ONONDAGA LAKE PRE-DESIGN INVESTIGATION: PHASE III WORK PLAN - ADDENDUM 1 GEOTEXTILE TUBE EVALUATION – BENCH-SCALE TESTING

Syracuse, New York

Prepared For:

Honeywell
5000 Brittonfield Parkway
Suite 700
East Syracuse, NY 13057

Prepared By:

PARSONS

290 Elwood Davis Road, Suite 312
Liverpool, New York 13088
Phone: (315) 451-9560
Fax: (315) 451-9570

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1.0 INTRODUCTION

This addendum describes the samples to be collected and preliminary bench-scale testing to be performed for the sediment consolidation area (SCA) geotextile tube evaluation. This work will be conducted during the Phase III field program. Since the scope was not identified in the Onondaga Lake Phase III Pre-Design Investigation (PDI) Work Plan, the sample locations and details of the analyses to be performed are described in this document. Unless stated otherwise, the samples for the analyses identified above will be collected in accordance with the bulk sediment and water sampling procedures outlined in the Phase I PDI Work Plan (Parsons, 2005).

First, the objectives of this Phase III Work Plan Addendum will be presented, followed by general information related to the implementation of Phase III field activities. Next, details regarding the collection and preparation of the sediment samples will be provided. Finally, the bench-scale testing and data management and reporting will be described.

2.0 OBJECTIVES

The purpose of the Phase III PDI is to collect information required to conduct remedial design activities. The tasks discussed in this work plan addendum focus on collecting and testing sediment and water from Onondaga Lake to evaluate the potential use of geotextile tubes for dewatering sediment at the SCA.

The specific objectives for the bench-scale tests described herein are as follows:

- To evaluate, using bench-scale testing including jar tests, the potential use of polymers to enhance sediment dewatering.
- To evaluate the geotextile tube dewatering characteristics of representative sediment samples from SMUs 1 and 6 (both with and without polymer) using bag tests.

The specific tasks required to meet these objectives are described in Sections 4 and 5.

3.0 MOBILIZATION AND LOGISTICS

The scope of work covered in this addendum includes the bulk sampling of sediment and surface water. This section covers the mobilization and logistics to support the field tasks outlined in this addendum.

3.1 Health and Safety

Parsons ranks health and safety as the highest priority. A copy of the Project Safety Plan (PSP) is presented in Appendix C of the Phase I PDI Work Plan (Parsons, 2005) with an update provided in Appendix A of the Phase III PDI Work Plan. The PSP will be strictly followed by personnel. Copies of the plan will be maintained at the support zone and on each vessel.

3.2 Site Facilities

Support zone and facilities were established during the Phase I PDI near existing permanent structures at the west end of Wastebed B. These facilities will be utilized to support the Phase III PDI activities including those covered in this addendum.

3.3 Decontamination and Waste Handling

Decontamination will be conducted at the decontamination area established during Phase I and on the various barges and vessels. The decontamination and waste disposal procedures will be conducted in accordance with the Phase I PDI Work Plan (Parsons, 2005).

4.0 SAMPLE COLLECTION, PREPARATION, AND INITIAL TESTING

Based on estimates contained in the Onondaga Lake ROD (NYSDEC and USEPA, 2005), the majority of sediments to be dredged are from SMUs 1 and 6 (i.e., approximately 65% from SMU 1 and 10% from SMU 6). The Phase I and II data from index testing and Column Settling Tests (CSTs) show that there are differences in physical characteristics within each of these SMUs, and these differences appear to have significant impact on settling and self-weight consolidation behavior. Therefore, for comparison purposes, it is proposed that samples are collected from Phase II CST locations as follows:

- Three locations within the west side of SMU 1 (ILWD Area A locations OL-STA-10114 through OL-STA-10116), as shown on Figure 1. If access to OL-STA-10116 is limited because of water depth, the sample will be collected as close as practical to this location. Based on previous investigations, samples from these areas tend to contain NAPL; therefore, during sample collection, the objective will be to collect a representative NAPL-containing Solvay waste sample. The sample will be identified as NAPL-containing based on a visual evaluation.

- Three locations within the east side of SMU 1 (ILWD Area B locations OL-STA-10117 through OL-STA-10119), as shown on Figure 1. Although NAPL is present in this area of SMU 1, it typically is not as prevalent as in ILWD Area A; therefore, the objective in this area will be to collect a representative non-NAPL containing Solvay waste sample. The sample will be identified as non-NAPL-containing based on a visual evaluation.

- One location within the southern portion of SMU 6 (OL-STA-60098), as shown on Figure 2. The objective is to collect a black silt within a 25-ft radius of this previous sample location.

- One location within the northern portion of SMU 6 (OL-STA-60100), as shown on Figure 2. It is uncertain whether both black silt and marl or just black silt or just marl are present within the top 1 m (i.e., the proposed dredge cut) at this location. Therefore, since the objective is to test a sample that is representative of the material to be dredged, we propose testing the material collected within the top 1 m regardless of whether it is black silt, marl, or a combination thereof.

Sediment from each of these locations will be collected from either the 0-1 m (0-3.3 ft) depth or the 0-2 m (0-6.5 ft) depth, as indicated in Table 1. The required sample quantity from each location is also provided in Table 1. During the sample collection process, if field personnel note that different material than anticipated is being collected, these deviations will be discussed with NYSDEC. In addition, the material types and presence of NAPL in the samples will be reported in the field notes.

Following sample collection, representative samples from each location (i.e., six within SMU 1 and two within SMU 6) will be sent to GeoTesting Express in Boxborough, MA for index testing including moisture content (ASTM D2216), grain-size analysis with hydrometer (ASTM D422), Atterberg limits (ASTM D4318), and specific gravity (ASTM D854). The SMU 6 samples will also undergo organic content testing (ASTM D2974).

In addition to the sediment, approximately 600 gallons of lake water will be collected to prepare the 10% solids by weight slurry. All samples will be collected in accordance with the Phase I PDI Work Plan (Parsons, 2005). Due to the water volume requirements, all lake water will be collected offshore of the PDI site trailers directly into sample containers placed onshore for shipment to the laboratory. From the 600 gallons, a representative water sample will be sent to Severn Trent Laboratories for analytical testing. The proposed analytical testing is summarized in Table 2. All sample analysis will be performed in accordance with the procedures outlined in the Phase I PDI WP (Parsons, 2005).

The results of the geotechnical analyses described above will be discussed with NYSDEC prior to compositing of samples for bench-scale testing. As indicated in Table 1, it is currently anticipated that the samples collected from the three locations within ILWD Area A will be used to prepare a composite sample. Similarly, the samples collected from the three locations within ILWD Area B will be used to prepare a composite sample. Thus, after compositing, there will be four samples (two from SMU 1 and two from SMU 6) for bench-scale testing. The results from the initial index testing will be used to confirm that this is the appropriate compositing strategy.

