Dear Interested Citizen:

This fact sheet provides you with information on the draft Onondaga Lake Sediment Management Intermediate Design Submittal for the Onondaga Lake Bottom Site, a sub site of the Onondaga Lake Superfund Site. If you have any questions, comments or would like more information about this project, please contact:

Mr. Timothy Larson P.E.
Project Manager
NYSDEC, 625 Broadway, 12th Floor
Albany, New York 12233-7016
(518) 402-9676
Email: tjlarson@gw.dec.state.ny.us

With respect to citizen participation inquiries, please contact:

Ms. Diane Carlton or
Ms. Stephanie Harrington
Citizen Participation Specialists
NYSDEC, 615 Erie Boulevard West
Syracuse, New York 13204-2400
(315) 426-7403
Email: reg7info@gw.dec.state.ny.us

For project-related health questions, contact the New York State Department of Health (NYSDOH) at the following:

Mr. Mark Sergott
Project Manager
NYSDOH, 547 River Street
Troy, New York 12180-2216
(800) 458-1158, Ext. 27860
E-mail: beei@health.state.ny.us

New York State Department of Environmental Conservation

FACT SHEET

DRAFT ONONDAGA LAKE SEDIMENT MANAGEMENT INTERMEDIATE DESIGN SUBMITTAL AND ASSOCIATED NYSDEC COMMENTS AVAILABLE FOR REVIEW

Onondaga Lake Bottom Site (#7-34-030)
Onondaga County - June 2010

Introduction

The draft Onondaga Lake Sediment Management Intermediate Design (dated February 2010) has been submitted by Honeywell and reviewed by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (EPA). This document provides intermediate-level design information on the management of sediments to be dredged as part of the Onondaga Lake remedy. The design document and NYSDEC's comment letter associated with the document (dated May 29, 2010) are available for review in the locations listed on page four.

Sediment Management Intermediate Design Submittal for the Onondaga Lake Bottom Site

The Onondaga Lake remediation plan was separated into four designs in order to advance critical design components so that dredging activities can begin as scheduled in May 2012.

This design document describes how the dredged lake-bottom sediments will be pumped through a double-walled pipe up to the Sediment Consolidation Area (SCA) located on Wastebed 13, how the sediments will be managed within the SCA, and how water that drains from the sediments will be collected and transported to the SCA Water Treatment Plant. Comprehensive efforts to protect the public's health and safety are an important part of the work to restore

Onondaga Lake. Health and safety plans are reviewed by the NYSDEC and the New York State Department of Health and are incorporated in to every stage of the restoration.

The design team will continue to work with the community to ensure that the health and safety of the surrounding community and environment is maintained throughout the remedy. A dredging and SCA operations health and safety plan is being developed and will be available for public review and comment in the summer of 2011 and will include:

- Site Security & Community Health and Safety Plan
- Air Quality Monitoring and Mitigation Plan
- Spill Contingency Plan
- Traffic Management Plan
- Noise Abatement Plan

Components of the Onondaga Lake remedy that are discussed in the Sediment Management Intermediate Design include:

- Transport of sediments in a slurry (sediment/water mixture) from the shoreline through a double-walled pipe to the Sediment Consolidation Area (SCA)
- Pre-processing of the sediment slurry prior to being pumped into the geotextile tubes (e.g., screen of larger material, sand separation, addition of polymer to aid in the dewatering of the sediment slurry within the geotextile tubes)
- Use of geotextile tubes for dewatering of sediment slurry
- Management of stormwater and water draining from geotextile tubes
- Management of debris removed from the lake to facilitate dredging and capping

The figure below illustrates the sediment slurry pipeline route (shown as a green line), sediment processing area (shown as a brown area), and the Sediment Consolidation Area (shown as a green area).

Geotextile tubes (similar to the ones shown below) will be used to dewater the sediment slurry within the Sediment Consolidation Area.

Water draining from the geotextile tubes will be collected and pumped to the Sediment Consolidation Area Water Treatment Plant that will also be located in close proximity to the SCA. The design of the Sediment Consolidation Area Water Treatment Plant is discussed in separate design documents and can be accessed at the locations listed on page four.

Dredging debris management will consist of recycling, placing the debris within the SCA, or disposing the material off-site depending on the nature of the debris.

Next Design Submittal

Public comments will be incorporated into the next design submittal related to these elements of the remedy, the Draft Sediment Management Final Design, which is scheduled to be submitted during January 2011.

Public Participation

Public input is encouraged throughout the design process. In May, 2009 the DEC released for public review the draft Onondaga Lake Dredging, Sediment Management & Water Treatment Initial Design Submittal. The NYSDEC issued a fact sheet announcing the availability of the document. In May, 2009, as part of the Onondaga Lake bottom remediation program Citizen Participation Plan, the NYSDEC formed a Lead Community Participation Working Group. This group, made up of volunteer community members, meets on a regular basis to ensure the public has a forum to contribute information, opinions, perspectives, and recommendations about the program.

DEC will consider public input on the draft Sediment Management Intermediate Design received by August 16, 2010 as we move ahead with the remedial design process.

Project Contact List

The NYSDEC intends to use electronic mailing as much as possible for environmental and economic reasons. If you would like to begin receiving information electronically on the Onondaga Lake Bottom site, such as this fact sheet, please sign up for the Onondaga Lake News email list by visiting the NYSDEC website (www.dec.ny.gov/chemical/52545.html). Once signed up, please also notify the NYSDEC at reg7info@gw.dec.state.ny.us to stop receiving printed copies in the mail.

Location of Reports and Information

The Draft Onondaga Lake Sediment Management Intermediate Design Submittal and other information on the Onondaga Lake cleanup are available online at www.dec.ny.gov/chemical/37558.html on the NYSDEC website. This design document and other Onondaga Lake cleanup documents are also available for review at the locations listed below.

Atlantic States Legal Foundation
658 West Onondaga Street
Syracuse, NY 13204
Phone: (315) 475-1170
Please call for an appointment.

Camillus Town Hall
4600 West Genesee Street
Room 100
Syracuse, NY 13219
Phone: (315) 488-1234

Liverpool Public Library
310 Tulip Street
Liverpool, NY 13088
Phone: (315) 457-0310

Moon Library
SUNY ESF
1 Forestry Drive
Syracuse, NY 13210
Phone: (315) 470-6712

NYSDEC
625 Broadway
Albany, NY 12233-7016
Phone: (518) 402-9676
Please call for an appointment.

NYSDEC, Region 7
615 Erie Blvd. West
Syracuse, NY 13204-2400
Phone: (315) 426-7400
Please call for an appointment.

Onondaga County Public Library - Central Library at the Galleries
447 South Salina Street
Syracuse, NY 13202
Phone: (315) 435-1800

Solvay Public Library
615 Woods Road
Solvay, NY 13209
Phone: (315) 468-2441

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau D – 12th Floor
625 Broadway, Albany, New York 12233-7013
Phone: (518) 402-9676 • **Fax:** (518) 402-9020
Website: www.dec.ny.gov

Alexander B. Grannis
Commissioner

May 29, 2010

Mr. John P. McAuliffe, P.E.
Program Director, Syracuse
Honeywell
301 Plainfield Road, Suite 330
Syracuse, NY 13212

Re: Onondaga Lake Bottom Subsite – Onondaga County, NY
Draft Onondaga Lake Sediment Management Intermediate Design Submittal
Dated February 2010

Dear Mr. McAuliffe:

We have received and reviewed the above-referenced document, which was transmitted by your February 24, 2010 letter to my attention, and we have enclosed comments that we generated based on our review of the document. Please provide us with a letter containing responses to our comments, as soon as possible, such that our comments can be appropriately addressed in the Sediment Management Draft Final Design. In addition, please distribute the Draft Onondaga Lake Sediment Management Intermediate Design Submittal, including a copy of this letter and the enclosed comments, to the various document repositories as discussed in the governing consent decree.

If you have any questions relating to our enclosed comments, or would like to set up a meeting to discuss the enclosed comments, please contact me 518-402-9768.

Sincerely,

Timothy J. Larson, P.E.
Project Manager

Encl.

ec: B. Israel, Esq, - Arnold & Porter
J. Gregg – NYSDEC
J. Davis - NYSDOL, Albany
J. Heath, Esq.
T. Joyal, Esq.
M. McDonald – Honeywell
H. Kuhl
R. Nunes - USEPA, NYC
M. Sergott - NYSDOH, Troy
B. Ransom, HETF/Onondaga Nation
F. Kirschner - AESE

Comments on "Draft Onondaga Lake Sediment Management Intermediate Design," Prepared by Parsons and O'Brien & Gere for Honeywell, February 2010

Note: With the realization that this intermediate design submittal will not be revised and resubmitted for review, the following comments should be addressed in, or prior to the submission of, future design submittals.

General Comments

1. There are various components of the Sediment Management Design that are discussed in general terms in this document and detailed discussions relating to these components are deferred to the Sediment Management Draft Final Design. We need to have a good understanding of the various components (and opportunities to discuss these) of the Sediment Management Design in advance of the submission of the Sediment Management Draft Final Design. Therefore, with the goal of resolving any technical issues in advance of the submittal of the final design, we should have regular meetings this summer to discuss in detail all of the components of the Sediment Management Design.

2. A Stormwater Pollution Prevention Plan (SWPPP) will need to be finalized before any construction activities covered by this design are implemented. The draft Sediment Management Intermediate Design submittal includes references to various items that will be addressed as part of the SWPPP. Any comments relating to the SWPPP will be addressed as part of our review of the SWPPP and are not addressed by these comments.

3. Has the reuse of water for non-potable uses such as seal water, wash water, and polymer make-up water been considered. It appears that the design currently anticipates using water from Ninemile Creek and Onondaga Lake. If used as pump seal water, the creek water would likely need to be filtered to remove sediment. Otherwise, the packing glands may wear out prematurely. This in turn generates another waste stream. Honeywell should look at the feasibility of reusing treated effluent water from the treatment plant or using clean stormwater as make-up water.

4. How will dredge material from remediation areas A and B be pumped to the SCA? The report notes that while most of the material will be transported along the pipeline shown in the report, these two areas, due to their location, may have a different route.

5. Will installation of the pipeline, where it crosses Ninemile Creek, result in any conflicts with the remediation of Ninemile Creek?

6. It is believed that if Honeywell does not screen sand and gravel from the dredge water, prior to pumping it to the waste beds, the sand and gravel may cause wear and tear on the pump impellers, resulting in frequent maintenance and down time. Was this issue evaluated in the design?

7. The design currently discusses the use of packing glands on the pumps located along the pipe line. Were mechanical seals considered? Mechanical seals will eliminate the need for seal water.

8. Under ECL Article 15-0331, if Honeywell withdraws more than 100,000 gpd from Ninemile Creek and/or Lake Ontario, they will need to file an annual report with the Department.

9. The screening and sand separation process and polymer make-down system, i.e. "Slurry Pre-Processing Area" aka "Process Area" should be enclosed in a building since emissions from these components may need to be collected and treated.

10. More detail is needed on the separated materials management area. Is debris removed from the lake bottom planned to be temporarily stored in this area in addition to the material that comes out of the primary and secondary screening process? What does the liner design consist of? How will odors be mitigated? Section 2.3.2.2 states that all material generated by the primary screening process will be incorporated into the SCA prior to closure, for final containment. This needs to be discussed in more detail.

11. It is not clear how NAPL recovery is addressed by this submittal. If any NAPL is encountered at the SCA, how will it be recovered?

12. After closure of the SCA, how is leachate associated with the SCA managed? Will the leachate be collected and treated at the WTP or at another facility?

13. The anticipated volume of water to be treated by the water treatment plant differs between Parsons and OBG design documents. OBG's Design Package #1 plans for 5160 gpm of water from the SCA to the treatment plant. Parson's mass balance shows 5737 gpm. This apparent discrepancy needs to be addressed.

Specific Comments

Typically, paragraph numbering corresponds to complete paragraphs on a page, and begins with the first full paragraph on a page. Paragraph numbering typically includes the last paragraph on a page, even if that paragraph continues onto the next page. Bullets are considered part of the paragraph introducing them.

Executive Summary

ES.1 Page ES-2, Paragraph 1, Bullet 2. The Sediment Consolidation Area (SCA) Civil and Geotechnical Initial Design Submittal (IDS) was submitted in August 2009 and not December 2009 as stated.

ES.2 Page ES-3, Schematic. The Sediment Capping and Dredge Area and Depth IDS was submitted in December 2009 and not August 2009 as stated.

Section 1

1.1 Page 1-2, Schematic, Section 1.1. The Sediment Capping and Dredge Area and Depth IDS was submitted in December 2009 and not August 2009 as stated.

Section 2

2.1 Section 2, General. It is not evident that an evaluation was conducted with respect to the structural and geotechnical aspects of the pipeline installation, aside from where crossings of structures or rights-of-way are made. The weight of a double-walled pipe filled with slurry may be such that subgrade preparation will be required in some areas to provide sufficient bearing capacity. Differential settlement over a four-year period may also be an issue, particularly at booster pump stations. In addition, consideration must be given to the transfer of dynamic forces; during active pumping, there may be significant forces encountered at bends and, in particular, at the foot of long sloping segments that may require the installation of pipe mounts and bolsters which may, in turn, require footings for support. The transient dynamic effects from relatively sudden changes in flow (e.g., water hammer) that may result during emergency shutdowns should also be considered. The impact of the weight of the pipeline on slopes should also be considered, particularly for slopes at berms containing Solvay waste in and around the SCA.

2.2 Page 2-1, Section 2.1, General. The handling, separation, and collection methods for NAPLs that may be encountered during each of the conveyance and dewatering steps should be presented.

2.3 Page 2-1, Paragraph 2, Section 2.1. It is noted that the details of the dredging process itself will be addressed separately in the Dredging and Capping Design document. However, from the brief overview of the documents provided here, it is not clear that precautions to prevent entrainment of materials into the slurry line that could damage booster pumps (e.g., gravel, large pieces of wood, or other debris, etc.) have been considered in this intermediate design. The underlying premise may be that the action of the cutterhead on the dredge would allow only appropriately-sized materials to reach the pipeline. However, consideration should be given to the concept that the optimal pump for the dredge operation may pass materials that are too large or hard for (and therefore damage) the pumps optimized for the slurry pipeline operation. There is a significant potential impact to the available uptime of the system as a whole if this aspect of the dredging operation is not sufficiently considered.

2.4 Page 2-4, Paragraph 4, Section 2.2.1. Emergency shutdown and restart operations (including operating procedures and inputs to equipment selection) due to pipeline or dredge-related failures are a significant design consideration. Selection of final procedures and equipment to account for these possibilities are deferred until the final design; however, the intermediate design document should have identified options under consideration (e.g., sizing the booster pumps to allow "pumping through" a failed booster pump to clear out the pipeline, shutting down the system with slurry in the line and restarting, permitting backflow to the lake to clear out the line, etc.). Depending on the emergency shutdown/restart methodology, there may be unacceptable operational or

environmental risks (e.g., water quality impacts due to backflow of slurry may be an unacceptable side-effect of an emergency shutdown) that cannot be identified given the current level of information provided.

2.5 Page 2-6, Section 2.2.2.3. This section includes a reference to the wetland delineation report in Appendix E along with an indication that 20 individual wetlands areas along the pipeline alignment have been delineated. A summary of the nature of any wetland disturbance along with an estimate of the size (area) of the temporary wetland disturbance caused by the pipeline and/or booster pump stations should be provided.

2.6 Page 2-8, Paragraph 2, Section 2.2.3. The critical velocity is apparently selected on the basis of an 8% incline. Justification for this 8% design grade is not provided. Portions of the pipeline appear to exceed this incline (e.g., a 12-ft rise over a 20-ft run [60% grade] near the I-690 Exit 7 ramps on drawing C-105, a 5-ft rise over a 20-ft run [25% grade] after the pipeline crosses Ninemile Creek on drawing C-112, a 35-ft rise over a 225-ft run [15% grade] after crossing the CSX right-of-way on drawing C-116, etc.). If short exceedances of the 8% design grade are meant to be permissible, the document should identify or discuss the true limiting grade for any length of pipeline, the limiting parameters (e.g., maximum run) for grades in excess of the overall design grade, and whether any other special considerations need to be given to such "overgrade" sections.

2.7 Page 2-8, Paragraph 4, Section 2.2.3. It is stated that the horsepower requirements associated with total dynamic head (TDH) of 800 to 1,000 ft range from 1,800 to 2,400 horsepower (hp). However, it should be clarified that this horsepower range is estimated based on the Hazen-Williams model at a total headloss of about 1,000 ft resulting in 1,930 hp with an accuracy of -10 / +20% (approximately 1,800 to 2,400 hp). The horsepower at the low end of the range (1,800 hp) corresponds to a TDH of 930 ft rather than 800 ft.

2.8 Page 2-8, Paragraph 4, Section 2.2.3. It is stated that up to five booster pumps may be required to meet the total requirement for the approximately 20,000-ft-long pipeline and that each pump will be about 500 hp (page 2-16). Since the last section of the pipeline alignment from Ninemile Creek near Pump Station #5 (see drawing C-115) to Wastebed 13 will need to convey the slurry over the largest rise in elevation (from 370 ft at Ninemile Creek to over 435 ft at the Wastebed 13 berm), the pipeline hydraulic analysis models should also be provided for each section between booster pump stations to ensure adequate conveyance throughout the system, including the last section.

2.9 Page 2-9, Paragraph 1, Section 2.2.4. In addition to the items specified in the text, the engineering details for the booster pump stations must also include containment systems/measures to prevent slurry discharges to the environment in the event a pump fails in such a manner that slurry could escape the pump's housing. Sizing of the containment system should take into account the potential for continued flow from downgradient after rupture, as well as backflow from upgradient of the failed booster pump.

