation	*days*	$1,500	9	$13,500	5	$7,500	14	$21,000	11	$16,500
Smooth Geomembrane Material & Installation	*square feet*	$0.305	0	$0	0	$0	0	$0	800,000	$244,000
Textured Geomembrane Material & Installation	*square feet*	$0.420	1,950,000	$819,000	535,000	$224,700	2,485,000	$1,043,700	1,900,000	$798,000
Geonet Material and Installation	*square feet*	$0.240	1,950,000	$468,000	535,000	$128,400	2,485,000	$596,400	2,700,000	$648,000
Geotextile Material and Installation	*square feet*	$0.120	1,950,000	$234,000	535,000	$64,200	2,485,000	$298,200	2,700,000	$324,000
				$1,539,400		$429,700		$1,969,100		$2,035,400
Vegetative Cover										
Mob/Demob (included above)	*lump sum*	$0	1	$0	1	$0	2	$0	1	$0
Place Cover Soil	*cubic yards*	$2.20	217,000	$477,400	60,000	$132,000	277,000	$609,400	300,000	$660,000
Seed and Mulch	*1k sq. ft.*	$24.00	1,950	$46,800	600	$14,400	2,550	$61,200	2,700	$64,800
				$524,200		$146,400		$670,600		$724,800
Surface Water Management										
Earthwork for proper drainage	*cubic yards*	$2.20	10,000	$22,000	10,000	$22,000	20,000	$44,000	0	$0
Lift Station upgrades	*lump sum*	$10,000	1	$10,000	1	$10,000	2	$20,000	0	$0
Temporary Silt Fences, etc.	*lump sum*	$1,000	4	$4,000	4	$4,000	8	$8,000	5	$5,000
Letdown Pipe	*lin. Ft.*	$18.75	2500	$46,875	1500	$28,125	4000	$75,000	3550	$66,563
Fabric-Formed Concrete	*sq. ft.*	$4.50	5600	$25,200	3200	$14,400	8800	$39,600	4800	$21,600
Energy Dissipaters	*each*	$3,300	7	$23,100	4	$13,200	11	$36,300	6	$19,800
				$131,175		$91,725		$222,900		$112,963
Solidification Unit	*lump sum*	$2,000	1	$2,000		$0	1	$2,000	1	$2,000
CQA Activities										
Geomembrane Inspections	*days*	$500	11	$5,500	3	$1,500	14	$7,000	15	$7,500
Geomembrane Testing	*lump sum*	$1,000	4	$4,000	1	$1,000	5	$5,000	5	$5,000
Geonet / Geotextile Inspections	*days*	$500	3	$1,500	2	$1,000	5	$2,500	4	$2,000
LFG System Inspections	*days*	$500	0	$0	0	$0	0	$0	80	$40,000
Barrier Soil Inspections	*days*	$500	29	$14,500	8	$4,000	37	$18,500	40	$20,000
Barrier Soil Lab Testing	*lump sum*	$1,000	4	$4,000	1	$1,000	5	$5,000	5	$5,000
Veg. Soil Cover Inspect.	*days*	$500	20	$10,000	6	$3,000	26	$13,000	28	$14,000
Veg. Soil Cover Lab Testing	*lump sum*	$1,000	4	$4,000	1	$1,000	5	$5,000	5	$5,000
Veg. Soil Cover Surveys	*days*	$1,000	2	$2,000	2	$2,000	4	$4,000	2	$2,000
Barrier Soil Surveys	*days*	$1,000	2	$2,000	2	$2,000	4	$4,000	2	$2,000
PE Oversight	*hours*	$90	95	$8,550	25	$2,250	120	$10,800	260	$23,400
CQA Report	*lump sum*	$2,500	1	$2,500	1	$2,500	2	$5,000	1	$2,500
				$58,550		$21,250		$79,800		$128,400
Legal & Administrative	*lump sum*	$5,000	1	$5,000	1	$5,000	2	$10,000	1	$5,000
Contingency		5.00%		$142,476		$39,844		$182,320		$202,078
				$2,992,001		$836,719		$3,828,720		$4,243,641