Once the NYSDEC concurs with the compositing strategy, a sediment/water slurry will be prepared for each sample. During full-scale implementation, it is likely that the larger particles will be removed from the slurry prior to pumping it to the SCA. Therefore, the prepared slurry will be screened through a 1-inch sieve. This screen size was selected because of the size of the bags to be used for testing and the separation processes currently anticipated during full-scale implementation. The sediment and water will be mixed to achieve a slurry that is approximately 10% total solids by weight, after removal of the greater than 1-inch size particles. The total solids by weight of the slurry will be measured and recorded after slurry preparation is complete. In addition, a slurry sample from each location (or composited location) will undergo analytical testing, as indicated in Table 2.

5.0 BENCH-SCALE TESTING

A schematic of the testing procedure following slurry preparation is provided in Figure 3. Bench-scale testing will include both initial polymer testing (including jar tests) and bag tests, performed by Waste Stream Technology in Buffalo, New York, an independent laboratory. The presence of representatives from NYSDEC and Honeywell at the laboratory is anticipated during at least a portion of the testing.

The initial polymer testing (e.g., jar tests) will consist of injecting a polymer or polymers into the slurry mixture and stirring it. It is currently anticipated that, at a minimum, anionic and cationic polymers will be considered. Observations (e.g., turbidity, settling time, appearance of floc) will be recorded. Based on these observations and discussions with NYSDEC, polymer(s) will be selected for the bag tests.

Bag testing will consist of hanging bags tests performed in accordance with the Geosynthetic Research Institute (GRI) Test Method GT-14 (see Appendix A), which is the currently recognized industry standard for evaluating dewatering characteristics of geotextile bags. These bags will be provided by Tencate, the manufacturer of Geotube® geotextile bags. In addition, Tencate will also provide bags that were specifically developed for an alternate test method referred to as the Geotube® Dewatering Test (GDT), which is described in Appendix B. Both the hanging bags and the GDT bags will be made from the same geotextile type. Although this new method was developed by Tencate to be more representative of field conditions, its validity has not yet been recognized in the industry. Therefore, for purposes of comparing dewatering characteristics, we anticipate performing the GDT in parallel with GT-14, as indicated in Figure 3. Since GT-14 is considered the primary test method for this program, it is currently anticipated that only the effluent from the GT-14 method will be analyzed for the chemical constituents, as indicated in Figure 3. However, analytical testing of the GDT effluent may be performed if observations during bag testing warrant it. In addition, if for any reason the laboratory is unable to conduct the GDT, the program will continue utilizing only GT-14.

Bag tests will be performed using slurry samples both with and without polymer(s) addition. The number of bag tests will be determined based on the initial polymer testing and discussions with the NYSDEC; however, at this time, it is anticipated that bag tests will be performed both with and without polymer(s), as shown in Figure 3. In addition to the procedure described in GT-14, the following tasks will be performed as part of the hanging bag tests:

- The effluent that is collected after 1, 10, and 30 minutes will be measured for both total suspended solids and turbidity. The volume of effluent will be reported as follows: volume collected between 0 and 1 minute; between 1 and 10 minutes; between 10 and 30 minutes; and after 30 minutes (i.e., between 30 minutes and when the bag ceases to drain). The time associated with when the bag stops draining will also be recorded. In addition, for the hanging bag tests only, the effluent from 1 to 10 minutes and from 10 to 30 minutes will be collected for analytical testing, as specified in Table 2.

- Observations regarding the slurry and effluent (e.g., presence of NAPL or odors) will be recorded during testing.

- After the bag test is complete, the dewatered sediment sample in the bag will undergo the following testing:

    - Torvane or mini-vane shear testing – This testing will be performed on dewatered samples at the center of the bag and along the edges. The sample should not be disturbed prior to this testing.

    - Percent total solids by weight – This testing will be performed on dewatered sediment samples from the center (3 – top, middle, and bottom) and the edges (4).

    - Index testing (moisture content [ASTM D2216], grain-size with hydrometer [ASTM D422], Atterberg limits [ASTM D4318], and specific gravity [ASTM D854]).

- Observations regarding the filter cake formed on the inside of the bag will be recorded.

Samples for additional testing (e.g., total percent solids) will likely be taken at various times during testing. The selection of these samples will be at the discretion of laboratory personnel and representatives from NYSDEC and Honeywell based on observations during testing.

6.0 DATA MANAGEMENT AND REPORTING

The majority of the scope described in this work plan deals with specialized bench-testing procedures. Deliverables for the various components of the work plan will consist of data summary reports that will be submitted to NYSDEC following completion of the bench-testing program. Observations of NAPL and material type during field sampling will be included in the summary reports, along with the initial geotechnical test results. For the bag tests, the reporting requirements described in GT-14 will be followed. In addition, effluent volumes, dewatering times, percent solids, strength test results, analytical test results, observations of NAPL in the effluent, and odors during testing will be reported.

The sample names, QA/QC procedures, sample collection, data entry, and data validation for applicable sections of this work will be conducted in accordance with the Phase I PDI Work Plan (Parsons, 2005). Any deviations from these procedures will be discussed with NYSDEC prior to execution of the work.

7.0 REFERENCES

NYSDEC and USEPA, 2005. *Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site Syracuse, New York Record of Decision.* Albany, New York.

Parsons, 2005, *Onondaga Lake Pre-Design Investigation: Phase I Work Plan*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.

TABLES

TABLE 1

Phase III Onondaga Lake Pre-Design Investigation

Geotextile Tube Evaluation - Sample Collection and Index Test Summary

July 2007

		Material Type	Depth Interval (Feet)	Total Sediment Volume (Gallons)[1]	Total Surface Water Volume (Gallons)[2]	Minimum Number of Index Tests[3]		Sampling Details
						Initial	Dewatered	
ILWD Area A[4]								
	OL-STA-10114	Solvay waste with NAPL	0-6.5	17	150	1	1	Collect SED in 5 gallon pails and SW in carboys Measure pH, temp, cond and DO of SW sample
	OL-STA-10115		0-6.5	17		1		
	OL-STA-10116		0-6.5	17		1		
ILWD Area B[4]								
	OL-STA-10117	Solvay waste without NAPL	0-6.5	17	150	1	1	
	OL-STA-10118		0-6.5	17		1		
	OL-STA-10119		0-6.5	17		1		
SMU 6								
	OL-STA-60098	Black silt	0-3.2	50	150	1	1	
	OL-STA-60100	Black silt and/or marl	0-3.2	50	150	1	1	