2.10 Page 2-9, Paragraph 1, Section 2.2.4. The design should consider the compatibility of the seal and any lubricants with the slurry, the potential quantity of emissions at booster pump

stations, the need for ventilation systems, and/or whether treatment of any such venting is required. The pH of the slurry fluid may also impact the durability of seal components, and should be considered in the design.

2.11 Sections 2.3 and 2.4, General. Details on the storage provisions should be provided to NYSDEC prior to draft final design being submitted. Without adequate storage between the primary screening operation and the geotextile tube feed pumps, transient events in the dredging operation could adversely affect the geotextile tube filling operation.

2.12 Page 2-9, Paragraph 4, Section 2.3. Reference is made to Phase 1 dredging of the ILWD material for Remediation Areas B, C, and D. It is our understanding that, although Solvay waste is present in Area B, the ILWD is Area D and Area C generally does not contain Solvay waste or ILWD material. It appears that the major difference between Phases 1 and 2 is that Phase 2 material (non Solvay waste impacted sediments) would undergo secondary screening and an additional sand separation step using hydrocyclones. The use of the terms "Phase 1" and "Phase 2" is confusing with respect to other aspects of the remediation and therefore other terminology should be used.

2.13 Page 2-10, Paragraph 8, Section 2.3.2.1 and page 2-11, Paragraph 5, Section 2.3.3.1. It is stated that SCA water would be used to rinse the primary and secondary screens. Consideration should be given to using SCA water treatment plant (WTP) effluent (treated water).

2.14 Page 2-13, Paragraph 5, Section 2.3.6. It is stated that minimization of the total suspended solids (TSS) in the geotextile tube filtrate through the use of proper chemical conditioning is critical for maintaining the functionality of the gravel collection system and the downstream WTP. To optimize the functionality of the gravel collection system and the downstream WTP through the use of chemical conditioning, please provide a discussion on target concentrations of TSS and other parameters related to tube performance. As noted on page 2-19 (Section 2.4.3), the dewatering contractor will be required to maintain the desired tube performance and filtrate quality. It should be discussed whether the contractor will need to meet certain performance standards (e.g., dewatering time, TSS concentration in filtrate).

2.15 Page 2-15, Paragraph 1, Section 2.3.6.1. It is stated that the WTP effluent will serve as the primary source of the approximately 300 gallons per minute (gpm) of polymer make-down water required (as specified from the design dosing rate obtained from the bench-scale testing). Details regarding the regulatory requirements for the potential use of Onondaga Lake and Ninemile Creek water as an alternative make-down water source will need to be discussed.

2.16 Page 2-15, Paragraph 3, Sentence 2, Section 2.3.6.1. It is stated that 5 to 10 gpm of flush water may be used when the solids content of the dredge slurry exceeds "certain percent solids." Please specify this value (e.g., > 12% solids).

2.17 Page 2-15, Section 2.3.7. A summary of the solids mass balance should be provided and include estimates of the volumes (in cubic yards) of sediment (of the total 2.172 million

CY), polymer/coagulant added to the tubes, and solids from the WTP that would be contained in the geotextile tubes as well as the volumes (in cubic yards) of separated materials that would be contained elsewhere in the SCA.

2.18 Page 2-16, Section 2.3.8. It is indicated in the table that the geotextile tube feed pump will have a 3,000 gpm capacity, while drawing D-105 indicates 6,000 gpm capacity. Thus, (2) should be added in the Description column for the number of geotextile tube feed pumps. Also, the sizes of the slurry tanks and SCA sump pumps should be included in the Comment column.

2.19 Page 2-16, Section 2.4 – This section discusses how the geotextile tubes will be dewatered and that additional information will be provided by the contractor. A detailed Operations and Maintenance (O&M) Manual must be developed and submitted to the Department for approval. This O&M manual must be a separately bound document to be kept at the SCA site for reference by the operator and the Department. The O&M manual should follow the general guidelines of Part 360-2.9, Operation and Maintenance Manual.

2.20 Page 2-19. Water draining from the geotextile tubes will flow into a gravel layer prior to being pumped to the water treatment plant. Has Honeywell evaluated whether or not the gravel layer will foul or plug due to solids and/or biological activity?

2.21 Page 2-21. The report states the following:, *After SCA closure, the liquids management system will handle remaining water that is generated by the continuing dewatering of the dredge material within the tubes and precipitation that infiltrates through the SCA cover."* How will this water be treated? How will Honeywell maintain the dewatering system within the SCA and ensure that no fouling of the piping or gravel layer occurs?

2.22 Page 2-21, Section 2.5.3.2, Paragraph 5 – This section discusses that each side of the SCA channel has sufficient capacity to carry the full design flow. Please provide the calculations that show what the full design flow is.

2.23 Page 2-22, Section 2.5.4. Since these "stormwater diversion basins" will contain SCA filtrate and stormwater in contact with the geotextile tubes, a different terminology should be used (e.g., SCA discharge temporary storage basins). In addition, the components of the composite liner system beneath these basins, the need for use of temporary covers, the potential impact of settlement from the adjacent SCA, and the conditions under which these basins will be utilized needs to be discussed with NYSDEC in advance of the submittal of the draft final design.

2.24 Page 2-22, Section 2.5.4 – This section discusses that each storage point will have sufficient capacity to hold the volume of water produced by approximately one day of dredging. Did the basis for the design address precipitation that will be falling on the basins as the basins are filling up with leachate?

2.25 Page 2-22, Section 2.5.4.1 – This section discusses that the worst case scenario for water storage is with one layer of geotextile tubes covering the SCA. The calculations showing this is the worst case scenario should be provided.

2.26 Page 2-23, Paragraph 1, Section 2.5.4.1. It is proposed that the existing wastebed leachate collection pond will be used for storage of the WTP effluent during METRO shutdown events and that the operational capacity of this pond to hold the required water volume will be validated during final design. A treated WTP effluent basin should be evaluated as opposed to the retention ponds.

2.27 Page 2-23, Paragraph 4, Section 2.6. As noted in a comment on Section 2.1 above, consideration should be given to the potential that there may be different tolerances for the handling of hard and/or oversized materials for the pumping system on the dredge itself, as opposed to the slurry pipeline. Cobbles, fragments of metals or concrete, timber, etc., that may be safely passed by the dredge's pump system may still have the potential to damage slurry pipeline components.

Section 3

3.1 Page 3-3, Table. Capping should begin in 2012 in order to minimize environmental exposure of contaminated sediments.

3.2 Page 3-3, Paragraph 2, Section 3.4. The outline of the Sediment Management Operations Contingency Plan (SMOCP) is general, and the contents of the future "Spill Control" section should be discussed with NYSDEC. At a minimum, spill control measures should account not only for controlling and recovering from a leak within the pipeline (for which secondary containment is provided by the double-wall pipe), but also for controlling and recovering from a spill that may result from a failure that results in a breaching of pump housing. At a minimum, this should include contingency for a spill of all slurry pipeline contents upgradient of the pump. Depending on the capabilities of the system's monitoring and instrumentation system, capacity for some quantity of slurry originating downgradient of a failed and breached booster pump (and which may still be subject to pumping by a prior booster pump), should also be included. In addition the mitigation of a geotextile tube failure should be discussed.

Appendix A

A.1 Table 2.1 in the report does not include the summary of the physical and geotechnical characteristics of the sediments in Remediation Area B since, as stated in the footnote, data are only available from four locations within the dredge prism (and these data are shown on page 3 of 10 in Appendix A). (In the dredging productivity calculations in Appendix B, the specific gravity and water content for Remediation Area B were assumed to be the same as Remediation Area C.) Page 1 of 10 in Appendix A combines the four locations from Remediation Area B with the locations from Remediation Area A and presents summary statistics for this combined data set. Since these summary values are not used in the productivity calculations and the same data and separate summary values for Remediation Areas A and B are on pages 2 and 3, respectively, page 1 of 10 should have been deleted.

Appendix B

B.1. Although the dredging productivity calculations in this appendix are reasonable, there should be some sensitivity analysis of key factors other than sediment volume, flow rate, and slurry solids content that may have a significant impact on productivity rates and dredging duration. For example, for Remediation Area D which has the largest volume, the dredge duration (241 days at 5,000 gpm and 10% solids) is less than for Remediation Area E (274 days) even though the dredge volume is about 500,000 CY lower in Remediation Area E. This difference is primarily attributable to the much higher average in-situ water content in Area D (148.5%) than in Area E (61%). If the average minus one standard deviation is used for water content in Area D (101%), the total dredge duration would increase from 3.35 seasons to about 3.8 seasons (at 5,000 gpm and 10% solids).

Appendix D

D.1 Drawing C-001, Appendix D. The pipeline route for the dredging of Remediation Areas A and B should be added to this figure and alignment plans for this section should be included in the next design document.

D.2 Drawings C-002 and C-003, Appendix D. The alignment of the pipeline for the WTP effluent to the discharge point should also be shown.

D.3 Drawing C-007, Appendix D. It should be indicated whether these cross sections are pre- or post-settlement. Also, see comments above related to terminology for the stormwater basins and liner requirements. For both the stormwater basins and the SCA, the final design should also include standard procedures for repairing tears, punctures, or other reasonably foreseeable damage that may impact the liners.

D.4 Drawings C-101 through C-117, Appendix D. A profile view of the pipeline along the alignment should be included with the plan views on these drawings.

D.5 Drawings D-001 through D-004, Appendix D. Include a legend and table of abbreviations for all symbols, similar to that included on drawing D-101.

D.6 Drawing D-001, Appendix D. It is believed that two slurry tanks should be shown upstream of the geotextile tube feed pumps as is shown for Phase 2 on drawing D-003.

Appendix E

The following editorial comments are offered to make the report easier to review by someone not intimately familiar with the site and/or present in the field during the wetland determination.

E.1 <u>Project Background, page 1</u>: The authors mention site features such as Settling Basin 9/10, 11, and 13, the Interbed Area, and the Sediment Containment Area. As various observations related to the wetland delineation are tied to these features, it would be useful if they were labeled on all the Figures.

E.2 The authors mention points A and C (survey area) and refer the reader to Figure 1. While points A and B are indeed labeled on Figure 1, point B is also labeled, yet not referred to in the text. This should be clarified.

E.3. Previously Delineated Wetlands, page 3: Wastebed B should be identified on the Figures where appropriate.

E.4. Figure 3: A number of wetlands are depicted on Figure 3 in blue hatching and one wetland (SYW-18) is depicted in red hatching. While it is mentioned in the text that SYW-18 is a New York State mapped wetland and that wetlands identified through the National Wetland Inventory program are present, there should be a legend indicating this.

E.5. Figure 5A: There is little contrast between the text and the underlying figure and it is difficult to read the text.

E.6 There is text present that is not part of the discussion (e.g., the red triangles with text referring to specific geographic locations) and it should be deleted for clarity.

E.7 WP 14 is listed twice in association with wetland 9 and 10. One listing is likely to be incorrectly labeled and should read WP 15. The detailed sub-figures used to detail wetlands 17 and 18 on Figure 5B would be useful for some of the smaller wetlands on Figure 5B.

Appendix F

F.1 Page 2, Paragraph 1, Appendix F. As discussed in a comment on Section 2.2.3 above, the pipeline hydraulic analysis models should also be provided for each section between booster pump stations to ensure adequate conveyance throughout the system, including the last section.

F.2 Page 3, Paragraph 1, Appendix F. In the Durand equation (Eq #2), the power of 1.5 is missing from the formula for the bracketed term. Also, this equation is 7.87 in Herbich (2000), not 7.86. In addition, the units for C_V should be provided (unitless fraction?) as well as the value used for the sediment drag coefficient (C_D) and its source.

F.3 Page 3, Hazen-Williams Method, Appendix F. It is not clear why the Hazen-Williams equation 7.85 from Herbich (2000), which is based on flow in gallons per minute (gpm), was converted to the form in which flow is in ft^3/s and pipe diameter is presumably in inches as in the Herbich equation (D was not defined below Equation 4 on page 3 which was previously defined in feet on page 2). The equation is sensitive to the value of power, therefore the same decimals in the original equation should be used. Also, a different coefficient is shown here on page 3 (4.57) than in the equation in the tables (4.73). Please clarify/revise.

F.4 Page 4, Paragraph 3, Appendix F. The minor head loss is calculated assuming nine plug valves and one check valve. It should be clarified if this corresponds to the intake and discharge of the five booster pumps.

F.5 Page 4, Paragraph 4, System Curves, Appendix F. It is stated that the hydraulic profile given in drawing C-025 was used in calculating headloss through the system. However, this drawing was not included in this intermediate design report and should be provided with the responses to these comments.

F.6 Page 5, Paragraph 1, Appendix F. It is indicated that a grain size of 0.2 mm was used for the calculations, including for terminal settling velocity, whereas on pages 6 and 7 it is indicated that 0.425 mm was used for calculating critical velocities and terminal settling velocity. Please clarify why two different values are used. If they should be the same, presumably 0.425 mm is the correct value based on the discussion on page 6.

F.7 Page 5, Paragraph 4, Appendix F. Should the Hazen-Williams approach prove to be overly conservative, does the possibility exist that an overestimated head loss could translate into an artificial need to pump additional water into the system to keep the flow at or above critical velocity? If so, the design should address this possibility and measures that could be taken to optimize flow rate vs. solids content (e.g., means of artificially inducing head loss, etc.).

F.8 Page 6, Paragraph 4, Sentence 2, Appendix F. It is stated that Table 3 shows the weight-based percentage of the fine sand sized particles, total sand sized particles, and total gravel and sand sized particles (0.075 – 75 mm). However, the percentages for the total gravel and sand sized particles are not included in Table 3.

F.9 Page 7, Paragraph 1, Appendix F. The F_L value used in the calculation of the critical velocity was 1.1. However, based on Figure 7.27 in Herbich (2000) at C_V = 4% and a grain-size diameter of 0.425 mm (as stated on page 7), F_L should be about 1.25 which results in a higher critical velocity of about 13 ft/sec. The F_L is about 1.1 with a grain size of 0.2 mm (see comment above).

F.10 Page 7, Paragraph 3, Appendix F. For Equation 10, D is defined as the pipe diameter in inches whereas in Equation 7.82 in Herbich (2000), d, which is the median grain diameter, is used in this equation. Please clarify/revise (e.g., if Equation 7.82 in Herbich is not correct for this application, it should not be referenced). Also, it is indicated that Vt (terminal settling velocity) was based on Figure 7.22 in Herbich (2000). The value for Vt shown in the calculations sheet is 0.08 ft/sec (24 mm/sec). It should be stated which relationship on Figure 7.22 was used for this estimate (e.g., Sand and Gravel); although it appears that a diameter of 0.2 mm was used rather than 0.425 mm.

F.11 Page 9, Paragraph 1, Appendix F. The symbol "γ" used in the power requirement equation should be defined as specific weight not specific gravity.

F.12 Page 11, Table with equations, Appendix F. The head loss due to friction in an equivalent pipe flowing with clean water (h_f) is missing in the Durand and Newitt equations. Please revise.

F.13 Page 11, Calculations Sheet, Appendix F. Any parameter values not previously defined in the text of the appendix should be defined in the calculation sheets along with a reference (e.g., kinematic viscosity of slurry, roughness, V_0, Reynolds number based on grain diameter, drag coefficient).

F.14 Page 11, Calculations Sheet, Table with equations, Appendix F. The Hazen-Williams equation is shown twice. Also, as noted in a comment above, there is a discrepancy between the constant value shown in this table (4.73) and the value in the equation on page 3 (4.57).

F.15 Page 12, Calculations Sheet, Appendix F. The total headloss calculated is for the entire pipeline length of about 20,000 ft. The value listed in Column 12 for the static head (elevation change) is 58.4 ft. The basis for this value is not clear as the elevation change from the lake to Wastebed 13 is about 77 ft (elevation 440 ft – 363 ft), which is what was used in the Operations IDS (Figure 4.7). Please clarify/revise.

Appendix G

G.1 Page 3, Paragraph 3, Section 4, Appendix G. Polymer screening notes are included in Appendix D of this appendix, not Appendix C. Please revise.

G.2 Page 3 (continued on Page 4), Paragraph 4, Section 4, Appendix G. Jar testing results are presented in Appendix E, not Appendix D. Please revise.

G.3 Page 5, Paragraph 4, Section 6, Appendix G. It is unclear as to what is meant by a 101% reduction of TSS (from SMU 6 at 3% solids). Based on Table 1, the percent reduction for 3% solids from untreated (446 mg/L) to treated (5 mg/L) is 98.9 %.

G.4 Page 6, Table 1, Appendix G. Units should be included for the TSS concentrations in the table (mg/L).

G.5 Page 10, Appendix G. It is noted in Section 3 (Hydrocyclone Testing) of Appendix G that the samples were diluted with site water to 10% solids by weight slurry for use in hydrocyclone testing. The Sample IDs in Appendix B (Initial Characterization) of this appendix for SMU 1B and SMU 6 note composite slurry samples of "approximately 10%." However, the data show that the composite sample from SMU 1B was diluted to about 8% solids and the sample from SMU 6 was diluted to about 5% solids by weight. The text in Section 3 should be clarified.

Appendix H

H.1 Page 3, Appendix H. It is noted here and in Appendix G that foam was generated and became stable during mixing of lake water with SMU 1 sediments to replicate the dredge slurry. It is also noted that the presence of this foam would impact the screening and hydrocyclone processes. Although use of hydrocyclones is not proposed for SMU 1 (ILWD) sediments, the presence of this foam will need to be considered and managed at each of the slurry pre-processing steps (e.g., screening, polymer addition).