CLINTON LANDFILL NO. 3 RAIL OFF-LOADING FACILITY
CLOSURE COST ESTIMATE

February 11, 2008

WORK ACTIVITY	UNITS	UNIT COST	RAIL OFF-LOADING FACILITY	
			NO. OF UNITS	COST
Collect, Transport & Dispose Waste	tons	$50.00	100	$5,000
Gondola Car Off-Loading Area				
Equipment & Structure Decontamination	*days*	$1,000.00	3	$3,000
Demobilize Excavators	*each*	$500.00	2	$1,000
Structure, Platform and Ramp Demolition	*days*	$2,000.00	3	$6,000
Remove, Transport & Dispose Demolition Debris	*tons*	$50.00	300	$15,000
Remove Rails	*days*	$1,500.00	1	$1,500
Remove, Transport & Dispose Rail Ties	*tons*	$50.00	40	$2,000
Remove, Transport & Dispose Gravel	*tons*	$50.00	1150	$57,500
Backfill and Grade to Drain	*cubic yards*	$2.20	500	$1,100
Seed and Mulch	*1k sq. ft.*	$24.00	12	$288
Collect Rock / Soil Samples	*day*	$800.00	0.5	$400
VOCs Analyses	*each*	$158.40	8	$1,267
Metals Analyses (Total Conc. & TCLP)	*each*	$233.20	8	$1,866
PCB Analyses	*each*	$88.00	8	$704
PNAs Analyses	*each*	$149.60	8	$1,197
				$92,822
Intermodal Container Off-Loading Area				
Demobilize Container Handler	*each*	$500.00	1	$500
Remove Rails	*days*	$1,500.00	0.5	$750
Remove, Transport & Dispose Rail Ties	*tons*	$50.00	10	$500
Backfill and Grade to Drain	*cubic yards*	$2.20	60	$132
Seed and Mulch	*1k sq. ft.*	$24.00	5	$120
				$2,002
P.E. Oversight				
Onsite Observations and Reviews	*days*	$800.00	10	$8,000
Closure Report and Certification	*lump sum*	$2,000.00	1	$2,000
				$10,000
Contingency		5.00%		$5,491
			TOTAL:	**$115,315**

CLINTON LANDFILL NO. 3 WASTE PROCESSING FACILITY
CLOSURE COST ESTIMATE

December 14, 2007

WORK ACTIVITY	UNITS	UNIT COST	WASTE PROCESSING FACILITY	
			NO. OF UNITS	COST
Remove, Transport & Dispose Wastes				
Solid Wastes	*tons*	$50.00	150	$7,500
Liquid Waste Disposal Permitting	*lump sum*	$5,000	1	$5,000
Liquid Waste Transportation and Treatment	*gallons*	$0.169	12,000	$2,028
				$14,528
Waste Processing Building				
Contractor Mobilization	*lump sum*	$5,000.00	1	$5,000
Equipment, Tanks & Structure Decontamination	*days*	$1,000.00	3	$3,000
Demobilize Excavator	*each*	$500.00	1	$500
Building Demolition	*days*	$2,000.00	3	$6,000
Remove, Transport & Dispose Demolition Debris	*tons*	$50.00	100	$5,000
Remove, Transport & Dispose Contaminated Gravel	*tons*	$50.00	120	$6,000
Backfill and Grade to Drain	*cubic yards*	$2.20	250	$550
Seed and Mulch	*1k sq. ft.*	$24.00	20	$480
				$26,530
P.E. Oversight				
Onsite Observations and Reviews	*days*	$800.00	5	$4,000
Closure Report and Certification	*lump sum*	$2,000.00	1	$2,000
				$6,000
Contingency		5.00%		$2,353
			TOTAL:	**$49,411**