TOTALS	200	600	12

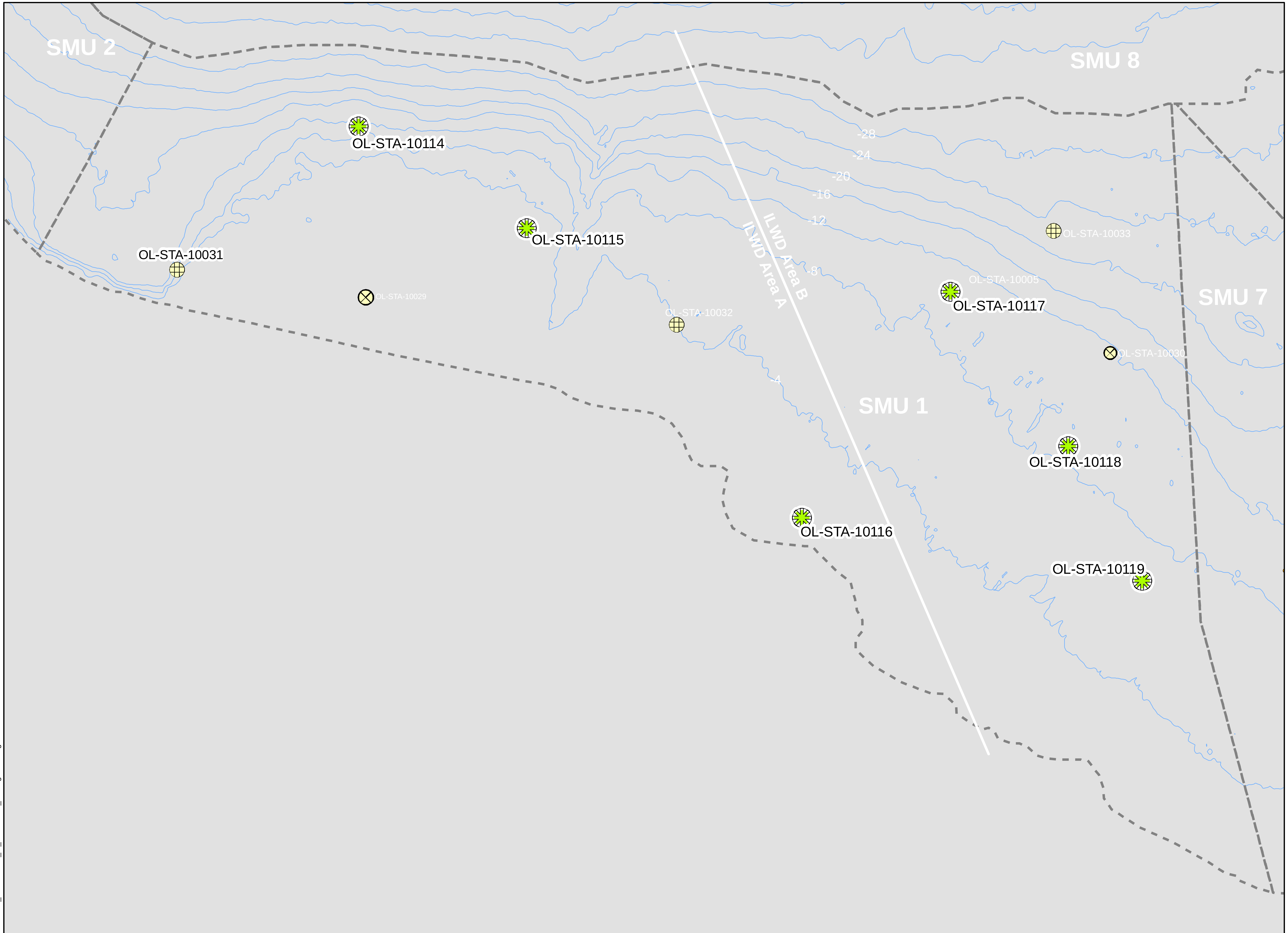
NOTES:

1. Total sample volumes at each location assume that sediment and lake water will be composited to obtain a total percent solids of approximately 10 percent by weight.
2. The typical volumetric ratio for preparing a slurry at 10% solids (by weight) is 4 parts water to 1 part sediment. Since index testing of the sediment (i.e., prior to slurry preparation) is required, it is anticipated that 150 gallons of water should be sufficient for each area. Because of the water volume required, all lake water will be collected offshore of the PDI site trailers.
3. Index testing will include moisture content (ASTM D2216), grain-size with hydrometer (ASTM D422), Atterberg limits (ASTM D4318), and specific gravity (ASTM D854) testing. In addition, organic content (ASTM D2974) will be performed on the SMU 6 samples.
4. It is anticipated that samples from OL-STA-10114 through OL-STA-10116 will be composited to form one sample for bench-scale testing. Similarly, it is anticipated that samples from OL-STA-10117 through OL-STA-10119 will be composited to form one sample for bench-scale testing.

TABLE 2
Phase III Onondaga Lake Pre-Design Investigation
Geotextile Tube Evaluation - Analytical Testing Summary
July 2007

Parameter	Method	Lake Water Sample	Slurry Sample	Effluent
pH	EPA 9045C/150.1	x	x	x
Turbidity	EPA 180.1	x		x
Percent total solids/TSS	SM2540G/EPA160.2	x	x	x
BOD	EPA 405.1	x	x	x
COD	EPA 410.1	x	x	x
TOC	EPA 415.1	x	x	x
Ammonia	EPA 350.1	x	x	x
TKN	EPA 351.2	x	x	x
Chloride	EPA 300.0	x	x	x
Nitrate	EPA 300.0	x	x	x
Sulfate	EPA 300.0	x	x	x
Phosphorus	EPA 365.4	x	x	x
TAL Metals	EPA 6010	x	x	x
Mercury	EPA 7470	x	x	x
Mercury (high resolution)	EPA 1631	x	x	x
Methyl mercury	EPA 1630	x	x	x
VOCs	EPA 8260	x	x	x
SVOCs	EPA 8270	x	x	x

FIGURES



Proposed Phase III Geotube Evaluation Bench-Scale Testing, and Phase II Water Treatment, CST, EET and Odor Bench Test Locations

Phase I Bulk Sediment and Water Sample for Emissions and Supernatant Water Treatment Evaluations (two locations, one composite)