Appendix I

I.1 Mass Balance Calculations, Excel file, Phase 2 5,000 gpm and 3,500 gpm sheets, Appendix I. In calculating the "Weight of Water Remained in Stockpile" (Row 112), only the removed over-sized particles from the primary screening (cell B32) was used. Although this is correct for Phase 1, the removed gravel from the secondary screening (cell B50) and the removed sand from the hydrocyclone (cell B62) should also be included in the calculation for Phase 2.

DRAFT ONONDAGA LAKE SEDIMENT MANAGEMENT INTERMEDIATE DESIGN

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FEBRUARY 2010

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APPENDIX H MINERAL PROCESSING SERVICES PHASE VI ADDENDUM 6 SUMMARY REPORT

APPENDIX I MASS BALANCE CALCULATIONS

LIST OF ACRONYMS

AOS	apparent opening size
AQMP	Air Quality Monitoring Plan
cm/sec	centimeters per second
CPP	Citizens Participation Plan
CPWG	Community Participation Working Groups
CQAPP	Construction Quality Assurance Procedures Plan
CSX	CSX Corporation
CY	cubic yard(s)
fps	feet per second
gpm	Gallons per minute
HDPE	high-density polyethylene
Honeywell	Honeywell International Inc.
IDS	initial design submittal
ILWD	in-lake waste deposit
LLDPE	linear low-density polyethylene
Metro	Metropolitan Wastewater Treatment Plant
MGD	million gallons per day
mg/L	milligrams per liter
MNR	Monitored natural recovery
NPL	National Priorities List
NYSDAM	New York State Department of Agriculture and Markets
NYSDEC	New York State Department of Environmental Conservation
NYSDOT	New York State Department of Transportation
OBG	O'Brien & Gere
OCWA	Onondaga County Water Authority
OSHA	Occupational Safety and Health Administration
PDI	Pre-Design Investigation
P-GDT	pressure-gravity dewatering test
QA	Quality Assurance
RA	Remediation Areas

LIST OF ACRONYMS
(CONTINUED)

RDT	rapid dewatering test
RDWP	Remedial Design Work Plan
ROD	Record of Decision
ROW	right-of-way
SCA	sediment consolidation area
SMOCP	Sediment Management Operational Contingency Plan
SOW	Scope of Work
SMU	Sediment Management Unit
SVOC	semi-volatile organic compound
TDH	total dynamic head
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
WST	Waste Stream Technology, Inc.
WTP	water treatment plant

EXECUTIVE SUMMARY

Honeywell continues the progress toward achieving the goals of the Record of Decision (ROD) and the community's vision for a restored Onondaga Lake with the development of this Sediment Management Intermediate Design. This Intermediate Design presents the intermediate-level design details associated with the conveyance and dewatering of the sediments to be dredged as part of the remedy, and the supporting infrastructure and processes that will support those operations. The lake remediation plan, which was selected by the New York State Department of Environmental Conservation (NYSDEC) and the U.S. Environmental Protection Agency (USEPA), calls for a combination of dredging and capping – standard environmental cleanup methods that will address the contamination in lake sediments and water. This Intermediate Design is an advancement of the design for the transportation and dewatering phases for the sediments that will be dredged.

Honeywell's remedial design effectively restores Onondaga Lake while ensuring long lasting protection of health and the environment by meeting the design and performance criteria consistent with the requirements set forth in the ROD and associated Consent Decree Statement of Work (SOW). This design is the culmination of work from more than 100 local engineers and scientists working with nationally recognized experts from various universities, research institutions, and specialty engineering firms, with input from community stakeholders.

Community input remains a vital component of Honeywell's design for the restoration of Onondaga Lake. Honeywell is committed to working with community leaders, interested stakeholders, and citizens to include input, recommendations, comments, and perspectives into the design process. Community members have the opportunity to participate in the design, construction, and post-construction periods as detailed in the NYSDEC's Citizen Participation Plan (CPP) (NYSDEC, 2009). Feedback received through the community participation process has already had a considerable influence on design-level decisions in several areas of the remedial design, including:

- Geotextile tubes for sediment dewatering (i.e., control of potential odors)
- Hydraulic dredging and transportation
- Secondary containment of the slurry pipeline

The selected remedy outlined in the ROD calls for the dredging and disposal of up to an estimated 2.65 million cubic yards (CY) of contaminated sediments, construction of an isolation cap over an estimated 425 acres in the shallower areas of the lake, construction of a thin-layer cap over an estimated 154 acres in the lake's deeper areas, construction and operation of a hydraulic control system along part of the shoreline, completion of a pilot study to evaluate methods to prevent formation of methyl mercury, wetland and habitat restoration, monitored natural recovery, and long-term maintenance and monitoring.

Onondaga Lake Design Process

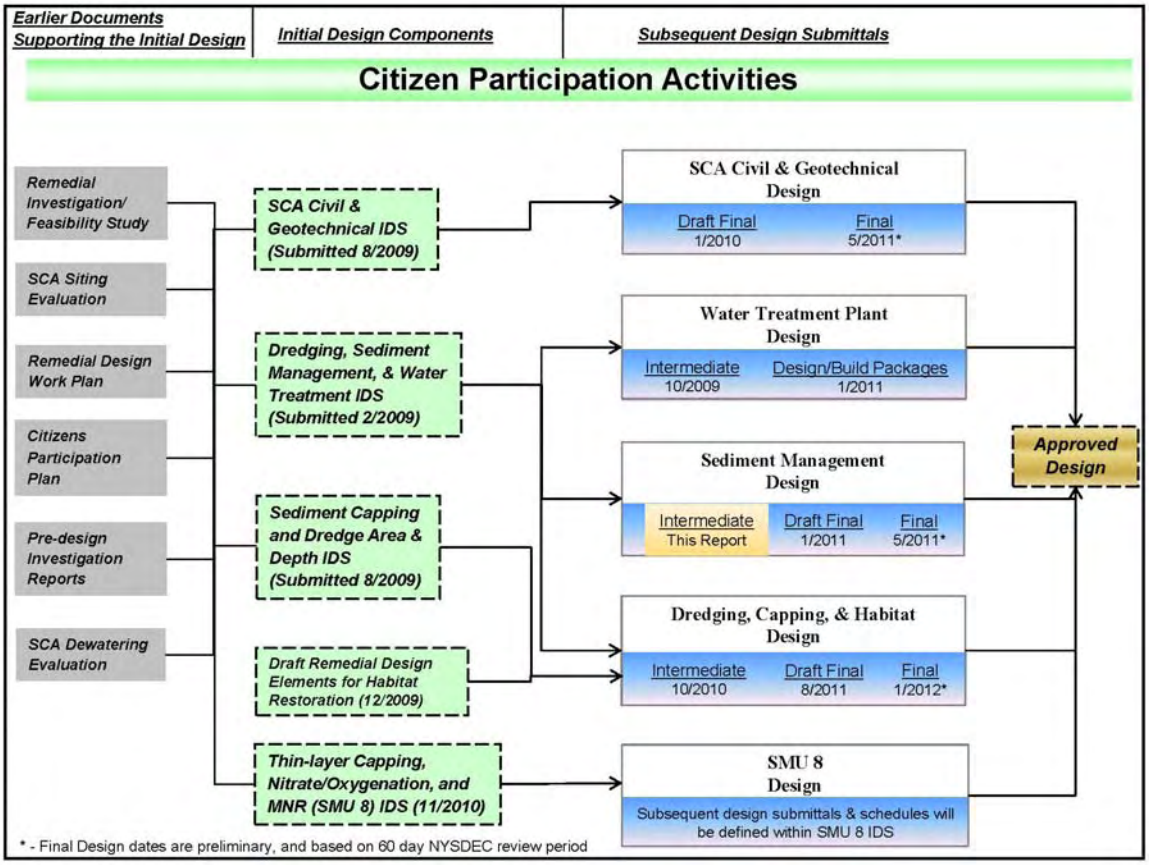
The Remedial Design Work Plan (RDWP) describes how the designs for all the various components of the remedy will be developed and distributed. As detailed in the RDWP, the remedial design will include the preparation of four IDSs, each of which will be submitted separately, and will address various elements of the remedy. Separating the design into four initial submittals has allowed for a streamlined schedule associated with critical path activities. The four initial design submittals (IDSs) include the following:

- Dredging, Sediment Management, and Water Treatment (Submitted February 2009)
- Sediment Consolidation Area (SCA) Civil and Geotechnical IDS (Submitted December 2009)
- Capping and Dredge Area and Depth IDS (Submitted December 2009)
- Thin-Layer Capping, Nitrate Addition/Oxygenation, and Monitored Natural Recovery (MNR) IDS (scheduled for submittal 11/25/2010)

Following the initial phase of the design, separate design tracks were established, with each track ultimately constituting a portion of the overall Onondaga Lake Design. These design tracks include:

- SCA Civil & Geotechnical Design
- Water Treatment Plant (WTP)
- Sediment Management
- Dredging, Capping, & Habitat
- SMU 8 (deep water)

The graphic below depicts the overall Onondaga Lake Design process, how project documents submitted to date serve as the basis for the various design tracks, and presents the schedule for the submittal of the remaining design components.



General Schematic of Onondaga Lake Design Process

This Intermediate Design is an advancement of the design for the conveyance of the dredge slurry to the SCA, the dewatering of the sediments, and the infrastructure needed to support these operations. This Intermediate Design incorporates comments received from the NYSDEC on the Dredging, Sediment Management, and Water Treatment IDS and further develops the design for these remedial components.

Slurry Conveyance

The slurry conveyance system will incorporate several components that ensure the integrity of the pipe and conveyance operation, while protecting human health and the environment.

Sediment will be hydraulically dredged from the lake remediation areas and will be pumped through a flexible pipe to an onshore support area. Upon reaching shore, this wet sediment mix ("dredged slurry") will be routed into a double-contained slurry pipeline, where it will be conveyed to the SCA, located on Wastebed 13. From the lake to the SCA, the dredged material is never exposed to the air. In fact, secondary containment will be provided for the entire length of the pipe through the use of a double-walled pipe, lined channel, or other containment means. A leak detection system in the pipeline will also be incorporated into the design.

Sediment Dewatering

Sediment dewatering is a necessary step in the sediment management process, and includes several material screening steps. These steps, including oversize material/debris screening and

gravel/sand removal, are designed to enhance the primary method of dewatering, which is through the use of geotextile tubes. After the dredge slurry passes through the screening steps, it will be injected into the geotextile tubes for final dewatering and management.

Geotextile tubes were selected for dewatering based on an enhanced ability, over alternative dewatering methods, to achieve the various project objectives, including:

- Objective 1 - protect the public and wildlife during SCA operations
- Objective 2 - facilitate efficient emissions and odor management
- Objective 3 - protect workers during SCA operations
- Objective 4 - maintain geotechnical stability and SCA liner system integrity
- Objective 5 - meet operations requirements
- Objective 6 - select a method acceptable to the public
- Objective 7 - meet cell closure requirements
- Objective 8 - minimize dewatering area
- Objective 9 - enhance the water treatment process
- Objective 10 - minimize imported material quantities

Water seeping from the geotextile tubes, as well as precipitation falling into the SCA, will be collected in a controlled drainage system and sent to the SCA WTP, for treatment.

The design team will continue to work with the community to develop various performance criteria and work plans specifically designed to ensure that the health and safety of the surrounding community and environment are maintained throughout the execution of the remedy. The community health and safety plans that will be developed as part of the final Onondaga Lake design will include:

- Site Security & Community Safety Plan
- Air Quality Monitoring Plan (AQMP)
- Spill Contingency Plan
- Traffic Management Plan
- Noise Abatement Plan

- Navigational Protection Plan

Honeywell is also committed to minimizing the carbon footprint of remedial construction activities. Evaluations are being conducted to identify opportunities to incorporate sustainability concepts, including those presented in the Clean and Green Policy (USEPA, 2009) into all aspects of the remediation. To the extent practicable, use of renewable energy sources, utilization of locally produced/sourced materials and supplies, reduction/elimination of waste, efficient use of resources and energy, and other practices will be specified in the remedial design, and implemented during remedial construction.

SECTION 1

INTRODUCTION AND DESIGN PROCESS OVERVIEW

This Onondaga Lake Sediment Management Intermediate Design has been prepared on behalf of Honeywell International Inc. (Honeywell). The lake bottom is on the New York State Registry of Inactive Hazardous Waste Sites and is part of the Onondaga Lake National Priorities List (NPL) Site. Honeywell entered into a Consent Decree (United States District Court, Northern District of New York, 2007) (89-CV-815) with the NYSDEC to implement the selected remedy for Onondaga Lake as outlined in the ROD issued on July 1, 2005. The following documents are appended to the Consent Decree: ROD, Explanation of Significant Differences, SOW, and Environmental Easement.

This Design Report provides an intermediate-level design evaluation of components of the Onondaga Lake Remediation pertaining to the conveyance and management of dredged sediments from the lake. This Report has been prepared in advancement of several of the components of the conceptual level design previously submitted in the Onondaga Lake Dredging, Sediment Management, and Water Treatment Initial Design Submittal (Parsons, 2009). For other key aspects of this design, advancement of design details will completed as part of the final phase of design, in collaboration with the dredging contractor that will selected for this project. A dredging contractor will be selected in the first quarter of 2010.

1.1 DESIGN PROCESS OVERVIEW

As described in the Dredging, Sediment Management, and Water Treatment IDS (Parsons, 2009), the conceptual design of the Onondaga Lake Remediation was split into four IDSs. These IDS reports included:

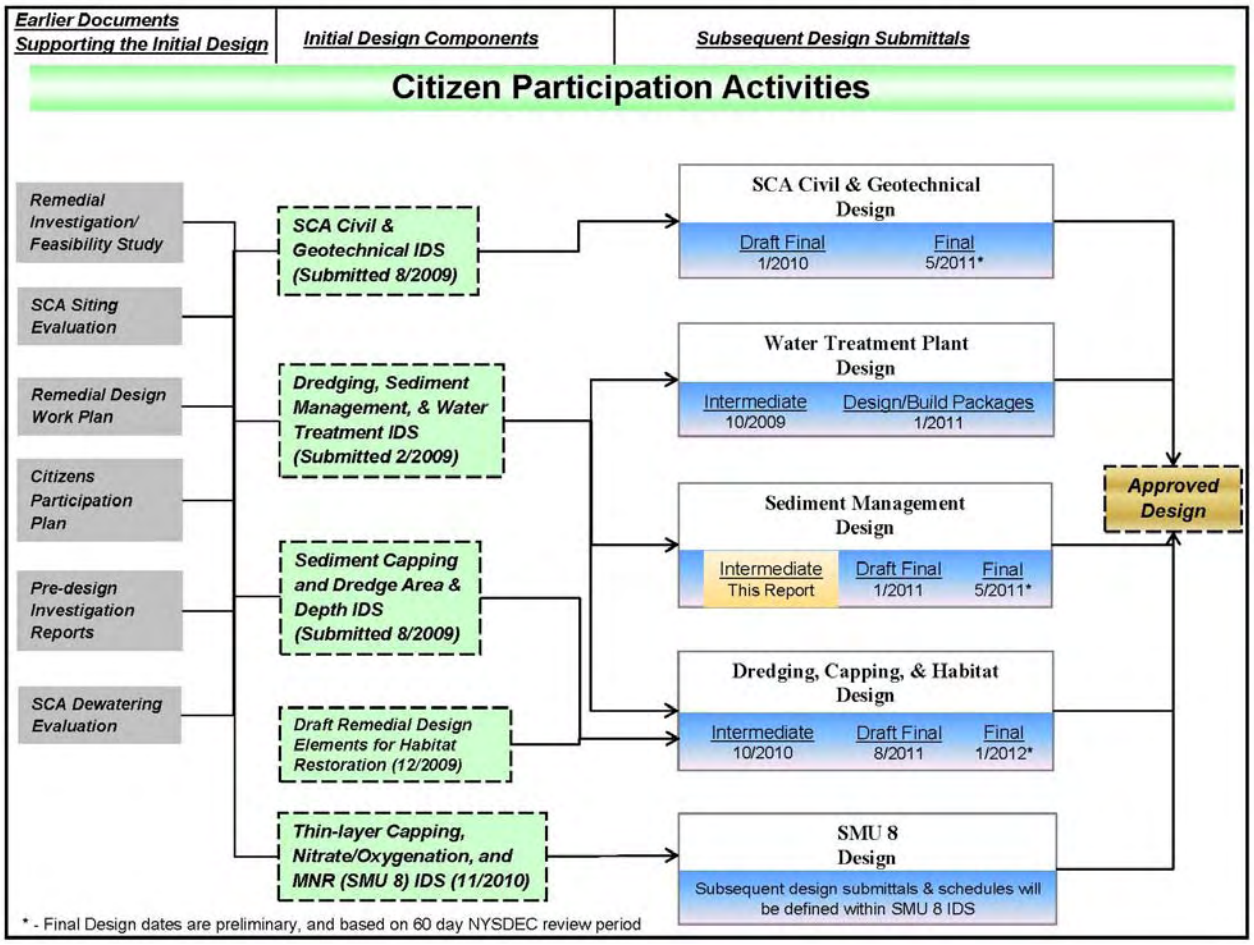
- The *Dredging, Sediment Management, and Water Treatment IDS* (hereafter referred to as the Operations IDS) provided initial design-level information pertaining to operational components of the remedy including the dredging, conveyance, and dewatering of impacted lake sediments, and treatment of construction water generated during the process. This IDS was submitted in February 2009.
- *The SCA Civil & Geotechnical IDS* (hereafter referred to as the SCA IDS) included the civil and geotechnical design elements (e.g., liner system) required for construction of the SCA. This IDS was submitted in August 2009.
- *The Sediment Cap and Dredge Area Depth and Volume IDS* (hereafter referred to as the Dredging & Capping IDS) included the proposed, conceptual level, design detail for the sediment cap component of the remedy, as well as the design details pertaining to habitat restoration, and dredging volumes and removal areas/depths. This IDS was submitted in December 2009.
- *The Thin-Layer Capping, Nitrate Addition/Oxygenation, and MNR (SMU 8) IDS* focuses on the deep water areas of the lake, and will provide initial design-level details pertaining to thin-layer capping (including locations, extent, materials, and sequencing), nitrate addition and/or oxygenation for the purposes of inhibiting the

formation of methylmercury within the lake, and the approach to monitoring natural recovery in specific areas of the lake. This IDS will be submitted in November 2010.