POST-CLOSURE CARE COST ESTIMATES
CLINTON LANDFILL NO. 3

				PREMATURE CLOSURE									ROUTINE CLOSURE		
				MSW UNIT			CHEMICAL WASTE UNIT			TOTAL					
ACTIVITY	UNIT	COST	FREQUENCY	UNITS / EVENT	NO. EVENTS	TOTAL COST	UNITS / EVENT	NO. EVENTS	TOTAL COST	UNITS / EVENT	NO. EVENTS	TOTAL COST	UNITS / EVENT	NO. EVENTS	TOTAL COST
Routine Inspections															
Years 1 - 5:															
Labor:	$45	*per hour*	*quarterly*	6	20	$5,400	2	20	$1,800	8	20	$7,200	24	20	$21,600
Equip. / Misc.:	$50	*per event*	*quarterly*	1	20	$1,000	1	20	$1,000	2	20	$2,000	1	20	$1,000
Years 5 - 30:															
Labor:	$45	*per hour*	*annual*	6	25	$6,750	2	25	$2,250	8	25	$9,000	24	25	$27,000
Equip. / Misc.:	$50	*per event*	*annual*	1	25	$1,250	1	25	$1,250	2	25	$2,500	1	25	$1,250
						$14,400			$6,300			$20,700			$50,850
Cover Maintenance															
Years 1 - 5:															
Equipment Mob/Demob	$850	*lump sum*	*annual*	1	5	$4,250	0	5	$0	1	5	$4,250	1	5	$4,250
Erosion / Settlement Repair	$2.20	*per cubic yd.*	*annual*	7,250	5	$79,750	1,950	5	$21,450	9,200	5	$101,200	25,750	5	$283,250
Vegetation Repair:	$24.00	*per 1k sq. ft.*	*annual*	196	5	$23,520	52	5	$6,240	248	5	$29,760	695	5	$83,400
Mowing	$25	*per acre*	*annual*	45	5	$5,625	12	5	$1,500	57	5	$7,125	160	5	$20,000
Years 5 - 30:															
Equipment Mob/Demob	$850	*lump sum*	*every 5 years*	1	5	$4,250	1	5	$4,250	2	5	$8,500	1	5	$4,250
Erosion / Settlement Repair	$2.20	*per cubic yd*	*every 5 years*	7,250	5	$79,750	1,950	5	$21,450	9,200	5	$101,200	26,000	5	$286,000
Vegetation Repair:	$24.00	*per 1k sq. ft.*	*annual*	20	25	$12,000	6	25	$3,600	26	25	$15,600	70	25	$42,000
Mowing	$25	*per acre*	*annual*	45	25	$28,125	12	25	$7,500	57	25	$35,625	160	25	$100,000
						$237,270			$65,990			$303,260			$823,150
Leachate Collection, Recirculation and Disposal															
System Maintenance Labor:	$45	*per hour*	*quarterly*	6	120	$32,400	1	120	$5,400	7	120	$37,800	24	120	$129,600
Pump Removal / Cleaning:	$45	*per hour*	*annual*	12	30	$16,200	2	30	$2,700	14	30	$18,900	48	30	$64,800
Electrical Power	$250	*per year*	*continuous*	3	30	$22,500	1	30	$7,500	4	30	$30,000	12	30	$90,000
Pipe Clean-out:	$1,000	*per event*	*every 5 years*	3	6	$18,000	1	6	$6,000	4	6	$24,000	12	6	$72,000
Leachate Tank Replacement:	$50,000	*per event*	*once*	1	1	$50,000	1	1	$50,000	2	1	$100,000	1	1	$50,000
MSW Unit Leachate Trans.& Disposal	$0.07	*gallon*	*continuous*	50,000	30	$105,000	0	30	$0	50,000	30	$105,000	200,000	30	$420,000
CWU Leachate Trans.& Disposal	$0.26	*gallon*	*continuous*	0	30	$0	280	30	$2,184	280	30	$2,184	560	30	$4,368
						$244,100			$73,784			$317,884			$830,768
Groundwater Monitoring															
Field Labor:	$45	*per hour*	*quarterly*	36	120	$194,400	27	120	$145,800	63	60	$170,100	76	120	$410,400
Field Equip. and Supplies:	$200	*per event*	*quarterly*	3	120	$72,000	2	120	$48,000	5	60	$60,000	7	120	$168,000
MSW Unit Routine Analytical (G1):	$145	*per sample*	*quarterly*	36	120	$626,400	0	0	$0	36	120	$626,400	49	120	$852,600
MSW Unit Annual Analytical (G2):	$295	*per sample*	*semi-annual*	36	60	$637,200	0	0	$0	36	60	$637,200	49	60	$867,300