Phase I Bulk Sediment Sample for Column Settling and Effluent Ellutriate Testing

NOTES

1. Bathymetry contours are in 4 foot intervals.
2. Water depth based on average lake elevation of 362.82 feet.

0 50 100 200 300 400 500
Feet

FIGURE 1

Honeywell

Onondaga Lake
Syracuse, New York

SMU 1
Phase III PDI Bench Test
Sample Locations

PARSONS

290 ELWOOD DAVIS RD, SUITE 312, LIVERPOOL, NY 13088 Phone:(315)451-9560

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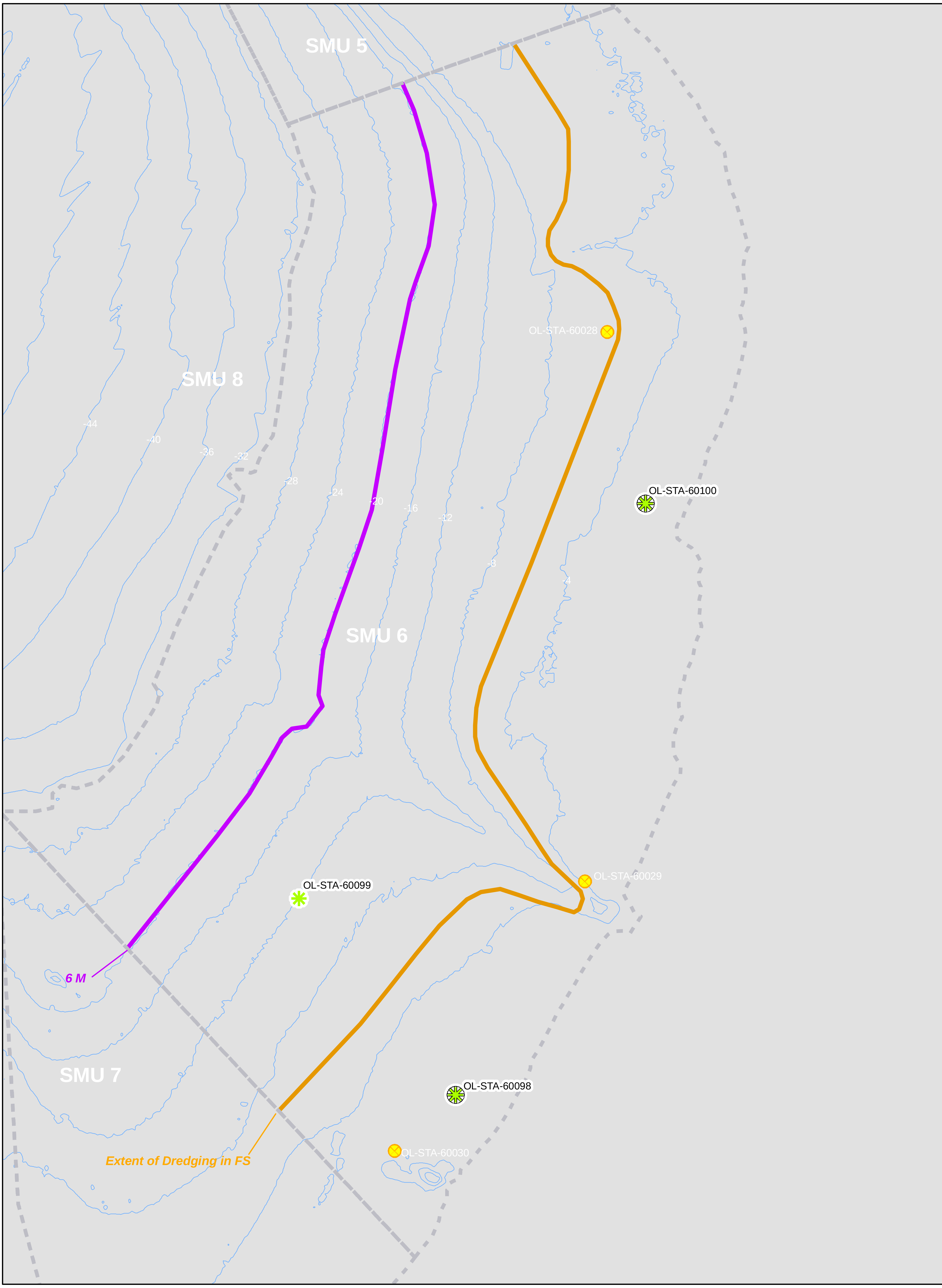


Proposed Phase III Geotube Evaluation Bench-Scale Testing, and Phase II Water Treatment, CST, EET and Odor Bench Test Locations

Phase II Water Treatment, CST, EET and Odor Bench Test Sample Locations

Phase I Bulk Sediment and Water Sample for Emissions, Column Settling and Effluent Ellutriate Testing (3 Locations, 1 Composite)

NOTES

1. Bathymetry contours are in 4 foot intervals.
2. Water depth based on average lake elevation of 362.82 feet.

0 125 250 500 750 1,000

Feet

FIGURE 2

Honeywell

Onondaga Lake
Syracuse, New York

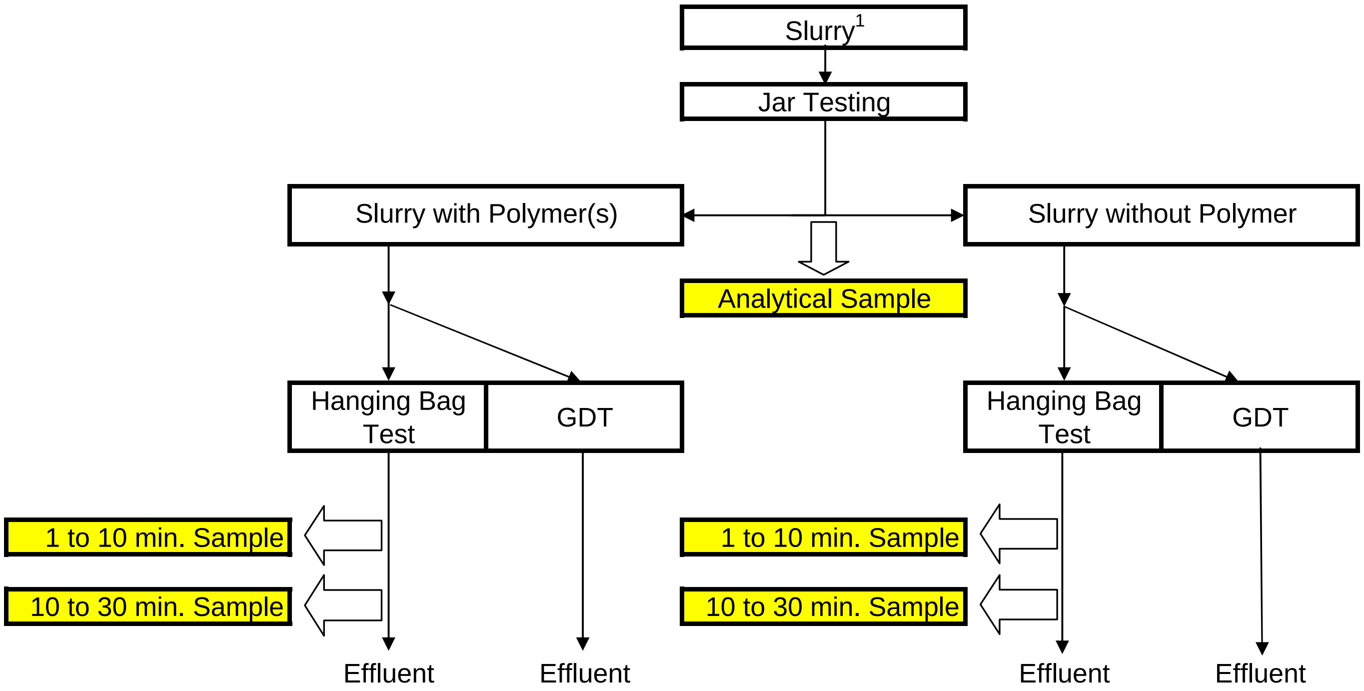
SMU 6
Phase III PDI Bench Testing
Sample Locations