Following the initial phase of the design, separate design tracks were established, with each track ultimately constituting a portion of the overall Onondaga Lake Design. These design tracks include:

- SCA Civil & Geotechnical Design
- Water Treatment Plant (WTP)
- Sediment Management
- Dredging, Capping, & Habitat
- SMU 8 (deep water)

The graphic below depicts the overall Onondaga Lake Design process, how project documents submitted to date serve as the basis for the various design tracks, and presents the schedule for the submittal of the remaining design components.



1.2 INTERMEDIATE DESIGN SUBMITTAL ORGANIZATION

This design report documents design and analysis that were completed to advance the slurry conveyance and sediment dewatering operations initially included in the Dredging, Sediment Management, and Water Treatment IDS (Parsons, 2009). This Intermediate Design is organized into four sections and nine appendices. A summary of each section is provided below.

- Section 1: Introduction and Design Process Overview – Presents a summary of the overall Onondaga Lake Remedial Design process, and the contents of this Intermediate Design.
- Section 2: Engineering Analysis and Design – Provides intermediate-level design details and technical evaluation for specific aspects of the remedy included in the sediment management aspects of the project.
- Section 3: Draft Final Sediment Management Design Submittal – Summarizes the content of the Final Design submittal, including a preliminary list of specifications and Drawings to be included.
- Section 4: References – Lists the references used to prepare this Intermediate Design Report.

SECTION 2

ENGINEERING ANALYSIS AND DESIGN

As described in Section 1, this Intermediate Design focuses on the conveyance and dewatering of dredged sediment at the SCA, and supporting operations. This design report summarizes the advancement of details for several remedial components, initially provided in the Operations IDS (Parsons, 2009). For other key aspects of this design, advancement of design details will completed as part of the final phase of design, in collaboration with the dredging contractor that will selected for this project. A dredging contractor will be selected in the first quarter of 2010.

2.1 SEDIMENT CONVEYANCE AND DEWATERING SCOPE OVERVIEW

Sediments from Onondaga Lake will be dredged hydraulically from the remediation areas (RAs) within the lake. Details pertaining to the definition of material that will be dredged (e.g., areas, depths, etc) and operational details associated with the dredging process will be addressed as part of the Dredging and Capping Design. The dredged sediment will be conveyed hydraulically, as slurry, from the lake to the SCA (located on Wastebed 13) utilizing a series of booster pumps.

Once at the SCA, the dredge slurry will be passed through several sediment screening steps. These steps, including oversized-material screening and gravel/sand removal, are designed to enhance the geotextile tube dewatering process, the primary method of sediment dewatering.

Following these material separation steps, the slurry will undergo polymer injection, which will precondition the slurry for dewatering within the tubes.

Next, the dredged sediment will be discharged into geotextile tubes for final dewatering. The geotextile tubes will be managed within the lined SCA, which will collect and manage water discharged from the geotextile tubes. Details pertaining to the design of the SCA are presented in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010).

The geotextile tube filtrate and water coming into contact with filling tubes or dredged sediment (herein referred to as contact water) will be collected and routed to the WTP for treatment (metals, volatile organic compound [VOC]/semi-volatile organic compound [SVOC]/total suspended solids [TSS] removal) prior to discharge to Onondaga County Metropolitan Wastewater Treatment Plant (Metro), for ammonia removal.

There are several areas associated with design and construction of the slurry conveyance and sediment dewatering operations where adaptive management concepts may be appropriate. Adaptive management refers to enhancements to project implementation based on lessons learned and from actual experience gained during the course of the project. These lessons learned can lead to revisions to the assumptions that were made during the course of the design, allowing the project construction schedule and final effectiveness to be optimized. Specific areas of the sediment management design and construction where adaptive management may be appropriate include the application of material (oversized, gravel, sand) screening steps,

optimum production rates, polymer injection operations, and geotextile tube operations. Each of these areas of the sediment management design are discussed in detail below.

2.1.1 Dredge Volume

The current estimate of sediment volume to be dredged from the Lake is approximately 2,172,000 CY, which includes the current best estimate volume and contingency volumes. This volume estimate reflects data collected through the Phase V PDI, detailed design evaluations, and detailed dredge volume estimation that were completed as part of the Dredging & Capping IDS (Parsons, 2009). The breakout of this volume by remediation area, base volume, and contingency volume, is presented in the table below. Details pertaining to the development of these dredge volume estimates, including the basis for the contingency volumes, are provided in the Dredging & Capping IDS (Parsons, 2009). This volume provides the basis for operational design of the conveyance and dewatering systems presented herein.

Remediation Areas	Surface Area (AC)	Base Dredge Volume (cy)	Contingency Volume (cy)	Design Volume (cy)
A	23.6	133,000	38,000	171,000
B	2.9	20,000	5,000	25,000
C	7.0	38,000	11,000	49,000
D	89.2	1,147,000	57,000	1,204,000
E	83.8	588,000	135,000	723,000
Total	206	1,926,000	246,000	2,172,000

2.1.2 Design Flowrate and Dredge Productivity

The dredging, slurry conveyance, pre-processing, and geotextile tube dewatering processes will be an integrated system, with each process designed to operate within constraints imparted by each of the other components. The primary design factor common to each of the system components is the maximum design slurry flowrate. This flowrate, generated by the dredge, will largely dictate the sizing and capacity of each of the remaining components.

Successful completion of the sediment dredging in the four year schedule required by the Consent Decree will depend on, among several factors, the capacity of the dredging and conveyance systems to move the sediments at a sufficient rate. Two main variables dictating the ability of the system to meet the required schedule include the flowrate produced by the dredge, and the average percent solids (percent by weight, contained within the dredge slurry) that the dredging operation is able to maintain.

Maintaining percent solids will depend on both the performance of the dredging contractor, and on the geotechnical characteristics of the material that is being dredged. Geotechnical characteristics that were initially presented in the Operations IDS (Parsons, 2009) have been updated to reflect additional data collected and modifications to the Remediation Area delineation that was completed as part of the Dredging and Capping IDS (Parsons, 2009). These statistics are based on the five phases of design investigation which has been completed prior to the preparation of this report. As part of this design investigation, nearly 10,000 samples were collected, and more than 200,000 chemical and geotechnical analyses were completed. These

updated sediment characteristics are summarized in Table 2.1, and presented in greater detail in Appendix A.

To assess the impact of these two variables on the overall dredge schedule, and to assess capacity requirements of the conveyance system, a dredging productivity sensitivity analysis was completed. The methodology of this analysis is included in Appendix B, and the results are summarized in the table below. As detailed in Appendix B, the durations shown in the table below assume an average dredging "up-time" (effective time in which the dredge is actually dredging sediment in a given period of time) of 70%. This factor accounts for routine maintenance, shift changes, dredge relocation, and other operational factors. Similarly-executed dredge projects have maintained up-time factors of greater than 80%. In addition, this calculation is based on an assumed dredging schedule of 24 hours per day, 7 days a week, 30 weeks a year (approximately mid-April to mid-November), and an estimated 32 Metro shutdown days. Further details pertaining to this Metro shutdown analysis are presented in Appendix C.

Based on experience at other similar dredging projects that have been completed, it is not uncommon for dredging operations to decreased levels of "up-time" during startup periods (e.g., beginning of the dredging project, start of a new dredging season, etc.). Often times, during these startup periods, various components of the dredging/conveyance/dewatering system will require adjustments to be made as field conditions may be different from what was anticipated during the system design. The duration of this period, and the degree to which it impacts production vary from site to site. Due to the scale of the project, the dredging/conveyance/ dewatering systems that will be constructed for the Onondaga Lake project may be subject to similar "ramp-up" periods, where system "up-time" fall short of the estimated 70% average. However, it is anticipated that maintaining the average 70% "up-time" over the duration of the project, including start-up periods", will be achievable.

Estimated Dredge Volume - 2,172,000 cy						
	Dredge Design Flowrate					
Average % Solids	4500 gpm	4800 gpm	5000 gpm	5200 gpm	5500 gpm	5700 gpm
	Dredging Duration (Seasons)					
12%	3.06	2.87	2.75	2.65	2.50	2.42
11%	3.36	3.15	3.02	2.91	2.75	2.65
10%	3.72	3.49	3.35	3.22	3.04	2.94
9%	4.16	3.90	3.75	3.60	3.40	3.29
8%	4.71	4.42	4.24	4.08	3.86	3.72
7%	5.42	5.08	4.88	4.69	4.43	4.28

As described in the Operations IDS (Parsons, 2009), based on an evaluation of the thickness and nature of the dredge cuts required in the various remediation areas, it is estimated that the solids by weight of the slurry produced by the dredge will vary between 7-12%. For the purposes of this design report, an average percent solids of 10% by weight is assumed. Under this scenario, compliance with the four-year dredge schedule would be feasible over a broad range of design flowrates within the pipeline. The design flowrate will be optimized to provide sufficient capacity to ensure the dredging can be completed in the schedule outlined in the ROD, without exceeding the design throughput capacity of the WTP, which has been sized to maximize discharge to Metro to the anticipated permit-limit of 6.5 million gallons per day

(MGD). For the purposes of this Intermediate Design, a maximum flowrate of 5,000 gallons per minute (gpm) is assumed as the operational output from the dredge. This design flowrate will be subject to modification during the final design, based on the actual equipment selected/proposed by the dredging contractor. This final flowrate, and the corresponding design details of the conveyance system, will be presented in the final design.

2.2 SLURRY CONVEYANCE

Sediments dredged from the RA's will be pumped hydraulically from the dredge head through an in-water (floating or submerged) pipeline to the lakeshore. When necessary, in-water booster stations may be utilized by the dredging contractor to convey the slurry to shore over distance greater than the capacity of the dredge pump. Details pertaining to these in-water booster pumps will be provided by a contractor submittal during remedial operations. Upon reaching shore, the pipeline will be routed on land, and use a series of booster pumps to convey the slurry to the sediment processing area located adjacent to the SCA. A general layout drawing of the slurry pipeline is presented in Drawing C-004 (see Appendix D).

2.2.1 Design and Performance Criteria

Based on dredge schedule requirements, water balance determinations, and water treatment flowrates, a maximum flowrate of 5,000 gpm is assumed as the operational output from the dredge. The slurry conveyance system is being designed to operate 24 hours a day, and will operate as a complete system with the dredging equipment selected for the project. As such, final sizing of the operational capacity of the system, including booster pump size and pipeline diameter, will be coordinated with the dredging equipment specified by the selected dredging contractor. Capacity of this system will be sized to handle anticipated dredging production levels, and will be sufficient to allow for the completion of the dredging operation within the four-year time frame required by the ROD. Selection of the dredging contractor will be completed in early 2010. Finalization of this system, including the targeted slurry flowrate will be completed as part of the final design.

To ensure the protection of human health and the environment, the design of the slurry conveyance system incorporates several measures and procedures to ensure the integrity of the pipe and conveyance operation. Secondary containment will be provided for the entire length of the pipe, through the use of a double-walled pipe, lined channel, or other containment means. The specification of the secondary containment measures will be completed as part of the final design. In addition to secondary containment, means for leak detection in the pipeline will be incorporated into the design. The detailed pipeline design will clarify leak detection measures and procedures.

Several design and operational procedures will also be specified to minimize the potential for slurry back flow if a booster pump or dredge pump fails. These will be presented in the Sediment Management Final Design. In addition, prior to regularly planned shutdown periods of the slurry conveyance system, the pipe will be rinsed with lake water to remove solids contained within the pipe. Furthermore, a supply of key replacement parts will be kept onsite, to allow for quick repair/replacement and to minimize system downtime.

The slurry pipeline alignment and associated supporting utilities requires coordination and approval by other third parties, property owners, and entities. Several of these groups have

specific requirements (e.g., occupancy permits, operational limitations, etc.) for the design and operation of the slurry pipeline, which will be addressed as part of the remedial design.

2.2.2 Slurry Pipeline Alignment

The slurry pipeline alignment was selected based on several factors, including minimization of both visibility and accessibility of the pipeline to the public. In general, the pipeline and booster pumps will be located as far away from areas of heavy public use as possible.

When dredging in Remediation Areas C, D, or E, the pipeline will transition from water to land near Wastebed B, which is close to the dredging that will occur in the southern end of the lake. From Wastebed B, the pipeline will run along the western shore of the lake, along the western side of the Wastebeds 1-8 site adjacent to the I-690 corridor, to an intersection point with Ninemile Creek. From the creek intersection point, the pipeline will then follow the Ninemile Creek corridor to Wastebed 13. The total length of the pipeline from Wastebed B to the SCA is approximately 19,830 feet (3.75 miles).

During dredging in Remediation Areas A and B, the pipeline may be routed directly to an intersection point with Ninemile Creek, at its discharge to Onondaga Lake. For this stretch, the pipeline will be located on land adjacent to the creek.

Drawings C-101 through C-117 (see Appendix D) present the pipeline route. The alignment depicted in these drawings will be finalized as part of the final design, and may be subject to modifications based on detailed engineering analysis, and access agreement/permitting discussions with various property owners. In addition, drawings included in the final design will depict final booster pump locations, necessary utility connections, infrastructure requirements, and other design features. Additionally, grading plans in the areas of these booster pumps will be prepared, in areas where existing conditions are not conducive to the siting of a booster location.

2.2.2.1 New York State Department of Transportation (NYSDOT) Requirements

As depicted in Drawings C-105 through C-109, a portion of the slurry pipeline will be located proximate to the I-690 west bound lane, and will cross beneath the I-690 Westbound Exit 6 Ramp connecting to NY-695S (Drawing C-107). To cross this exit ramp, underground installation of the pipeline using trenchless technology will be required. To ensure compliance and acceptance by NYSDOT for these portions of the slurry pipeline, a Highway Permit and a Use and Occupancy Permit will be obtained. As part of the permit application process, the following design details, at a minimum will be provided to NYSDOT, per their requirements:

- Set of highway drawings, depicting property boundaries, existing structures and utilities, proposed pipeline route and supporting structures, and proposed power line routes
- Proposed plans for pipeline, booster pumps, and power line installation/operation/ decommission
- Contingency plans for pipeline breakage/leakage
- Highway permit application (covers installation/operation/decommission)
- Use and occupancy permit application (covers installation/operation/decommission)

The permits described above will be obtained prior to initiating any of the construction activities associated with the slurry pipeline. To facilitate the initiation of dredging activities in 2012, the slurry pipeline is expected to be constructed in 2011. To ensure all necessary NYSDOT requirements are met, the permitting process has been initiated concurrent with the preparation of this Intermediate Design.

In addition to these permits, the pipeline installation will also adhere to the requirements outlined in the "Guidelines in New York State Highway Design Manual". Requirements will include the installation of additional NYSDOT specified highway guardrails.

2.2.2.2 New York State Department of Agriculture and Markets (NYSDAM) Requirements

As depicted in Drawings C-105 through C-109, a portion of the slurry pipeline will be located on property owned by the NYSDAM and used by the New York State Fair as parking lots during events. To ensure all necessary NYSDAM requirements are met, discussions with NYSDAM have been initiated concurrent with the preparation of this Intermediate Design.

2.2.2.3 Ninemile Creek / Wetland Considerations

To the extent practicable, the pipeline alignment has been selected so as to minimize the impact of the slurry pipeline and any supporting infrastructure (e.g., service road) on the identified wetland areas and Ninemile Creek. Placement of the pipeline within or alongside the creek will be minimized to the extent practicable, to protect the natural habitats contained within these areas. Honeywell will continue to coordinate with NYSDEC and USEPA to finalize this alignment to optimize these factors, and provide maximum protection to these habitat areas.

In support of the design of the slurry pipeline, wetland delineation was performed along the pipeline route, upstream of the confluence of Geddes Brook. This work was completed by O'Brien & Gere (OBG), under a NYSDEC approved work plan (Honeywell, 2009). A summary report has been prepared for this delineation effort, and is included as Appendix E. A total of 20 individual wetland areas were identified and delineated as part of this effort. These areas have been incorporated into the pipeline alignment drawings included as Appendix D. Following completion, any impacted wetlands will be restored. Details pertaining to the restoration of these areas will be presented in the final design.

The pipeline alignment presented in Drawings C-101 through C-117 (see Appendix D) will cross the creek twice (crossing from one bank to the other) to reach the SCA. The first crossing location is in the vicinity of State Fair Boulevard, and the second crossing is near the southwest corner of the Wastebeds 9-11 site. The location of these crossings will be finalized during the Final Design, in coordination with the Ninemile Creek remediation project team, and NYSDEC/USEPA. To maintain the navigability of the Creek, and to minimize the potential for the pipeline to act as a barrier to floating debris (trees, branches, leaves, etc.) flowing downstream, the slurry pipeline will be submerged in locations where it crosses from one side of Ninemile Creek to the other.