CWU Routine Analytical (G1):	$145	*per sample*	*quarterly*	0	0	$0	27	120	$469,800	27	120	$469,800	27	120	$469,800
CWU Annual Analytical (G2):	$630	*per sample*	*semi-annual*	0	0	$0	27	60	$1,020,600	27	60	$1,020,600	27	60	$1,020,600
						$1,530,000			$1,684,200			$2,984,100			$3,788,700
Leachate Monitoring															
Field Labor:	$45	*per hour*	*semi-annual*	1	60	$2,700	1	60	$2,700	2	60	$5,400	4	60	$10,800
Field Equip. and Supplies:	$50	*per event*	*semi-annual*	1	60	$3,000	1	60	$3,000	2	60	$6,000	1	60	$3,000
Semi-Annual Analytical (L1):	$1,255	*per sample*	*semi-annual*	1	60	$75,300	1	60	$75,300	2	60	$150,600	4	60	$301,200
Annual Analytical (L2):	$835	*per sample*	*annual*	1	30	$25,050	1	30	$25,050	2	30	$50,100	2	30	$50,100
						$106,050			$106,050			$212,100			$365,100
LFG Management System Ops.															
Flare Station/Wellfield Operations	$250	*day*	*monthly*	1	360	$90,000	0	360	$0	1	360	$90,000	2.5	360	$225,000
System Maintenance	$100	*event*	*annual*	3	30	$9,000	0	30	$0	3	30	$9,000	3	30	$9,000
Condensation Transportation & Disposal	$0.07	*gallon*	*continuous*	500	30	$1,050	0	30	$0	500	30	$1,050	5000	30	$10,500
Electricity	$1,000	*per year*	*annual*	1	30	$30,000	0	30	$0	1	30	$30,000	1	30	$30,000
Clean Collection Piping	$1,000	*per day*	*every 5 years*	3	6	$18,000	0	6	$0	3	6	$18,000	12	6	$72,000
Remove Equipment	$1,500	*lump sum*	*at end*	1	1	$1,500	0	1	$0	1	1	$1,500	1	1	$1,500
Plug Wells and Remove Equipment	$200	*per well*	*at end*	55	1	$11,000	0	1	$0	55	1	$11,000	228	1	$45,600
						$160,550			$0			$160,550			$393,600
Landfill Gas Monitoring															
Years 1 - 5:															
Labor:	$45	*per hour*	*annual*	8	5	$1,800	2	5	$450	10	5	$2,250	30	5	$6,750
Equip. / Misc.:	$100	*per event*	*annual*	1	5	$500	1	5	$500	2	5	$1,000	3	5	$1,500
Years 5 - 30:															
Labor:	$45	*per hour*	*annual*	8	25	$9,000	2	25	$2,250	10	25	$11,250	30	25	$33,750
Equip. / Misc.:	$100	*per event*	*annual*	1	25	$2,500	1	25	$2,500	2	25	$5,000	3	25	$7,500
						$13,800			$5,700			$19,500			$49,500
Surface Water Lift Station O&M															
Labor - annual maintenance:	$500	*per day*	*annual*	1	30	$15,000	1	30	$15,000	2	30	$30,000	0	30	$0
Equipment and supplies:	$1,000	*per year*	*annual*	1	30	$30,000	1	30	$30,000	2	30	$60,000	0	30	$0
Electrical Power:	$2,500	*per year*	*annual*	1	30	$75,000	1	30	$75,000	2	30	$150,000	0	30	$0
						$120,000			$120,000			$240,000			$0
Security	$1,000	*per event*	*every 5 yrs.*	1	6	$6,000	1	6	$6,000	2	6	$12,000	1	6	$6,000
						$6,000			$6,000			$12,000			$6,000
Data Eval. & Closure Certification															
Routine Data Eval.:	$45	per hour	quarterly	4	120	$21,600	4	120	$21,600	8	120	$43,200	16	120	$86,400
Annual Reports	$2,000	per year	annual	1	30	$60,000	1	30	$60,000	2	30	$120,000	1	30	$60,000
Annual Data Review:	$90	per hour	annual	4	30	$10,800	4	30	$10,800	8	30	$21,600	16	30	$43,200
Closure Certification:	$2,500	per event	once	1	1	$2,500	1	1	$2,500	2	1	$5,000	1	1	$2,500
						$94,900			$94,900			$189,800			$192,100
Contingency	2.00%					$50,541			$43,258			$89,198			$129,995
					TOTAL:	$2,577,611		TOTAL:	$2,206,182		TOTAL:	$4,549,092		TOTAL:	$6,629,763