PARSONS

290 ELWOOD DAVIS RD, SUITE 312, LIVERPOOL, NY 13088 Phone:(315)451-9560

Q:\GIS\GIS_Lake\Phase_III_PDI\Bench_Testing\SMU-6-geotube.mxd

FIGURE 3
Phase III Onondaga Lake Pre-Design Investigation
Geotextile Tube Evaluation - Testing Schematic
July 2007



Note:
1. It is anticipated that a 10% solids slurry (by weight) will be prepared for each of the following locations:
    - ILWD Area A (composite of OL-STA-10114 through OL-STA-10116)
    - ILWD Area B (composite of OL-STA-10117 through OL-STA-10119)
    - OL-STA-60098
    - OL-STA-60100

APPENDIX A

Drexel UNIVERSITY

Geosynthetic Research Institute
475 Kedron Avenue
Folsom, PA 19033-1208 USA
TEL (610) 522-8440
FAX (610) 522-8441

GRI GEI GII GSI GAI GCI

Original - June 16, 2004

GRI Test Method GT14*

Standard Test Method for

Hanging Bag Test for Field Assessment of Fabrics Used for Geotextile Tubes and Containers

This test method was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new test methods on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any projects developed according to this test method either at this time or in the future.

1. Scope

1.1 This test method is used to determine the dewatering efficiency of dredged or slurried material passing through a geotextile bag. Results are *quantitative* in that the solids content before and after dewatering can be determined, and *qualitative* in that visual observations of effluent and retained solids are made. The quantity of sediment that passes through the bag is also obtained.

Note 1: In some cases, water quality analyses are necessary before and after the test is performed. Such testing should be agreed upon by the parties involved.

Note 2: The test is generally used to assess and decide on the appropriateness of a particular fabric to be used in the fabrication of a geotextile tube or container with respect to a site-specific dredged or slurried material infill.

1.2 This test method requires adequate equipment and materials; they are a fabric sample fabricated into a large bag, a frame to suspend the geotextile bag(s), adequate material that is representative of site specific conditions, and collected effluent to assess the performance.

*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This test method will be reviewed on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

1.3 The values stated in SI units are the standard, while inch-pound units are provided for information. The values expressed in each system may not be exact equivalents: therefore, each system must be used independently of the other, without combining values in any way.

1.4 The standard does not purport to address the possible safety issues and concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices for contaminated dredged or slurried materials and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards

D123 Terminology Relating to Textile Materials
D653 Terminology Relating to Soil, Rock, and Contained Fluids
D4354 Practice for the Sampling of Geosynthetics for Testing
D4439 Terminology for Geosynthetics

2.2 GRI Standard

GT10 Test Methods, Properties and Frequencies for High Strength Geotextile Tubes Used in Coastal and Riverine Structures

3. Terminology

3.1 Definitions

3.1.1 dredged or slurried material – transported high water content sediments from rivers, harbors, lagoons, or municipal, agricultural, aquicultural, mining, processing or industrial facilities.

3.1.2 geosynthetic, n – a planar product manufactured from polymeric material used with foundation soil, rock, earth, or any other geotechnical engineering related material as an integral part of a man-made project, structure, or system.

3.1.3 geotextile, n – any permeable textile material used with foundation, soil, rock, earth, or any other geotechnical engineering related material, as an integral part of a manmade project, structure, or system.

3.1.4 performance property, n – a result obtained by conducting a performance test

3.1.5 performance test, n – in geosynthetics, a procedure which simulates selected field conditions such that the results can be used in design or acceptance.

3.1.6 geotextile bag, n – a fabric container or bag designed and fabricated to retain a maximum percent of fine material and potentially harmful substances while allowing for drainage and consolidation of the contained material within the bag.

4. Summary of Test Method

4.1 A geotextile bag is constructed by sewing one or more layers of fabric together to form a bag that will support and contain a measured amount of dredged or slurried material.

4.2 The bag is suitably suspended from a support frame while the designated material is poured into it for the purpose of evaluation of the bag's filtration efficiency and effectiveness.

4.3 This test is intended to be conducted in the field with in-situ dredged or slurried material. As such, the test is considered to be a performance test.

5. Significance and Use

5.1 The goal of this test is to access the filtration efficiency of a given fabric in the form of a geotextile bag with respect to a site specific dredged or slurried material. The geotextile bag is made of the same material from which the geotextile tube or container is to be constructed. The dewatering ability and sediment discharge from the geotextile bag are both major indicators of the performance of the actual geotextile tube or container. In addition, visual observation of the performance of the geotextile bag with respect to infilled material is also an important indicator of future performance.

Note 3: It is recognized that the flow conditions (vertical, rather than horizontal) and stress conditions (pulsed and low rather than continuous and high) may not be representative of actual field conditions.

6. Required Supplies and Apparatus

6.1 A fabricated geotextile bag of approximately 61 cm (24 in.) in width, 165 cm (65 in.) in length, and capacity of 200 L (50 gal) as shown in Figure 1.

6.2 An adequate frame capable of supporting the bag(s) with its material infill, see Figure 2a.

6.3 An adequate container of the site-specific material; typically at least 150 L (50 gal), see Figure 2b, and smaller 15 L (5 gal) buckets for handling purposes.