2.2.2.4 Ninemile Creek Remediation

As depicted in Drawings C-110 through C-113, a portion of the slurry pipeline will be located in or along portions of Ninemile Creek where construction activities associated with the

remediation of the Creek will take place. Due to spatial constraints on the shoreline between the Creek and I-695 exit ramp crossing over the creek, the slurry pipeline may be situated in the creek or along the bank for limited portions of this stretch. Coordination with the Ninemile Creek project will minimize the impacts of the slurry pipeline on the remedial activities associated with the Creek, and identify efficiencies where constructed infrastructure can be designed to support both projects.

2.2.2.5 CSX Corporation (CSX) Requirements

The slurry pipeline will cross through CSX's right-of-way (ROW) in two locations. The first crossing, shown on Drawing C-110 (see Appendix D), is under the former Erie Lackawanna line adjacent to State Fair Blvd and the 690-695 interchange. CSX regulations do not allow utility pipeline occupancy under or within 45 ft of any railroad bridge, unless by special design and approval by the CSX Chief Engineer. Since CSX approval is not certain at this time, the option of installing the pipeline using trenchless technology under the railroad and State Fair Blvd along the bank of Ninemile Creek is being advanced concurrently with the request for CSX approval. The second CSX crossing is under three adjacent tracks north of the SCA area shown in Drawing C-116. The pipeline will cross under the tracks to the east of the Ninemile Creek railroad bridge.

CSX's regulations and preferred procedures for operating in their ROW are outlined in the "Design and Construction Standard Specifications: Pipeline Occupancy". Standard design procedures for utility encroachment will be followed in applying for these two permits (permits are granted on per location basis) so they can be considered standard proposals by CSX. The slurry pipeline high-density polyethylene (HDPE) "carrier" pipe is required to be encased in steel within the CSX ROW. CSX's standard method of underground pipeline installation for casings up to 36 inch pipe is bore and jack which uses a rotating auger bore.

To obtain permits for the two CSX crossings, two application packages will be submitted for CSX review and approval. The Facility Encroachment Application Packet for new installations includes:

- Utility Encroachment Form
- Drawings in CSX's required format showing: the pipeline plan view, pipeline profile view and the cross sectional view
- Review fees based on the size of casing

2.2.3 Pipeline and Booster Pump Hydraulic Design

This section discusses the approach that will be taken for the hydraulic design the slurry conveyance pipeline and associated booster pump stations. For the purposes of demonstrating the approach that will be taken for hydraulic modeling, an example calculation is included in Appendix F. The design approach includes definition of the following items:

1. Critical (minimum) flow velocity
2. System total dynamic head (TDH)
3. System horsepower requirements
4. Booster pump size (Hp), number, and location

A critical (minimum) flow velocity must be maintained in the pipe to prevent excessive settling of particles in the pipe. As flow velocities increase within the pipeline, the system TDH also increases, which increases the pump energy input to convey the material at that velocity. One focus of the slurry conveyance hydraulic design will be to weight these two factors and select the optimum pipe size that meets critical velocity criteria but also minimizes TDH and pumps energy requirements.

Based on the geotechnical properties of the dredge material and a review of standard HDPE pipeline sizes, the critical velocity is estimated to be 12.5 feet per second (fps) for pipeline sections with an 8% incline. An example calculation is included in Appendix F for demonstrating the approach to critical velocity calculation. This critical velocity assessment will be finalized in conjunction with the selection of the dredging equipment.

Based on the above critical velocity estimates and the corresponding requirement to limit system TDH and pump energy requirements, 16 inch DR9 HDPE pipe (average inner diameter 12.3 inches) may be utilized for the conveyance line. Preliminary TDH calculations have been completed using this pipe size to range-find the size, number, and location of the booster pumps that may be employed in the conveyance system. Pipeline TDH and corresponding horsepower requirements were estimated using four different hydraulic models commonly employed in slurry conveyance modeling, as follows:

1. Hazen-Williams model
2. Darcy-Weisbach model
3. Durand model
4. Newitt model

Based on the preliminary hydraulic modeling, it is estimated that the system TDH will range from 800 feet to 1000 feet at a 5,000 gpm flowrate. Horsepower requirements associated with this TDH will range from 1,800 to 2,400 horsepower. Based on these requirements, it is estimated that up to five booster stations may be required. Preliminary locations of these stations are discussed below. The selection of hydraulic model and design of the slurry pipeline will be advanced further after selection of the dredging contractor and identification of specific dredging equipment. The final design of the slurry pipeline, including details pertaining to the number, size, and location of selected booster pumps, will be presented in the final design.

2.2.4 Booster Pump Stations

The locations for these five preliminary booster stations that have been identified are as follows:

- Booster pump station #1 – This station will likely be located on the on-shore support area located on the northwest corner of the Wastebed B site. This station will be located on Honeywell property, and is depicted on Drawing C-102 in Appendix D.
- Booster pump station #2 – This station will likely be located on the south east corner of the Wastebeds 1-8 site, adjacent to the entrance ramp to the fairgrounds parking area. This station will be located on property owned by NYSDOT, adjacent to the NYSDOT turnaround area and the Onondaga County West Side Pump Station. This station is depicted on C-105 in Appendix D.

- Booster pump station #3 – This station will likely be located adjacent to I-690W and the exit from the fairgrounds parking area, near an existing I-690 billboard. This station will be located on land owned by NYSDAM, and is depicted on Drawing C-109 in Appendix D.
- Booster pump station #4 – This station will likely be located on the Wastebeds 9-11 site, on the north side of the southern access road along Ninemile Creek, and upstream of the confluence between Ninemile Creek and Geddes Brook. This station will be located on Honeywell property, and is depicted on Drawing C-113 in Appendix D.
- Booster pump station #5 – This station will likely be located on the Wastebeds 9-11 site, on the north side of the southern access road along Ninemile Creek, just east of the southwest corner of the site. This station will be located on Honeywell property, and is depicted on Drawing C-115 in Appendix D.

The actual number of booster pump stations planned for construction, and their respective locations will be presented in the final design, and will incorporate design modifications associated with the finalization of the pipeline design, and the results of on-going access agreement negotiations. Additional engineering details pertaining to the design of these booster pump stations (e.g., foundation requirements, utility connections, etc.) will be provided in the final design.

Power alternatives (e.g., electric, diesel, etc.) for the booster stations will be evaluated during the final design. Electric booster stations could provide specific advantages, such as limiting the infrastructure needed to refuel diesel booster stations and allow Honeywell to evaluate the purchase of "green" electricity to reduce the carbon footprint of the project. Diesel booster stations could provide additional flexibility by eliminating the need to rely on supplied electrical power. Due to the lead time needed for installing electrical services to the booster locations, discussions and negotiations have been initiated with the two utility companies located in the project area (Solvay Electric and National Grid). The power supply for the various booster stations (electric, diesel, or a combination of both) will be specified in the final design.

2.3 SLURRY PRE-PROCESSING

As described in Section 2.1, the dredge slurry will undergo several pre-processing steps designed to optimize the geotextile tube dewatering process. Several of these pre-processing steps that were initially presented in the Operations IDS (Parsons, 2009) have been evaluated through various bench-scale studies. Some of these pre-processing steps have been retained as part of this design, including oversized-material screening and gravel/sand removal, while other processes under consideration (e.g., gravity thickening) were determined to present only marginal, if any, enhancing effects on the overall dewatering process, and have not been retained.

For processes retained, some will be utilized for the entire dredge operation, while some have been retained as an option for only a portion of the dredging operation. For the purposes of the dewatering design, the dredging has been divided into two phases: Phase 1 consists of dredging of the in-lake waste deposit (ILWD) material (Remediation Area B, C & D); and Phase 2 consists of dredging of non-ILWD material (Remediation Area A and E).

Based on bench-scale testing and geotechnical information obtained from field investigations, the material produced by the desanding of the non-ILWD material (Phase 2) is anticipated to be reusable in the construction of the subbase for the SCA cover. However, the material generated by this operation while dredging ILWD material (Phase 1) is not expected to be reusable. Based on this assessment, sand removal has been retained for potential implementation for Phase 2 dredging only, if this reuse is determined to be beneficial prior to, or during remedial construction.

Process flow diagrams for both Phases 1 and 2 of dredging are presented on Drawings D-001 and D-003 respectively (see Appendix D).

2.3.1 Design and Performance Criteria

The overall design objective of the pre-processing system is to enhance the geotextile tube dewatering process by removing material that can be more efficiently dewatered by other means, by enhancing the polymer addition step by removing a portion of the material which does not require polymer for dewatering, and by amending the dredge slurry to provide optimum dewaterability. The level of pre-processing will not impact the volume of material placed in the SCA, nor the dredge rate.

The slurry pre-processing system is designed to operate 24 hours a day, and have the capacity to process the maximum flow produced by the dredging and slurry conveyance operations. To account for the various sinks and sources of sediment/water/slurry throughout the process, the mass balance presented in Section 2.3.7 provides a maximum flow for each of the pre-processing components.

2.3.2 Primary Screening

The dredging contractor will take measures to limit the size and quantity of large debris entering the slurry pipeline. Details pertaining to these measures are being advanced as part of the dredging design, under a separate design package.

Following conveyance of the dredge slurry to the SCA, primary screening will be conducted during dredging of both ILWD material and non-ILWD material. For the purposes of this intermediate design, it is assumed that material greater than 2 inches in size will be removed during the primary screening operation. The final screen size will be presented in the final design.

2.3.2.1 Screening Process

Material rejected during the primary screening process will be conveyed to a temporary staging area. The underflow of the screen will be routed into a holding tank. During Phase 1 dredging, slurry in this tank will then be routed to the polymer addition system. During Phase 2 dredging, slurry in this tank will then be routed to the secondary screening process.

A source of water will be required to rinse the primary screens to maintain their operability. Rinsing frequency and duration will vary based on the nature of the material being dredged at a given time. Based on an assessment of commercially-available equipment capable of meeting the design requirements for the screening operation, the required rinse flow is assumed to be approximately 100 gpm. This water will be drawn from the SCA operational sumps. To accommodate periods when water from the SCA may not be available for this purpose, an

alternate water source (e.g., SCA WTP effluent, collected storm water, etc) will be used. In all cases, the screened material will be contained within the SCA.

2.3.2.2 Screened Material Management

Material produced from the primary screening operation will be transported from the temporary staging area to the lined separated material management area. Details pertaining to the design of this lined area will be provided in the final design. This material is expected to consist primarily of coarse gravel, cobbles, gravel or cobble size particles of ILWD material, or debris with very few fine particles. All material generated by the primary screening process will be incorporated into the SCA prior to closure, for final containment. For non-ILWD material, beneficial reuse of this material within the SCA (e.g., access roads and ramps) will be evaluated during the course of the remediation.

2.3.3 Secondary Screening

For Phase 2 dredging, the dredge slurry may undergo an additional screening step to remove gravel-sized material, referred to herein as secondary screening. Screening to remove gravel is an economical method for removal of gravel-sized material from natural sediment, and has the benefit of reducing the volume of sediment in the geotextile tubes and reducing the quantity of polymer required for pre-treatment. In addition, gravel-size particle removal will be required prior to sand separation, discussed in Section 2.3.4 below.

2.3.3.1 Screening Process

For Phase 2 dredging, slurry in the primary screen holding tank will be passed through a second screen. The rejected material from the second screen will be conveyed to a temporary staging area. The underflow of the screen will either be routed to the sand separation system, or directly to the chemical conditioning process.

Screen sizing for the removal of gravel-sized particles typically range from $^{3}/_{16}$ inch to $^{3}/_{8}$ inch. For the purposes of this intermediate design, a ¼ inch screen has been assumed. The final screen size for the secondary screening operation will be determined as part of the final design.

A source of water will be required to rinse the secondary screens to maintain their operability. Based on an assessment of commercially-available equipment capable of meeting the design requirements for the screening operation, the total required flow is assumed to be approximately 510 gpm. This flow will be sufficient for rinsing of both the secondary screens, and of the hydrocyclone screens, as described below. This water will be drawn from the SCA operational sumps. The screen rinse water will be visually monitored for residual polymer, which can accumulate on the screens, reducing their operability. To accommodate periods when water from the SCA operational sumps may not be available for this purpose, an alternate water source (e.g., SCA WTP effluent, collected storm water, etc.) will be available.

2.3.3.2 Screened Material Management

Gravel-sized material produced from the secondary screening operation will be transported to the lined separated material management area. Details pertaining to the design of this lined area will be provided in the final design. It is anticipated that this material will have a beneficial reuse, within the containment area of the SCA such as for access roads and ramps within the

SCA, and subbase for the SCA final cover. During the final design, the demand for this material will be evaluated. The secondary screening operation may be eliminated from the system, or terminated prior to the completion of dredging, if the screening process is ineffective, if it is determined that the material does not have beneficial reuse, or a preferable material is identified for the reuse opportunities.

2.3.4 Sand Separation

For Phase 2 dredging, the dredge slurry may also undergo a sand separation step. Based on previous project experience, the removal of sand-sized particles from the slurry flow prior to dewatering in the geotextile tubes can provide several benefits. Sandy material can dewater sufficiently without the use of polymers and geotextile tubes, potentially reducing the quantities of these materials to be used. Additionally, the removal of the sand-sized particles may enhance the filling and dewatering process within the geotextile tubes, by removing particles that would settle in the immediate vicinity of the discharge ports. This can lead to "camel-backing" of the bags, or creation of "humps," which can lead to tube stacking limitations. Finally, the removal of sand can produce a reusable material within the SCA, which reduces the need to truck material from off-site.

To assess the incorporation of a sand removal step to the dewatering process for the Onondaga Lake project, bench testing was completed by Wastestream Technologies (WST) as part of the Phase IV Pre-Design Investigation (PDI). This testing investigated the efficiency of hydrocyclones to remove sand-sized particles from samples collected from Remediation Areas D and E. The hydrocyclone tests indicated that removal of sand material from the dredge slurry was achievable using a hydrocyclone. The summary report describing the results of this testing is included in Appendix G.

As described above, natural lake sediments (i.e., non-ILWD material) are anticipated to be suitable for sand separation. Therefore, sand separation would only be conducted during Phase 2 dredging.

2.3.4.1 Sand Separation System

Hydrocyclones with linear motion screens will be utilized for sand removal. Hydrocyclones are static, conical devices sized by recycle pump feed rate, pressure, and the specific gravity and size of the particles to be removed from the stream. The underflow (sand sized particles separated by the hydrocyclones) drops to linear motion shaker screens placed under the hydrocyclones to further separate sand and liquid. The screened underflow will be conveyed to a temporary staging area. The screen size utilized for the linear motion screens (e.g., 100 mesh) will be determined as part of the final design. The underflow of the linear shaker screens and the overflow of the hydrocylone (non-captured fine sized-particles and liquid) are routed into the re-circulation tanks. Slurry from the bottom of the recirculation tanks is pumped into the hydrocyclones. Slurry from the top of the recirculation tanks, which only contains silt and clay size sediment particles, will then be pumped through to the polymer addition process.

As describe in Section 2.3.3.1 above, a source of water will be required to rinse the hydrocyclone screens to maintain their operability. Based on an assessment of commercially-available equipment capable of meeting the design requirements for the sand removal step, the

510 gpm discussed in Section 2.3.3.1 will be sufficient for both the secondary screens and hydrocylone.

2.3.4.2 Sand-Sized Material Management

Sand-sized material produced from the sand separation system will be transported to the lined separated material management area. Details pertaining to the design of this lined area will be provided in the final design. It is anticipated that this material will have a beneficial reuse, within the containment area of the SCA, as subbase material for the SCA final cover. This layer will facilitate the final grading of the SCA, while keeping this material within the containment system of the SCA. The sand removal operation may be eliminated from the design, or terminated prior to the completion of the dredging, if the sand separation process is ineffective, if it is determined that the material does not have beneficial reuse, or a preferable material is identified for the reuse opportunities.

2.3.5 Gravity Thickening

As described in Section 4.5 of the Operations IDS (Parsons, 2009), gravity thickening of the dredge slurry prior to discharge into the geotextile tubes could provide several enhancements to the dewatering operation, including providing a more consistent flow to the chemical conditioning and geotextile tube dewatering operations, and potentially decreasing the time required for dewatering of the sediments within the tubes by increasing the solids concentration of the incoming slurry.

To assess the incorporation of a gravity thickener to the dewatering process for the Onondaga Lake project, bench testing was completed by WST as part of the Phase IV PDI. Jar testing was completed as part of this investigation, to determine the optimal polymer and dosage that will be required for the thickening step. Following jar testing, modified column testing was completed to assess the potential efficiency of a thickening step with the polymer selected from the jar tests. Results from this testing were mixed, as the addition of the polymer did not significantly enhance the settling rate of the slurry, but were generally effective at reducing the total suspended solids in the supernatant.

In addition to this testing, the benefits of the thickening operation were evaluated on geotextile tube dewatering as a separate part of the Phase IV PDI. This testing indicated that the thickening step did not enhance the tube dewatering performance significantly. The summary report describing the results of this testing is included in Appendix G. Further details pertaining to this testing are provided in Section 2.3.6 below. Based on these results, the gravity thickening step has not been retained as part of the dewatering process.

2.3.6 Chemical Conditioning

Proper chemical conditioning is a critical element of the operation of the geotextile tube dewatering system. Chemical conditioning impacts the performance and capacity realized within each tube, as well as the quality of filtrate produced by the tubes. Minimization of filtrate TSS is critical for maintaining the functionality of the gravel collection system and the downstream WTP.