APPENDIX I – UPDATED LEACHATE AND GROUNDWATER ANALYTICAL COSTS

PDC Laboratories, Inc.
P.O. Box 9071 • Peoria, IL 61612-9071
(309) 692-9688 • (800) 752-6651 • FAX (309) 692-9689

ACCREDITED IN ACCORDANCE WITH nelac

January 20, 2009

Mr. George Armstrong
Peoria Disposal Company
PO Box 9071
Peoria, IL 61612-9071

Re: Clinton Landfill #3 – Analytical Costs

Dear Mr. Armstrong:

Unit costs for Clinton County Landfill #3 are:

G1 list (quarterly)	$ 144.55/well
G1/G2 lists (annual)	$ 438.55/well
CWU G2/G1	$ 772.45/well
L1 list (semi-annual)	$ 1253.00/well
L2 list (annual composite)	$ 833.70/well

These are usual and customary competitive prices for permitted requirements only. Not included are sampling costs or any non-routine analyses.

Please contact me with any questions and/or requests for additional information.

Sincerely,

PDC Laboratories, Inc.

Lisa Yerby Grant

Lisa Yerby Grant
Project Manager

APPENDIX J – REVISED APPLICATION PAGES 4 AND 5

- Landscape wastes, and
- Lead-acid batteries.

RCRA – empty drums will only be accepted as long as they are either intact with one end open, or crushed with both ends open. Drums containing waste will only be accepted in bulk shipment containers with all drums open and available for inspection. Non-special wastes will not be accepted in drums unless the drums are intact with one end open.

812.108.1 Maximum Capacity and Rate At Which Waste Will Be Placed

Gross airspace, inclusive of daily cover, intermediate cover and the separation layer between the CWU and MSW Unit; and exclusive of sidewall liner protective soil and the leachate sand drainage layer, is as follows:

LANDFILL UNIT	GROSS AIRSPACE (airspace cubic yards)
Municipal Solid Waste Unit	29,259,566
Chemical Waste Unit	2,529,506
TOTAL:	**31,789,072**

Waste volume calculations are provided with the Design Report in Attachment 2 of this application.

CLI anticipates that it will receive, on average, approximately 1,420,000 gate cubic yards of waste for disposal in the MSW Unit and 83,300 gate cubic yards of waste for disposal in the CWU each year.

812.108.2 Manner in Which Waste Will Be Placed And Compacted

Details of the manner in which waste will be placed and compacted to ensure compliance with 35 Ill. Adm. Code Part 811.105 are provided in the Operating Plan (Section 812.318 of this application).

812.108.3 Unit Weight of Waste

<u>Chemical Waste Unit</u>

Based on historical data from Clinton Landfill No. 2 and other landfills, CLI estimates that the unit weights of waste that will disposed in the CWU will average:

- 1,800 pounds per gate cubic yard (as received), and

- 2,000 pounds per airspace cubic yard (in-place).

Municipal Solid Waste Unit

Based on historical data from Clinton Landfill No. 2, CLI estimates that the unit weights of waste that will disposed in the MSW Unit will average:

- 600 pounds per gate cubic yard (as received), and
- 1,200 pounds per airspace cubic yard (in-place).

812.108.4 Length of Time Each Unit Will Receive Waste and Design Period

Chemical Waste Unit

Based upon receiving, on average, 83,300 gate cubic yards of waste per year, at 1,800 pounds per gate cubic yard, CLI estimates that the Clinton Landfill No. 3 CWU will receive about 75,000 tons of waste per year on average. At 2,000 pounds of waste per airspace cubic yard, CLI expects to consume approximately 75,000 airspace cubic yards (ascy) each year (on average). Therefore, the length of time the Clinton Landfill No. 3 CWU is expected to receive waste, i.e. its Operating Period, is calculated as follows:

CWU Operating Period (years) = 2,529,506 ascy ÷ 75,000 ascy/year = 34 years

The Design Period is defined as the Operating Period plus the Post-Closure Care Period. The Post-Closure Care Period for Clinton Landfill No. 3 will be 30 years. Therefore, the CWU Design Period is 64 years (34 + 30).

Municipal Solid Waste Unit

Based upon receiving, on average, 1,420,000 gate cubic yards of waste per year, at 600 pounds per gate cubic yard, CLI estimates that the Clinton Landfill No. 3 MSW Unit will receive about 426,000 tons of waste per year on average. At 1,200 pounds (0.6 tons) of waste per airspace cubic yard, CLI expects to consume approximately 710,000 ascy each year (on average). Therefore, the length of time Clinton Landfill No. 3 MSW Unit is expected to receive waste, i.e. its Operating Period, is calculated as follows:

MSW Unit Operating Period (years) = 29,259,566 ascys ÷ 710,000 ascys/year = 41 years