6.4 Adequately large effluent pans as shown in Figure 2c, such that the bottom of the filled bag can fit entirely in the collection pan(s). This typically is a pan of 30 cm (12 in.) by 38 cm (15 in.) by 51 cm (20 in.) deep.

Note 4: The bottom of the filled bag should be suspended above the liquid level of the collection pan at all times, see Figure 2d.

6.5 If necessary, an adequate source of liquid (typically locally available water or lagoon water) to dilute the intended infill material with adequate care to match the solids content.

6.6 If necessary, an adequate amount of material-specific conditioner (coagulant or flocculent) as agreed upon by the parties involved. In this regard, proportioning will have to be carefully controlled.

6.7 Proper stirring device to homogenize the mixture, see Figure 2b.

6.8 Stopwatch to monitor the process.

7. Sampling

7.1 Geotextile Bag

7.1.1 The lot sample for geotextiles is taken as directed in ASTM Practice D4354. Cut sufficient fabric lengths for the appropriate number of tests knowing that each bag requires a volume of approximately 200 L (50 gal). Cut the geotextiles with a hot knife so that edges do not unravel. If holes or damaged areas are evident the material should be discarded. Selvedge can only be used for the outer surface of the top circumference of the bag.

7.1.2 Geotextile bags are made by sewing one or more layers of geotextile together to form a container or bag with an approximate circumference of 122 cm (48 in.) and an effective length of 165 cm (65 in.) as shown in Figure 1. Seams are to be constructed of a double row of locked chain stitches. Upon sewing the geotextile into a bag, the seams should be on the outside of the bag. This step adds strength and neatness to the bag.

7.1.3 Typically four 61 cm (24 in.) support straps are sewn along the top circumference of the bag approximately 90 deg. from each other for the purpose of supporting the filled bag off of the frame, see Figures 1 and 2 a and c. These straps, in the form of loops, will extend about 25 cm (10 in.) above the top of the bag.

7.2 Dredged or Slurried Material – Obtain representative material from the proposed dredged area or industrial facility. Approximately 152 L (40 gal.) of material is required for each test, see Figure 2b. The material should be representative of the bulk material to be used in the actual operation. A sample of the material should be brought back to the lab for characterization and testing.

Note 5: It is often necessary to modify the material using a additive such as a conditioner, coagulant, flocculent or related polymeric material. This is a site-specific issue which must be agreed upon by the parties involved. Both the type of conditioner and the amount are important considerations.

8. Procedure

8.1 Attach the bag to the frame such that adequate stability is obtained.

8.2 The bottom of the bag should have a clearance of about 36 cm (14 in.) above the floor of the platform to accommodate removal of the collection pan as it fills with effluent sediment and water.

8.3 Position and level the assembled system such that all of the effluent is collected.

8.4 Mix the dredged or slurried material with the appropriate additive (if necessary) along with sufficient water in an evenly distributed manner. A stirrer or mixer may be necessary. This process can easily displace some slurry and will generally result in a mess. For this reason the test should be conducted in the field or in an area which can accommodate considerable spillage and fugitive liquids.

8.5 Using 20 L (5 gal) buckets, lift the mixed slurry to the top of the system and pour it into the bag in a continuous motion one bucket after the other. Start the stopwatch when the last bucket of mixture has been poured into the bag.

8.6 Collect effluent passing through the bag at three, or more, intervals. Times of 1, 10 and 30 minutes have been used for dewatering of fine materials and sludges. A minimum sample of 100 mL should be collected in a suitable, sealed, container for each time increment.

8.7 The test should be stopped after the liquid ceases to drain from the bag.

8.8 Sediment passing through the fabric bag can be collected, decanted, and subsequently analyzed as agreed upon by the parties involved.

8.9 The dewatered soil or sediment within the bag should be collected for geotechnical testing depending on the final use or disposal.

9. Calculations and Observations

9.1 The change in percent solids from the influent material to the effluent material should be measured and calculated. This results in a percent solids by weight *removal efficiency*.

Note 6: For example, if the influent was at 10% solids and the effluent was 0.01% solids, the removal efficiency would be $\frac{0.1-0.0001}{0.1}(100)=99.9\%$.

9.2 For effluent samples taken at various time intervals, chemical analyses could be performed as agreed upon by the parties involved.

9.3 At the completion of the test, the material filled bag should be cut open to sample and examine the stabilized material. A sample should be taken from the center of the bag at approximately mid-height. The percent solids and moisture content of the residual material could be measured if desired.

9.4 The condition and nature of the inside of the fabric bag should be observed insofar as the build-up of a *filter cake* on the inside of the fabric is concerned.

10. Report

10.1 The type, style and properties (physical, mechanical, hydraulic and endurance) of the fabric used in fabrication of the geotextile bag.

Note 7: If the fabric was made according to a generic specification, like GRI GT10, it should be so noted.

10.2 The type and amount of all additives (if any).

10.3 The initial characteristics of the dredged or slurried material should be reported. This will include the percent solids and perhaps chemical analysis as may be appropriate.

10.4 The appropriate characteristics of the effluent liquid and (if agreed upon) the passing sediment.

10.5 The numeric value of removal efficiency.

10.6 The characteristics of the dewatered material within the geotextile bag, e.g., percent solids, moisture content, sieve analysis, Proctor analysis, etc.

10.7 Any pertinent or relevant observations on the filter cake formed on the inside of the fabric bag.

Note 8: Additional testing may be suggested but must be communicated and agreed upon by the parties involved.