Bench-scale testing was conducted as part of the Phase IV PDI to identify polymers which will be most effective in enhancing the geotextile tube dewatering process. This investigation

included rapid dewatering tests (RDT) of more than 160 unique polymers from several of the major manufacturers with experience in similar sediment dewatering applications. In addition to these polymers, four geotextile fabric types were evaluated as part of the RDT. The three polymers identified as the best performers during the RDTs were carried to the next phase of the testing, the pressure-gravity dewatering test (P-GDT). Additionally, three of the four fabrics tested performed sufficiently during the RDT to warrant further evaluation in the P-GDT. The summary report describing the results of this testing is included in Appendix H.

The P-GDT is designed to assess the performance of the chemical conditioning step in a bench-scale pressurized geotube, by monitoring the dewatering rate of the sediments within the tube, and the quality of filtrate (e.g., TSS) passing through the tube fabric. The test is designed to expose the treated slurry to conditions considered representative of a full-scale operation, to ensure the polymer selected is capable of producing a sufficient dewatering performance to meet the project requirements.

The three RDT-best-performing polymers were tested in the P-GDT. Based on this testing, two dry polymers: Ashland 2520; and Kemira A-100, provided the best dewatering performance for the sediments tested (Remediation Areas D and E). During P-GDT testing, dry polymers were found to result in a better dewatering performance than emulsions. As such, the design of the polymer addition process will include infrastructure and equipment to process the dry polymer. Polymer utilized for this project will be the Ashland 2520, Kemira A-100, or an approved equivalent. Based on P-GDT testing, 1.59 pounds of dry polymer per dry ton of sediment will be used as the base design dosage rate.

Based on P-GDT testing results, the addition of a coagulant will be necessary to effectively dewater Remediation Area E sediments. Based on P-GDT testing, coagulant used for this project will be the Ashland 492 emulsion, or an approved equivalent. As such, the design of the polymer addition process will include infrastructure and equipment to process the emulsion coagulant. Based on P-GDT testing, 5.71 pounds of emulsion coagulant per dry ton of sediment will be used as the base design dosage rate. This coagulant will be added during Phase 2 dredging.

Based on experience at other projects, it may be necessary to modify the polymer/coagulant dosage rate on a regular basis to maintain optimum dewaterability, as the characteristics of the sediment processed by the dredging operation change from area to area. The dewatering operation will have the flexibility to modify the dosage as necessary. Additionally, should the polymers and coagulant selected based on the P-GDT testing not perform adequately during remedial operations, the contractor will have the flexibility to test and utilize an alternate polymer/coagulant as needed.

2.3.6.1 Polymer Storage and Mixing

Dry polymer is typically delivered in large (e.g., 2,000 pound) “supersacks,” which must be stored in a dry area prior to use. Polymer deliveries will be maintained on a regular basis (e.g., weekly), and sufficient polymer storage area will be provided to ensure adequate polymer is on hand to continue polymer addition. The storage building is shown on Drawing C-003 (see Appendix D), located in close proximity to the mixing and addition operations. The polymer mixing system will be equipped to accommodate the supersacks.

Prior to injection into the slurry line, dry polymer will be mixed with "make-down" water and allowed to age for a period of time. Based on the design dosing rate obtained from the bench-scale testing, approximately 300 gpm of polymer make-down water will be required. The bench-scale testing also evaluated SCA WTP effluent as make-down water. Based on the testing completed, the quality of the WTP effluent was sufficient to serve as make-down water, and will serve as the primary source during remedial construction. In the event that WTP effluent is not available, or water quality is not conducive to creating an effective polymer, accommodations for an alternative water source (e.g., surface water drawn from Onondaga Lake or Ninemile Creek) will be in place, sufficient to meet the 300 gpm demand.

Based on the bench testing described above, a minimum aging period of 30 minutes is required. Mixed polymer is typically considered usable for up to 72 hours after initial mixing. To ensure that all the polymer solution has achieved the minimum aging time, several polymer mixing/aging tanks will be provided.

The coagulant recommended during the P-GDT testing was an emulsion coagulant, and will be injected directly into the slurry line. Based on previous project experience, it may be necessary to supplement this injection with a small flow of flush water (5-10 gpm) when the solids content of the dredge slurry exceeds certain percent solids. To accommodate this potential demand, the return line from the WTP effluent, which will provide the polymer make-down water, will be sized with sufficient capacity to provide this flow.

2.3.6.2 Polymer/Coagulant Injection

Following the mixing and aging steps, the polymer will be injected in-line into the slurry. The number and location of the injection points will be based upon several factors including pipeline mixing, contact time and floc stability/shear. An in-line mixer will ensure complete mixing of the polymer and slurry. The mixture will then be pumped to the geotextile tube dewatering system for final dewatering.

Operational factors, such as a change of physical properties of the sediments being dredged or the implementation/suspension of sand removal, will lead to variation in the properties and corresponding polymer/coagulant demand of the slurry entering the polymer injection system. The density and flow rate of the dredge slurry will be continually monitored by in-line flow and density meters that automatically control the dose applied to the dredge slurry.

The flocculation of the dredge slurry will be observed in the field frequently to ensure proper conditioning of the dredge slurry is occurring prior to entry into the geotextile tubes. This will be accomplished by manually drawing grab samples from the header system via sample ports located downstream for the polymer injection spool pieces. The samples will be observed for proper floc formation and water clarity. Additionally, when necessary, the dewatering contractor will perform "jar tests" in the field, to assess the need for changes in the required polymer dose.

2.3.7 Dredging / Conveyance / Pre-Process System Mass Balance

To provide a basis for the sizing and design of the slurry pre-processing equipment, ancillary pipes and pumps, the geotextile tube header and distribution system, and the SCA WTP, a system mass balance was developed which identified the various flows (solids and liquid) associated with the dredging, dewatering, and water treatment systems. This mass balance was

developed in conjunction with the Onondaga Lake Remedial Design SCA WTP - Intermediate Design Submittal (OBG, 2009), which contains the mass balance for the water treatment plant under maximum flow conditions. Mass balance diagrams have been developed for the two dredging phases described in Section 2.3. This mass balance is presented in Appendix I.

2.3.8 Equipment List

Equipment that will be required for the processes described in this Section includes:

Drawing #	Tag #	Description	Comment
D-102	P-01	Supplemental Lake Water Pump	As needed to maintain pipe velocity
D-103, 104	P-02 to P-06	Booster Pump	500 hp
D-105	SC-01	Primary Screen	6,000 gpm capacity
D-105	SC-02	Primary Screen Tank with Auger	11,700 gal capacity
D-105	CV-01	Conveyor	~30 ft x 50 ft
D-105	P-07, -08	Geotextile Tube Feed Pump	3,000 gpm capacity
D-106	P-09, -10	Sand Separation Feed Pumps (2)	3,000 gpm, 75 Hp
D-107, 108	SC-03, -05	Secondary Screens	3,000 gpm
D-107, 108	SC-04, -06	Recirculation Tanks w/ Auger (2)	13,700 gal
D-107, 108	HC-1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D	Hydrocyclones (8)	750 gpm
D-107, 108	P-1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D	Recirculation Pumps (8)	750 gpm
D-107, 108	CV-02, -03, -04, -05	Solids Conveyor	~30 ft x 50 ft
D-109	T-02, -03	Slurry Tanks	
D-110	P-0x	Polymer Make-up Water Booster Pump	600 gpm, 15 Hp
D-110, 113	T-0x	Polymer Mixing Tank (2)	17,500 gal capacity
D-110	MX-01A,B,C	Polymer Mixer Unit (2)	
D-110, 113	T-0x	Polymer Make-Up Water Storage Tank	17,500 gal capacity
D-110, 113	P-0xA,B	Polymer Make-Up Water Pumps	300 gpm, 15 Hp
D-110	P-0xA,B	Polymer Pump	300 gpm, 15 Hp
D-110	POL-03	Dry Polymer Makeup Unit	
D-111, -112		Geotextile Tubes	
D-111, -112	P-11, -12	SCA/Stormwater Basin Pumps	3,000 gpm
D-111, -112	P-xx	SCA Sump Pumps	

2.4 GEOTEXTILE TUBE DEWATERING

Following applicable pre-processing and polymer addition steps, the remaining sediments contained within the dredge slurry will be dewatered for final management using geotextile tubes. As described in SCA Dewatering Evaluation (Parsons, 2009), geotextile tubes were selected based on an enhanced ability to achieve the various project objectives. The dewatering objectives that were developed as a basis for the comparative analysis of the various dewatering methods include:

- Objective 1 - protect the public and wildlife during SCA operations
- Objective 2 - facilitate efficient emissions and odor management
- Objective 3 - protect workers during SCA operations

- Objective 4 - maintain geotechnical stability and SCA liner system integrity
- Objective 5 - meet operations requirements
- Objective 6 - select a method acceptable to the public
- Objective 7 - meet cell closure requirements
- Objective 8 - minimize dewatering area
- Objective 9 - enhance the water treatment process
- Objective 10 - minimize imported material quantities

As discussed in Section 2.3.6, bench testing was conducted during the Phase IV PDI to further assess the effectiveness of the geotextile tube dewatering process, and to provide critical input to the geotextile tube dewatering design. Key results from this testing that will be incorporated into the design of the geotextile tubes are discussed in greater detail in Section 2.4.2.

Geotextile tubes will be placed in the SCA and receive pre-conditioned slurry from the slurry processing area. The geotextile tubes will retain the solids and allow filtered water (filtrate) to drain to the SCA liquids management system. The basic steps in geotextile tube dewatering are:

- Slurry is routed through a header system into the tubes via fill ports located on the top of each tube.
- Slurry will be pumped into the tubes over several filling cycles, until the tube capacity is reached. Maximum fill height is the primary method of process control for each individual tube.
- The filtrate seeps out of the tubes while the solids remain in the tube and consolidate.
- Filtrate flows to SCA liquids management system and is pumped to the water treatment system.

This section describes these process steps that will comprise the geotextile tube dewatering operation, outline supporting infrastructure, present design constraints associated with geotechnical and operational limitations, and provide the basis for advancing the final design of the geotextile tube dewatering operation.

2.4.1 Geotextile Tube Header System

Pumps located prior to the polymer addition equipment in the slurry processing area will be used to transfer the pre-conditioned slurry to the geotextile tube header system, located in the SCA. The pumps will have a capacity to handle the maximum flow produced by the dredging operation, as calculated in the mass balance presented in Appendix I.

As stated in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010), the SCA will be constructed in phases. An area of the SCA will be designated for active tube dewatering. The active area will be sized so that enough tubes, given the tube performance characteristics describe above, can be deployed to match the filtering rate with the dredge rate. The active area may consist of an entire phase of SCA construction, or combinations of several phases, and will be adjusted throughout the operation.

The geotextile tube header will consist of a piping network routed around the active area of the SCA with several branch manifolds deployed in a configuration that facilitates distribution of the slurry into geotextile tubes within the active dewatering area. Based on the maximum flows estimated for the project, five to 10 geotextile tubes will be on-line at any given time. The header system will have a capacity to handle the maximum flow, as calculated in the mass balance presented in Appendix I. The header piping will transition from solid pipe to flexible pipe near the geotextile tubes to allow for manual reconfiguration of the filling network, as full tubes are taken off-line, and new tubes are being prepared for filling. Valves will be installed in selected areas of the header piping to allow for control of slurry flow to the desired tube. Tube operation, including piping reconfiguration and flow control, will primarily be a manual operation. Tube operators will constantly monitor filling tubes, and perform necessary adjustments to maintain the performance of the tubes and line velocities in the header system to minimize plugging and excessive pressure buildups. The number of tubes being filled at any time will depend on the flow rate at that time, the characteristics of the slurry, and the rate of drainage through the tubes.

Details pertaining to the design of the geotextile tube header system will be provided in the Sediment Management Final Design Submittal.

2.4.2 Geotextile Tube Design

Geotextile tubes are fabricated in a variety of circumferences and lengths using high strength, permeable geotextile. For dewatering the Onondaga Lake sediments, geotextile tubes 80 to 90 ft in circumference, and up to 300 ft in length, will be used in the dewatering operation.

Based on the results of the P-GDT testing conducted in the Phase IV PDI, TenCate Geotube® Fabric GT500 was found to provide the best dewatering performance from other TenCate® fabrics tested. The fabric utilized for geotextile tubes for this project will be GT500, which has an apparent opening size (AOS) of 0.425 mm, or an approved equivalent from another manufacturer.

Several fabric materials were tested for compatibility with the Solvay waste material to be dredged from Remediation Area D (the ILWD). As part of this testing, high strength geotextile tubes and the thread for the geotextile tubes were evaluated. Both performed well and are considered suitable for the project. Further details are provided in the Draft Final SCA Civil and Geotechnical Design Submittal (Parsons, 2010).

2.4.3 Geotextile Tube Dewatering Operations

All dewatering operations will be conducted with an emphasis on personnel safety. All personnel working within the SCA will be property trained in all aspects of geotextile tube operations, and will be required to follow the safe work practices that will be established for the project.

The operational objectives for the geotextile tube dewatering are:

- To achieve a dewatered condition, in a reasonable time frame, that allows for tube stacking
- To achieve a filtrate quality that allows for effective operation of the water treatment system

- To operate within the geotechnical parameters of the SCA
- To minimize the impact on dredge production rates and project schedule

The geotextile tubes will undergo several fill cycles, until their capacity is reached. The capacity of each geotextile tube is a function of the tube's material properties and size. The primary control parameter is the maximum fill height of each tube, determined by the tubes circumference and seam loading. The height of actively-filling tubes will be continuously monitored by the geotextile tube operators. Once a geotextile tube has been filled to capacity, sediments within the tube will need to sufficiently consolidate before another tube can be safely stacked on top of it. The required level of sediment consolidation and the methods for verification will be developed by the contractor as a construction submittal.

The primary measure of the quality of the filtrate passing through the tubes is the TSS. Control of TSS levels is critical to maintaining the gravel collection layer beneath the tubes, controlling deposition in the sump areas, and ensuring the performance of the WTP. Based on the Phase IV bench-scale testing, it is estimated that the geotextile tube filtrate will contain TSS less than 200 milligrams per liter (mg/L). This 200 mg/L has been utilized as a conservative maximum TSS value for the design of the WTP.

Similar to the need for flexibility in the polymer addition process, as discussed in Section 2.3.6, it may be necessary to adjust geotextile tube operational parameters, such as number of fill cycles for each tube, to maintain the desired tube performance and filtrate quality. As such, the contractor will have the flexibility to modify the tube dewatering operations to maintain tube performance. In addition, the contractor will have responsibility of preparing draft tube arrangement plans and filling/tube management procedures.

As stated in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010), the SCA design is based on a concept of stacking the geotextile tubes to a height of approximately 30 ft (approximately five tubes stacked) over the SCA footprint. The sequence of tube placement (location, alignment, rate of stacking, etc.) up to this final configuration will be guided by the geotechnical behavior of the SCA as the project progresses. To monitor this behavior, extensive instrumentation including piezometers, settlement cells, settlement profilers, and inclinometers will be installed during the construction of the SCA. These instruments will be monitored during the dewatering operation to ensure the SCA continues to operate within its design parameters. The details of this monitoring program are outlined in the Geotechnical Instrumentation and Monitoring Plan, contained in Appendix N of the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010).

2.4.4 Supporting Infrastructure

A road is incorporated in the design of the top of the SCA perimeter berm that allows access to the SCA because installation of the header piping system, deployment of the geotextile tubes, and the filling operation of the tubes will require access around and within the SCA. Small, low-ground-pressure vehicles will be operated in the SCA to aid in tube deployment and other tasks. Some gravel may be placed at strategic locations in the SCA for this small vehicle access. Ladders, steps, and platforms will also be installed in the SCA for worker access. As layers of tubes are added, the gravel ramps/roads and ladders/steps/platforms will be extended to allow access to the active working areas. Infrastructure (e.g., lighting) will be installed to ensure the

health and safety of workers during night time operating hours, in accordance with applicable requirements (e.g., Occupational Safety and Health Administration [OSHA]). Details pertaining to this infrastructure will be prepared as a contractor submittal.

2.5 WATER MANAGEMENT

As the dredge slurry is pumped into SCA and into the geotextile tubes, filtrate water will weep out, while the sediment will remain in the tubes. The filtrate water will flow into the SCA liquids management system, which will have temporary pump upgrades for the flow conditions expected during operations. The SCA liquids management system will collect the filtrate and transfer it to the WTP.

As discussed in the Operations IDS (Parsons, 2009), the WTP will be subject to periods of shutdown, as dictated by the permit terms for the discharge of the water to the Metro treatment plant. These shutdown events are typically tied to periods of high precipitation. To minimize the impact of these shutdown events on the dredging operation, provisions for water storage before and after the WTP are included in the design.

2.5.1 Design and Performance Criteria

The design of water management strategies and infrastructure will be such that filtrate, process water, and precipitation/contact water falling within the shoreline debris management area, SCA, preprocessing area, separated material management area, and WTP

The management strategies and associated conveyance infrastructure will be designed to handle the maximum flow from the dredge, in addition to the daily average precipitation and recirculation flows identified in the mass balance. Based on the mass balance presented in Appendix I, and based on the dredge flowrate of 5,000 gpm, the SCA operational liquids management system will be sized to handle 5,750 gpm.