11. Precision and Bias

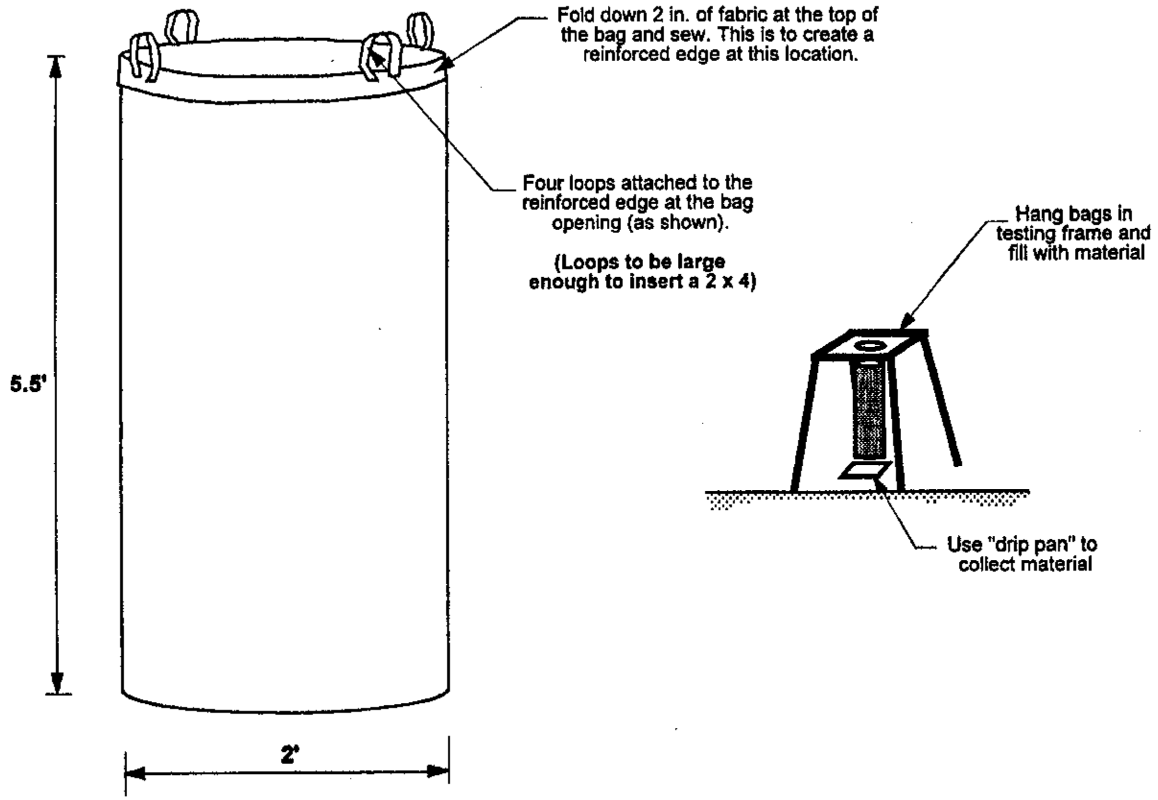
11.1 Precision – The precision of the procedure in this test method is being established.

11.2 Bias – The bias of this procedure is being established.

12. Keywords

12.1 flow rate; suspended solid; geotextile container; dredged material; slurried material; contaminated dredged material

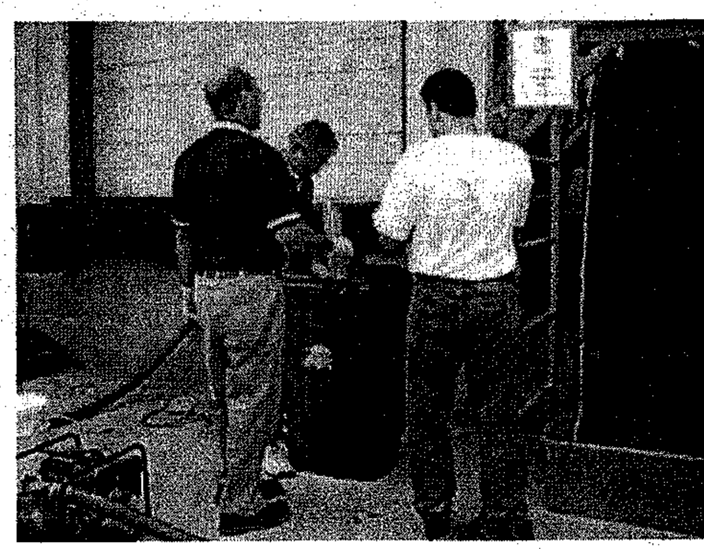
5.5 ft. long x 2 ft. wide Test Bag



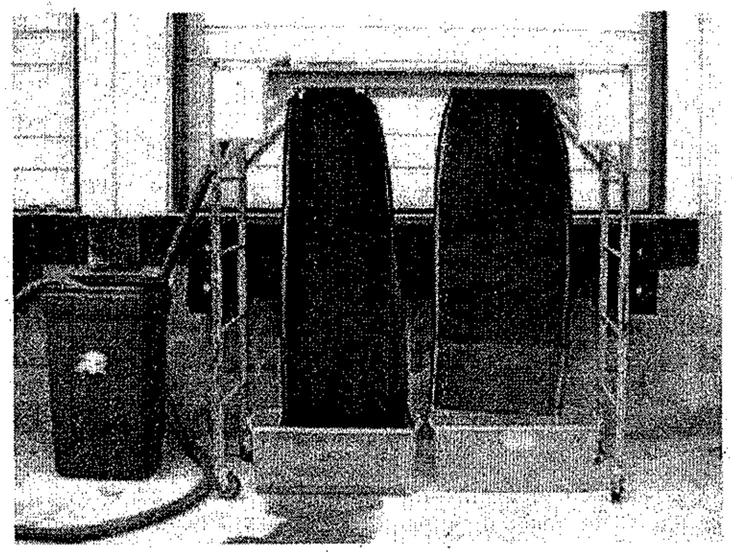
Notes:
1) Dimensions shown are un-filled, "flat" bag dimensions.

Figure 1 - Fabric sample size and dimensions to fabricate into geotextile bag for hanging bag testing.

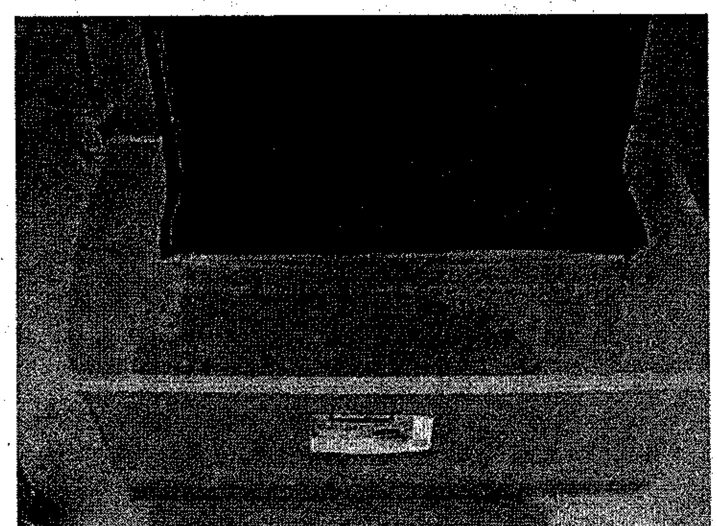
(a) Support frame with two bags ready for testing



(b) Infill mixture being prepared using mechanical stirrer



(c) Effluent pans beneath bags, with left tube filled



(d) Effluent coming from bottom of bag into container

Figure 2 - Photographs of various stages of hanging bag test

APPENDIX B

TENCATE

Geotube

TenCate Geotube GDT Test
A Demonstration of Geotube® Dewatering Technology

Prueba TenCate Geotube GDT
Una demostración de la metodología de la Tecnología de Desagüe Geotube®

Test de Déshydratation par la Technologie Geotube (DTG) de TenCate Geotube
Démonstration de la technologie de déshydratation Geotube®

Teste TenCate Geotube GDT
Uma demonstração da tecnologia Geotube® para desaguamento de lodo

Protective & Outdoor Fabrics
Aerospace Composites
Armour Composites
Geosynthetics
Industrial Fabrics
Synthetic Grass

TENCATE
materials that make a difference

1

2

Required Equipment for the Geotube® GDT Test

1. Several five-gallon (20L) plastic buckets
2. 50-gallon trash can
3. 3-gallon pouring pail
4. Variable speed electric drill with paint mixer attachment
5. GDT stand*
6. GDT bag (one-time use)
7. 35 gal. to 45 gal. plastic container or "tote"
8. Large mouth funnel
9. Stand-pipe with 2" male thread adapter
10. One 500ml beaker
11. Latex gloves
12. Hand sanitizer

Reference TenCate Geotube RDT Brochure for polymer makedown materials.

*TenCate Geotube reps have a custom stand for the GDT (See photo 1); however, a stand can be created from locally available materials including two 12" x 16" plastic file or milk crates placed in a plastic under-bed storage box. (See photo 2).

Equipo requerido para efectuar la prueba Geotube® GDT

1. Varias cubetas plásticas de 20 litros (5 galones)
2. Un contenedor de basura de 200 litros
3. Jarra para vaciar de 12 litros
4. Taladro eléctrico de velocidad variable con adaptador de mezclar pintura
5. Estructura GDT*
6. Bolsa GDT (utilizable solo una vez)
7. Contenedor plástico de 135- 170 litros
8. Embudo de boca ancha
9. Tubería de 2 pulgadas con adaptador roscado macho
10. Una vaso graduado de 500 ml
11. Guantes de látex
12. Limpiador para desinfección de manos

Revise el folleto TenCate Geotube RDT para calcular la dilución del polímero.

* Los representantes TenCate Geotube tienen una estructura disponible para la prueba GDT (ver la foto 1), sin embargo se puede crear uno con materiales disponibles localmente, incluyendo dos tubos de plástico Sterlite® de 12" x 16" colocados sobre un contenedor de los que se guardan debajo de la cama para guardar objetos. (ver la foto 2)

Matériel requis pour le test DTG de TenCate Geotube

1. Plusieurs seaux en plastique (20 litres)
2. Poubelles de 200 litres (50 gallons)
3. Seau de 15 litres (3 gallons) avec un bec verseur
4. Perceuse électrique à vitesse variable équipée d'un mélangeur pour la peinture
5. Structure de test DTG*
6. Sac de test DTG (à utilisation unique)
7. Bac en plastique de 100 à 200 litres (35 gal. à 45 gal.)
8. Entonnoir à large ouverture
9. Tuyau droit avec une bride de raccordement de 5 cm (2 pouces)
10. Un bécher de 500 ml
11. Gants en latex
12. Désinfectant pour les mains

Pour le matériel de préparation des solutions de polymère, voir la brochure de référence du test TDR de TenCate Geotube.

*Les représentants de TenCate Geotube disposent d'une structure sur mesure pour réaliser le test DTG (Voir photo 1); cependant, une structure peut être réalisée avec des équipements disponibles sur place comme par exemple deux caisses de plastique ajourée de type Sterlite® de 30 cm x 45 cm (12" x 16") placées dans un bac de rangement en plastique. (Voir photo 2).

Equipamentos necessários para o Teste Geotube® GDT

1. Vários baldes plásticos de 20L
2. Tonel de 200 L
3. Baldes de 12 L
4. Agitador elétrico com velocidade variável com haste anexada
5. Estrutura GDT*
6. Bolsa GDT (Utilizado apenas uma vez)
7. Recipiente plástico de 133 a 170 L
8. Funil de boca larga
9. Barra de sustentação com adaptador do tipo encaixe macho com 2"
10. 1 becker de 500ml
11. Luvas de latex
12. Desinfetante para as mãos

Consultar as especificações da TenCate Geotube RDT para a aplicação do polímero.

*TenCate Geotube possui estrutura GDT para fornecimento ao cliente para proceder o teste GDT (vide foto 1), entretanto uma estrutura similar pode ser elaborada com material disponível no local incluindo 2 engradados plásticos de Sterlite® com dimensões de 12" x 16" engradados plásticos posicionados abaixo para coleta do percolado (vide foto 2).

A Demonstration of Geotube® Dewatering Technology

The Geotube® GDT (Geotube® Dewatering Test) is a demonstration of sludge dewatering using a Geotube® container. The purpose of the test is to:

- Visualize the dewatering process
- Evaluate the efficiency of the selected polymer
- Analyze the clarity of the effluent
- Predict achievable percent solids

Step 1

Collect approximately 15-25 gallons (57-95 liters) of sludge. Mix the samples in a large container. A 50-gallon (190 liter) trash can is a good choice to ensure uniformity. If the percent solids of the sludge is low, a larger sample may be needed.

Step 2

Assemble the GDT frame and place a 35-45 gallon (132-170 liter) plastic container or "tote" under the frame to catch the effluent. Place a GDT Bag on top of the frame and insert the supplied 27 in. (68.5 cm) stand-pipe (The pipe represents approx. 1 psi of head pressure).

Step 3

Polymer and dosage will have been determined from bench-scale testing. Make down the polymer into solution. A polymer make down chart is available from TenCate Geotube. Mix the polymer into the sludge sample using a variable-speed electric drill and paint mixer attachment until floc is formed.

CAUTION:
High speed agitation may shear the floc.

Step 4

Fill the GDT Bag by pouring conditioned sludge into the top of the stand-pipe. A smaller bucket and funnel can be utilized to facilitate this process.

NOTE: Lift the stand-pipe off of the bottom of the GDT Bag; otherwise, the introduced sludge may back up in the pipe and overflow. This should no longer be of concern once the Test Bag has accumulated some volume of sludge.

Step 5

Continue to fill the GDT Bag with conditioned sludge as rapidly as possible until the sludge rises in the stand pipe to the line indicating 1 psi, then stop. Collect effluent samples from the corner of the bag.

The effluent should be examined for clarity and samples can be taken for testing if so desired.

Step 6 (Optional)

After the GDT Test Bag has had ample time to dewater, a sample of dewatered sludge can be collected to determine moisture content and percent dewatered solids. The findings may be extrapolated to estimate the results of a full scale project. GDT also can be used to conduct a mass-balance analysis.