In addition to the operational capacity of the filtrate collection and management system, the SCA will also be designed with contingency water storage capacity. This storage capacity will help minimize the impact on the Metro shutdown days on the dredging operation, and provide storage for high precipitation events. Total water storage capacity upstream of the WTP will be sized to contain the volume of water generated by a 25-year, 24-hour storm falling within the SCA.

2.5.2 Non-SCA-Area Water Management Systems

Water potentially requiring treatment will be collected from the following locations: the shoreline debris management area, SCA, preprocessing area, separated material management area, and the WTP. Surface water control features will be incorporated into the grading of these areas to direct surface water to collection points. In addition, water from decontamination facilities in these various support areas will be designed such that decon water can be routed to separate collection points. Pumps in these collection points will be installed to route the collected water to an appropriate point in the dredge slurry pipeline prior to water treatment. Engineering controls (e.g., grading and covers) will be utilized to minimize the amount of water requiring management. The surface water control system and collection points will be included in the Sediment Management Final Design.

2.5.3 Water Management Within the SCA

Water within the SCA will be managed by a liquids management system that will collect and remove water that is contained by the SCA composite liner system, as described below.

2.5.3.1 SCA Operation Liquids Management System Design

Details pertaining to the SCA composite liner and liquids management system design are described in Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010). The SCA composite liner system consists of the following components from top to bottom:

- 24-inch (average) drainage layer (24-inch minimum in truck traffic areas)
- Geotextile cushion
- 60-mil linear low-density polyethylene (LLDPE) geomembrane liner
- 12-inch minimum (18-inch minimum at the sumps) low-permeability soil component with top 6 inches compacted to achieve a permeability less than or equal to $1x10^{-6}$ centimeters per second (cm/sec)

The liquids management system includes the drainage layer (which is also part of the base composite liner system), pumps, sumps, and risers, which are designed to handle the appropriate design flows. The volume of liquids to be handled by the liquids management system will change significantly as the SCA transitions from operation to closure. Therefore, the liquids management system will have operational and post-closure phases. During operation, the liquids management system will collect filtrate from the geotextile tubes and precipitation that comes into contact with the tubes. After SCA closure, the liquids management system will handle remaining water that is generated by the continuing dewatering of the dredge material within the tubes and precipitation that infiltrates through the SCA cover. The details associated with the liquids management strategy under post-closure conditions are included in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010). The details associated with the liquids management strategy during operational conditions are discussed in the subsections below.

2.5.3.2 SCA Operational Liquids Management System Operation

The location and intensity of this flow is expected to vary within the SCA depending on precipitation events, dredge rate, dredge work schedule, and operation of the geotextile tubes. The operational liquids management system is designed to handle this variability by having mobile components and the ability to use temporary storage for precipitation events (described in Section 2.5.4).

Part of the potential spatial variability in SCA flows is due to variability in liquid flow routes. As filtrate flows out of the geotextile tubes, it will follow one, or a combination, of the following flow paths:

- Directly into the gravel drainage layer beneath the tubes
- Across the top of adjacent tubes and into the gravel drainage layer
- Across the top of adjacent tubes and to the channel between the geotubes and the perimeter berm of the SCA

Filtrate that enters the gravel drainage layer will follow the SCA liner slope towards two permanent collection sumps, from which it will be removed via submersible pumps in the risers. Filtrate that flows to the perimeter channel will either flow into the gravel drainage layer (via the exposed gravel on the inside edge of the channel) or follow the slope of this channel towards low points on the east and west sides of the SCA. Operational pumps will be situated on the SCA berms at the low points of the channels (operational collection points) to remove water from the channels and transfer it to the WTP. The amount of flow that enters the gravel drainage layer and the amount that flows down the channel will depend on the head and resistance to flow at any given time. Flow may also flow out of the gravel drainage layer and into the perimeter channel, also depending on head differentials and flow resistance. This potential redirection of flow contributes to the potential spatial variability of flow, but does not affect the total flow volume in the SCA.

It is possible that, due to variations in geotextile tube configurations, filtrate may locally pond before it follows the identified flow paths. Additional mobile pumps and aboveground piping will be deployed if necessary around the SCA to move ponded water to the perimeter channel for collection in the operational pumps and conveyance to the WTP, to ensure the maximum allowable head is not exceeded.

Design details associated with the permanent collection sumps are presented in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010). Water collected in these sumps will be pumped to the operational collection points via temporary, above-ground piping that will be repositioned as geotextile tubes are deployed in the area. Also as described in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010), the SCA perimeter berms and channels have been designed with adequate dimensions to convey the design flow to the operational collection points. In order to account for the potential spatial variability of flow, each side of the SCA channel has sufficient capacity to carry the full design flow. Likewise, the pump capacity at each operational collection point will have sufficient capacity for the full design flow.

2.5.4 Stormwater Diversion Basins

As described in Section 2.5 above, the discharge of water from the WTP to Metro will be subject to shutdown periods, based on total flow to the Metro facility during precipitation events. To minimize the impact of these shutdown events on the dredging operation, two water storage points have been designed into the overall process. Water storage will be available between the SCA and the WTP; and between the WTP and the Metro discharge point, herein referred to as upstream and downstream storage, respectively. Each storage point will have sufficient capacity to hold the volume of water produced by approximately one day of dredging.

2.5.4.1 Basin Design

To provide for upstream storage, two basins have been designed on the eastern and western berms of the SCA. As presented in the Draft Onondaga Lake SCA Civil and Geotechnical Final Design (Parsons, 2010), the SCA perimeter berm height and the stormwater basin volume were optimized so that a 25-year, 24-hour storm could be contained within the SCA and stormwater basins without discharging to the WTP. These basins are sized for the condition where all three phases of the SCA (i.e., 72 acres) have been constructed and covered with at least one layer of geotextile tubes, which is expected to be the case that requires the most storage. Based on this

design storm event, each of these basins will provide approximately four million gallons of storage, or eight million gallons total. Drawings C-005 and C-006 (see Appendix D) present preliminary site plans for these two basins. The Sediment Management Final Design will include detailed plans and design details associated with the civil and mechanical engineering design for these basins.

To provide for downstream storage, the existing wastebed leachate collection pond will be utilized. Operational capacity of this pond to hold the required water volume will be validated during final design. Details pertaining to the mechanical engineering design associated with the use of this basin will be included as part of the WTP Final Design.

2.5.4.2 Basin Operations

In general, the upstream basins will be utilized as needed to minimize water levels within the SCA. Water generation in excess of the WTP throughput capacity may occur under a variety of conditions, including during periods of extremely low percent solids in the dredge slurry, during storm events, and during Metro shutdown periods. As necessary during and following these conditions, the SCA and the stormwater basins will be used to manage the additional liquids that will be generated. The operational pumps pulling water from the operational collection points will also be designed to discharge both to, and from, the stormwater basins. In addition, the SCA will have overflow culverts leading to these basins. The use of these basins will depend on the storm severity, the lined area of SCA constructed, and the area covered with geotextile tubes. The culverts will be designed at an elevation that allows for normal operational flows and average precipitation to be managed within the SCA and management of flows in the stormwater basins only during periods of above-average rainfall. Further details pertaining to the operation of these upstream basins will be provided in the Sediment Management Final Design.

Under normal operations, effluent from the WTP will discharge directly to Metro. The leachate collection pond will be utilized only in instances when the WTP is unable to directly discharge to Metro, and collected water within the SCA requires treatment. To empty this pond following a Metro shutdown period, the WTP conveyance system will have the ability to pump from the collection pond to the Metro discharge point. Further details pertaining to the operation of this collection pond will be provided in the WTP Final Design.

2.6 DEBRIS MANAGEMENT

As part of the preparation for dredging and capping operation, an evaluation will be completed to assess in-lake debris, to determine which debris targets will not impact the function of the sediment cap, and can remain in place, and which targets will require removal. For debris that could impact the sediment cap or the efficiency of the dredging operation, debris removal may be conducted by the dredging contractor prior to dredging. Details pertaining to this debris removal operation will be addressed as part of the dredging and capping design. Any debris removed from the lake bottom will be transported to the shoreline support area for further processing. Debris management options may include:

- Porous debris and utility remnants, such as concrete, bricks, timber, railroad ties, rubber, and other porous materials. This material could be crushed, or otherwise reduced in size as appropriate and transported to the SCA.

- Non-porous debris and utility remnants, such as metal, large rocks, and possibly fiberglass, ceramic, glass, plastics or other non-porous materials. This material could be cleaned and recycled. For example, large rocks could be washed and possibly reused for armoring as appropriate. Large metal or other non-porous objects could possibly be sold for reuse or recycling. Small pieces of non-porous debris will likely need to be managed with the porous debris.
- Debris requiring special handling (e.g., compressed gas cylinders, chemical containers with unknown contents, etc.), if encountered, may require handling by specialty subcontractors and/or transported offsite for disposal.

Further details pertaining to the on-shore management of debris will be finalized in conjunction with the dredging contractor selected for the project, and will be provided in the sediment management final design. The final design will provide details pertaining to facilities required to manage the debris, both at the shoreline support area, as well as at the SCA. Figure 2.1 presents potential traffic routes that would be utilized for the transportation of debris from the lakeshore to the SCA.

2.7 UTILITIES

Various utilities will be needed to support dredging, slurry conveyance, sediment dewatering and water treatment. This section includes a summary of the utility needs, locations they will be needed, and plans for procuring the necessary utilities in sufficient time to allow for equipment testing prior to the start of dredging in 2012.

2.7.1 Lakeshore Support Area and Booster Stations #1 & #2

Several operations and activities will be based at the Lakeshore Support Area, that will be located on or near the Wastebed B site, including:

- Office facilities
- Operational support facilities for work crews (break trailers, decontamination trailers, etc.)
- Equipment storage
- Heavy craft (dredge, debris barge, etc.) service dock;
- Small craft (oversight boats, tender boats, etc.) dock
- Debris decontamination and staging
- Booster pump station(s)

Utility requirements for these activities are described below.

2.7.1.1 Electrical Service

Based on the activities and operations that will be staged in this area, two types of electrical service will be required. Office facilities, operational support facilities, equipment storage, docking facilities, and debris decontamination/staging areas will require 480 volt three phase power service. Existing service lines owned by Solvay Electric in the vicinity of the Wastebed B site will be sufficient for this demand.

Three phase electrical service will be required for the booster pump stations, if electrical boosters are selected. To supply power to booster pump station #1, located on Wastebed B, existing three phase infrastructure is currently in place, which supplied the Semet/Willis Groundwater Pump Station with three phase power. This service line, owned by Solvay Electric, will require line upgrades to ensure the supply is sufficient for the demands from the booster pump. Furthermore, additional infrastructure will be necessary to bring the power to the actual booster pump location. To supply power to booster pump station #2, preliminarily located at the southeast corner of the Wastebeds 1-8 site, existing infrastructure which supplies power to the Onondaga County West Side pump station may be utilized. However additional infrastructure will be necessary to extend the service a short distance, to the actual booster pump location.

The location of the Lakeshore Support Area lies within the jurisdiction of Solvay Electric Department. To ensure necessary connections are installed prior to the initiation of dredging activities, Honeywell has begun coordination with Solvay Electric Department to extend the necessary electrical service to the lakeshore site.

2.7.1.2 Water

For sanitary purposes, potable water will be needed for the office and support facilities. Potable water service is available near the Westside Pump Station. A buried tap from this source to the office and support trailer area will be installed during the construction of this support area.

Other activities and processes in the shoreline support area will require a source of non-potable water. Activities such as fire protection, equipment and debris decontamination, truck wash stations, and booster pumps will have a considerable demand for non-potable water. To provide water for these activities, surface water will be drawn from Onondaga Lake. The intake for the lake water will be designed with a screening system to prevent the intake of objects which may damage conveyance pipes and pumps (aquatic vegetation, debris, etc.). If necessary, lake surface water will be passed through a simple filtration system to remove suspended solids. Any surface water used onsite and considered construction/contact water will be collected and routed into the slurry pipeline for treatment at the WTP.

2.7.2 Slurry Pipeline Alignment (Booster Stations #3, #4, & #5)

Utility requirements along the slurry pipeline will be limited to booster pump locations. Electrical power and water services will not be required along the length of the pipeline in between these locations.

2.7.2.1 Electrical Service

Three phase electrical service will be required to power the booster stations, if electrical boosters are selected. Sufficient service is not currently available at the preliminary locations depicted in Drawing C-004 (see Appendix D). As such, installation and upgrading of existing infrastructure at booster locations 3, 4, and 5 will be required.

Booster pump station #3 and any associated appurtenances shall be served by a new three phase drop from Solvay Electric. The wooden pole infrastructure presently exists within the New York State Fairgrounds parking lot located on the Wastebeds 1-8 site. This infrastructure will require permission to build out the new three phase aerial conductor needed to support the Solvay Electric service drop.

Booster pump station #4, and any associated appurtenances, shall be served by a new three phase drop from Solvay Electric. The existing wooden pole infrastructure along the Wastebeds 9-11 maintenance road, alongside Ninemile Creek, may be utilized, but will require upgrading service conductors to support the new three phase Solvay Electric service drop.

Booster pump station #5, and any associated appurtenances, shall be served by a new three phase drop from National Grid. New infrastructure will need to be installed, as there are no current poles which extend to this vicinity to support a new three phase National Grid service drop.

The preliminary locations of the booster pump stations lie within the jurisdiction of both Solvay Electric Department and National Grid. To ensure necessary connections are installed prior to the initiation of dredging activities, Honeywell has begun coordination with Solvay Electric Department and National Grid to extend the necessary electrical service to these locations.

2.7.2.2 Water

As described above, the booster pump stations will require a constant non-potable water supply to feed the pump seal. Based on the caliber of pumps that will be required for this project, this flow is estimated to be 50 gpm per pump. As most of the pipeline route and corresponding booster stations are located in close proximity to either Onondaga Lake or Ninemile Creek, surface water will be drawn from the nearest source to fulfill this demand. Surface water intakes will be designed with a screening system to prevent the intake of objects which may damage conveyance pipes and pumps (aquatic vegetation, debris, etc.). If necessary, surface water will be passed through a simple filtration system to remove suspended solids. Most of the estimated 50 gpm flow will directly enter the pipeline, and be treated at the WTP. Most pump seals are design to “drip” a small portion of the pump seal water out of the pump casing. This water will be collected and routed into the pipeline for treatment.

2.7.3 SCA

Several operations and activities will be based at the SCA, including:

- Office facilities
- Operational support facilities for work crews (break trailers, decontamination trailers, etc.)
- Equipment storage
- Debris & sand removal
- Polymer addition
- Geotextile tube dewatering
- Water treatment

Utility requirements for these activities are described below.

2.7.3.1 Electrical Service

The SCA and supporting areas will be served by a new 13,200 volt primary metered service distributed to the site by the installation of a new National Grid service drop. After the

13,200 volt has been distributed to the site, transformation to a reduced voltage will be required. A new 3-switch compartment (line, load-1, load-2) pad mounted 13.2 KV switch at the SCA/WTP area will be used to distributed an individual 13,200 volt service to both the SCA and WTP. At the SCA and WTP, new pad mounted transformers will transform the power to 480 volt 3-phase. At present, the SCA is estimated to require a service of 2,500 amps at 480 volt three phase, and the WTP is estimated to require a service of 4,000 amps at 480 volt 3-phase. After transformation to 480 volt 3-phase, a new service-entrance-rated switchboard will be used to either distribute power to single pieces of equipment or motor control centers capable of providing the required starting characteristics of the equipment. SCA area equipment lighting will be 480 volt single phase. Convenience outlets and administrative support offices will be from the SCA service at 120 volt single phase.

Electrical services lines currently extend to the perimeter of the Wastebeds 12-15 site, near the Gerelock Road entrance, but do not extend to Wastebed 13. New poles and service lines are required to extend services to the Wastebed 13 area. The location of the SCA lies within the jurisdiction of National Grid. To ensure necessary connections are installed prior to the initiation of dredging activities, Honeywell has begun coordination with National Grid to extend the necessary electrical service up to the SCA site.

2.7.3.2 Water Demands

For sanitary purposes, potable water will be provided for the Office and Support Facilities. In addition, a potable water supply will be required for potential use as polymer “make-down” water, should the treated effluent water from the WTP not be suitable for that purpose. Additionally, potable water will be needed at the WTP for the purposes of eye wash stations, emergency showers, and sanitary purposes. The total estimated potable water demand at Wastebed 13 will be evaluated as part of the final design. Potable water is not available on the Wastebeds 12-15 site. As such, a buried service line will be constructed during the construction of the SCA and support areas. Based on discussions with the Onondaga County Water Authority (OCWA) and the Camillus Water Company, the level of potable water demand will determine the source of the potable water supplied to the site, and the supplier. To ensure potable water service is installed prior to the initiation of dredging activities, Honeywell has begun coordination with OCWA and the Camillus Water Company to extend water service to the SCA.

Water needed for fire protection could be potable or non-potable. The flow rate and source of fire protection water and the location of fire hydrants, if any, will be determined during final design.

SECTION 3

SEDIMENT MANAGEMENT FINAL DESIGN

3.1 DRAFT FINAL DREDGING AND SEDIMENT MANAGEMENT DESIGN REPORT

The Draft Final Sediment Management Design will be submitted on January 24, 2011. This report will contain the final design-level details, and engineering evaluations associated with the conveyance and dewatering of sediments dredged from the lake bottom, and will include drawings and specifications adequate to define the temporary system for conveyance, processing, and dewatering the dredged sediment. These elements of the design will be finalized with significant input from the dredging contractor selected for the project. Contractor input during the final design process will allow the design to be adjusted for any specific operational practices that the dredging contractor may utilize during implementation.

Drawings that will be included in the draft final design will include the following:

- General layout plans for each of the project work areas; including pipeline alignment plans
- Civil design plans for project work areas, booster pump stations, and stormwater basins
- Design details for erosion and sedimentation controls, grading, access roads, utilities, and drainage
- Final process flow diagrams and mass balance tables
- Equipment layout drawings
- Major equipment/pumps sections and details
- P&IDs
- Electrical plans for each of the project work areas
- Lighting Plans
- Power distribution single line diagrams

Supporting calculation packages will be finalized, and will include:

- Final mass balance calculations
- Conveyance system head curves/booster pump design calculations
- Stormwater generation calculations

Dredging productivity calculations, which have been included in this design report as a basis for sizing of the dredge slurry conveyance system, will be finalized as part of the dredging and capping design.

Honeywell is working with NYSDEC and the community to develop various performance criteria and work plans specifically designed to ensure that the protection of the surrounding community and environment is maintained throughout the execution of the remedy. As

described in the Operations IDS (Parsons, 2009), the performance criteria and work plans will be presented in the Final Design, and will include, but not necessarily be limited to:

- Site Security & Community Health and Safety Plan
- Air Quality Monitoring & Mitigation Plan
- Spill Contingency Plan
- Traffic Management Plan
- Noise Abatement Plan
- Navigational Protection Plan

3.2 PROJECT SCHEDULE

Critical to the success of the lake remedial action is the sequencing of events and interrelations of design and construction activities to assure the process is efficient and completed within the appropriate timeframe. A logical progression of the decisions, analysis, and planning needed to execute the work has been established during the initial design phase. This section outlines the schedule milestones established to accomplish the operational aspects of the remedial action consistent with the CD schedule requirements. The schedule is based on receipt of NYSDEC review and comments within 60 calendar days of submittal.

DESIGN & CONSTRUCTION MOBILIZATION MILESTONES

SEDIMENT MANAGEMENT	
Submit Sediment Management Draft Final Design to NYSDEC	1/24/2011
Start Construction Conveyance Pipeline & Support Facilities	5/28/2011
Conveyance Pipeline & Support Facilities Construction Complete	1/4/2012
Begin Dredging	5/31/2012
Complete Dredging	1/4/2016
WATER TREATMENT	
Submit Water Treatment Design\Build Procurement Packages to NYSDEC (Three Design Packages)	3/10/10, 5/12/10, 9/3/10
Start Construction Water Treatment System	9/14/2010
Water Treatment System Construction Complete	1/3/2012
Water Treatment System Operational	5/30/2012

DREDGING AND CAPPING	
Submit Capping, Habitat, and Dredging Intermediate Design to NYSDEC	10/27/2010
Submit Capping, Habitat, and Dredging Final Design to NYSDEC	1/4/2012
Begin Dredging	May 2012
Begin Capping	May 2013
Dredging Complete	1/4/2016
Capping Complete	1/4/2017

3.3 CONSTRUCTION QUALITY ASSURANCE PROCEDURES PLAN

A Construction Quality Assurance Procedures Plan (CQAPP) will be prepared as part of the Draft Final Sediment Management Design Submittal. This Plan will summarize the quality assurance (QA) requirements and procedures for the project, including:

- Identification of the roles and responsibilities of the project team members.
- Outline the chain of command and communication procedures for QA related issues.
- Summarize requirements for project meetings including schedule/frequency, purpose, required attendees.
- Outline QA oversight tasks, including routine inspections, QA testing, review of technical submittals, and documentation.

3.4 SEDIMENT MANAGEMENT OPERATIONS CONTINGENCY PLAN

A Sediment Management Operations Contingency Plan (SMOCP) will be prepared as part of the Draft Final Sediment Management Design Submittal. This plan will outline procedures associated with the normal operations of the integrated dredging, conveyance, and dewatering system, as well as outline procedures for management of the remedial activities and implementation of contingency measures under specific scenarios. Procedures will be developed for a variety of scenarios, including:

1. Mechanical problems
    a. Plan for dredge shutdown
    b. Plan for booster pump shutdown
    c. Plan for sediment processing shutdown
    d. Plan for geotextile tube dewatering operation shutdown
    e. Plan for WTP shutdown
2. Wet weather / Metro shutdown protocols
3. Air quality phased response actions

4. Spill control
    a. Monitoring
    b. Response
5. Noise abatement response actions
6. Seasonal Startups/Shutdowns
    a. Plan for winter shutdown
    b. Plan for spring startup

SECTION 4

REFERENCES

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APPENDIX A

LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

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DREDGE PRODUCTIVITY CALCULATIONS

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APPENDIX G

WASTESTREAM TECHNOLOGIES PHASE IV ADDENDUM 6 SUMMARY REPORT

APPENDIX H

MINERAL PROCESSING SERVICES PHASE IV ADDENDUM 6 SUMMARY REPORT

APPENDIX I

MASS BALANCE CALCULATIONS

APPENDIX I

MASS BALANCE CALCULATIONS

I.1 CALCULATION ASSUMPTIONS

The mass balance presented in this Appendix has been prepared to provide a basis for the sizing and design of the equipment, pumps, and pipelines that will be utilized in the various sediment management activities that are described in this Intermediate Design Report. Mass balance diagrams have been developed for dredging Phases 1 and 2. As presented in this Appendix, two scenarios have been evaluated for each dredging Phase, the maximum flow produced by the dredge, and the average flow. The maximum flow represents the mass balance of flows while dredging operations are ongoing. The average flow incorporates the dredging "up-time" (assumed to be 70%) to produce calculated average flows over the course of a one-day period.

As described in this design report, selection of a dredging contractor has not been finalized at the time of the preparation of this report. As such, assumptions must be made regarding the flowrate and slurry percent solids that are produced by the equipment utilized to execute the dredging portion of the remedy. As described in Section 2.1.2, a dredge flowrate of 5,000 gpm, and a 10% solids by weight slurry, are assumed to be maintained by the dredging operation. Following selection of the dredging contractor, these assumptions will be reevaluated. If necessary, the mass balance will be updated as part of the Final Design to reflect any changes in these assumptions.

Due to the nature of dredging operations, the achieved percent solids produced will vary significantly over short periods of time, which will result in significant short-term variation in the proportion of water versus solids entering the system at a given time. The impact of these changes on pre-processing equipment is expected to be minimal. Due to the time required for geotextile tube filtrate to flow through the gravel and/or drainage channels, water within the SCA will effectively have some residence time before reaching the sumps. This residence time will attenuate fluctuating solids content, limiting any potential impacts to the SCA WTP.

TABLE 2.1
ONONDAGA LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

			Gravel	Sand	Fines								
Remediation Area	Parameters	Water Content %	Percent Gravel %	Percent Sand %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity	Organic Content %	Carbonate Alkalinity %
A (Top 1 meter)	Average	80.7	3.4	35.9	60.8	51.5	9.3	49	36	13	2.68	3.5	
	Max	122.0	51.6	62.0	97.0	87.0	21.0	53	40	18	2.78	4.1	
	Min	50.3	0.0	3.0	19.8	18.0	1.8	42	33	9	2.60	2.9	
	Standard Dev (σ)	20.3	12.9	17.3	20.3	19.4	5.0	6	4	5	0.05	0.8	
	Number of Samples	15	16	16	16	16	16	3	3	3	18	2	
	Average+1.96σ	120.4	28.6	69.8	100.5	89.5	19.2	60	43	22	2.78	5.2	
	Average-1.96σ	40.9	-21.9	1.9	21.0	13.4	-0.6	37	29	3	2.59	1.8	
C (Top 1 meter)	Average	68.4	10.8	37.3	51.9	42.3	9.6	39	31	8	2.80		
	Max	104.5	58.2	87.0	92.0	84.0	23.1	39	31	8	3.40		
	Min	43.1	0.0	8.0	5.5	4.4	0.7	39	31	8	2.52		
	Standard Dev (σ)	19.6	19.3	20.5	27.5	25.9	6.3	NA	NA	NA	0.23		
	Number of Samples	11	25	25	25	25	25	1	1	1	38		
	Average+1.96σ	106.9	48.7	77.6	105.8	93.0	21.9	NA	NA	NA	3.25		
	Average-1.96σ	30.0	-27.1	-2.9	-2.0	-8.4	-2.8	NA	NA	NA	2.34		
D (Top 2 meter)	Average	148.5	1.4	14.4	84.2	64.0	20.1	60	40	20	2.54	7.4	58.5
	Max	242.2	36.0	78.0	99.7	98.9	44.0	161	88	112	2.75	15.7	83.0
	Min	19.0	0.0	0.3	17.2	12.6	0.0	26	25	0	2.02	2.9	23.0
	Standard Dev (σ)	47.5	5.3	16.4	18.3	16.2	10.1	32	12	23	0.10	3.9	9.7
	Number of Samples	114	126	126	126	125	125	105	105	105	96	16	83
	Average+1.96σ	241.6	11.7	46.4	120.0	95.7	39.9	122	64	65	2.73	14.9	77.5
	Average-1.96σ	55.4	-9.0	-17.7	48.4	32.2	0.4	-2	16	-25	2.35	-0.2	39.5
E (Top 1 meter)	Average	61.3	18.8	42.0	39.2	30.8	8.4	46	33	13	2.63	3.2	60.7
	Max	146.0	62.0	93.0	98.6	91.0	49.7	69	43	26	2.71	12.2	67.9
	Min	28.9	0.0	1.4	0.9	0.3	0.0	26	24	2	2.35	0.7	56.2
	Standard Dev (σ)	24.6	24.2	31.0	29.0	22.8	9.2	13	5	9	0.08	3.7	5.5
	Number of Samples	51	67	67	67	67	67	13	13	13	48	8	7
	Average+1.96σ	109.6	66.3	102.8	96.1	75.5	26.5	71	43	30	2.79	10.5	71.5
	Average-1.96σ	13.1	-28.7	-18.9	-17.6	-13.9	-9.6	20	22	-5	2.46	-4.1	49.9

Notes:
1. Negative values from Average-1.96σ calculations do not have practical meaning.
2. Remediation Areas B and F only have four and two sampling locations within the dredging prism, respectively; therefore, Remediation Areas B and F are not included in this summary.
3. NA indicates not applicable.

APPENDIX A

LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES
Remediation Area A&B-SMU 4&3 Index Test Results Summary (Top 1m within Dredging Zone)

								Gravel			Sand				Fines							
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity	Organic Content %
OL-STA-30012-VC	OL-0011-01	1123593	919124.6	0	3.3	1.65	82	0	0	0	41.8	0	12	30	58.2	41	18	63	40	23	2.55	2.4
OL-VC-30041	OL-0285-11	1124395	918100.9	0.0	3.3	1.7	256.7	0	0	0	3.3	0	2.3	1	96.7	89.7	7					
OL-VC-30042	OL-0285-10	1124361	918392	0.0	3.3	1.7	138	0	0	0	1.1	0	0	1.1	98.9	66.9	32	71	45	26		
OL-VC-30043	OL-0285-15	1124087	918489.4	0.0	3.3	1.7	195.8	0	0	0	2.8	0	1	1.8	97.2	91.2	6	105	79	26		
OL-VC-30088	OL-0654-14	1126589	917348.7	0.0	1.0	0.5															2.64	
OL-VC-30088	OL-0654-15	1126589	917348.7	1.0	2.0	1.5															2.61	
OL-VC-30088	OL-0654-16	1126589	917348.7	2.0	3.0	2.5															2.60	
OL-STA-40001-SS	OL-0100-21	1125717	915316.2	0.0	0.5	0.3	122												Non-Plastic			
OL-STA-40002-VC	OL-0118-27	1125857	916064.3	0.0	3.3	1.7	75	0	0	0	38.8	0	3.8	35	61.2	47.4	13.8		Non-Plastic		2.75	4.1
OL-STA-40003-SB	OL-0004-05	1126212	916643.3	2.0	4.0	3.0	64	0	0	0	47.8	0	4.8	43	52.2	42.1	10.2		Non-Plastic		2.65	2.9
OL-SB-40006-SS	OL-0100-18	1126049	915034.3	0.0	0.5	0.3	112												Non-Plastic			
OL-SB-40008-SS	OL-0100-20	1126054	915565	0.0	0.5	0.3	87												Non-Plastic			
OL-VC-40033	OL-0293-14	1126583	914154.8	0.0	3.3	1.7	71.6															
OL-VC-40034	OL-0293-18	1126272	914342.2	0.0	3.3	1.7	77.9															
OL-VC-40035	OL-0280-11	1125978	914699	0.0	3.3	1.7	86.6															
OL-VC-40036	OL-0280-03	1126013	914971.6	0.0	3.3	1.7	78.7															
OL-VC-40037	OL-0286-07	1126276	915058.3	0.0	3.3	1.7	56.1	0	0	0	5.1	0	1.1	4	94.9	78.9	16	42	33	9		
OL-VC-40038	OL-0286-10	1125836	915146.1	0.0	3.3	1.7	90.5	2.3	0	2.3	22.6	1.6	3	18.0	75.1	69.1	6	51	40	11		
OL-VC-40039	OL-0279-08	1126344	915408.9	0.0	3.3	1.7	56.3															
OL-VC-40040	OL-0292-12	1125964	915413.8	0.0	3.3	1.7	100.2															
OL-VC-40041	OL-0286-13	1125806	915733.8	0.0	3.3	1.7	81.7											53	35	18		
OL-VC-40205	OL-0656-09	1126120	914556.2	0.0	1.0	0.5															2.67	
OL-VC-40205	OL-0656-10	1126120	914556.2	1.0	2.0	1.5															2.69	
OL-VC-40205	OL-0656-11	1126120	914556.2	2.0	3.0	2.5															2.70	
OL-VC-40207	OL-0657-01	1126094	915230.3	0.0	1.0	0.5															2.65	
OL-VC-40207	OL-0657-02	1126094	915230.3	1.0	2.0	1.5															2.65	
OL-VC-40207	OL-0657-03	1126094	915230.3	2.0	3.0	2.5															2.66	
OL-VC-40207	OL-0657-04	1126094	915230.3	3.0	4.0	3.5															2.66	
OL-VC-40209	OL-0657-08	1125667	915229.8	0.0	1.0	0.5															2.70	
OL-VC-40209	OL-0657-09	1125667	915229.8	1.0	2.0	1.5															2.78	
OL-VC-40209	OL-0657-10	1125667	915229.8	2.0	3.0	2.5															2.73	
OL-VC-40211	OL-0658-10	1125592	915778.6	0.0	1.0	0.5															2.71	
OL-VC-40211	OL-0658-11	1125592	915778.6	1.0	2.0	1.5															2.73	
OL-VC-40211	OL-0658-12	1125592	915778.6	2.0	3.0	2.5															2.75	
S304	SF0052	1126196	915420.7	0.0	0.5	0.2		0	0	0	27	NA	NA	NA	73	63	10					
S304	SF0053	1126196	915420.7	0.5	1.0	0.7		0	0	0	62	NA	NA	NA	38	30	8					
S304	VC0025	1126196	915420.7	1.0	3.3	2.1		0	0	0	3	NA	NA	NA	97	87	10					
S358	SF0006	1126256	914359.8	0.0	0.5	0.2		0	0	0	58	NA	NA	NA	42	27	15					
S358	SF0007	1126256	914359.8	0.5	1.0	0.7		0	0	0	37	NA	NA	NA	63	42	21					
S360	SF0010	1125666	915765.9	0.0	0.1	0.0		0	0	0	42	NA	NA	NA	58	49	9					
S360	SF0066	1125666	915765.9	0.0	0.1	0.0		0	0	0	40	NA	NA	NA	60	53	7					
S360	SF0011	1125666	915765.9	0.1	0.5	0.3		0	0	0	22	NA	NA	NA	78	73	5					
S360	SF0164	1125666	915765.9	0.1	0.5	0.3		0	0	0	34	NA	NA	NA	66	62	4					
S360	SF0012	1125666	915765.9	0.5	1.0	0.7		0	0	0	55	NA	NA	NA	45	39	6					
S360	SF0169	1125666	915765.9	0.5	1.0	0.7		0	0	0	51	NA	NA	NA	49	43	6					
S81	S00520	1126367	915209.7	0.0	0.1	0.0	50.3	51.6	NA	NA	28.6	NA	NA	NA	19.8	18	1.8					
Average							99.1	2.7	0.0	0.1	31.1	0.2	3.5	16.7	66.2	55.6	10.6	64	45	19	2.68	3.1
Maximum						3.5	256.7	51.6	0.0	2.3	62.0	1.6	12.0	43.0	98.9	91.2	32.0	105	79	26	2.78	4.1
Minimum							50.3	0.0	0.0	0.0	1.1	0.0	0.0	1.0	19.8	18.0	1.8	42	33	9	2.55	2.4
Standard Deviation (s)							51.0	11.5	0.0	0.5	19.8	0.6	3.8	17.2	22.6	21.4	7.1	22	17	7	0.06	0.9
Number of Samples							19	20	19	19	20	8	8	8	20	20	20	6	6	6	19	3
Average+1.96s							199.1	25.3	0.0	1.2	70.0	1.3	10.9	50.5	110.4	97.5	24.4	108	79	33	2.79	4.8
Average-1.96s							-0.9	-19.9	0.0	-0.9	-7.7	-0.9	-3.9	-17.0	21.9	13.7	-3.3	20	12	4	2.56	1.4

Notes:
1. NA indicated that the full grain-size distribution curve is not available; therefore the coarse versus fine fractions of the gravel and sand are not available.
2. The Average, Minimum, Maximum and Standard Deviation are calculated based on the number of samples available for each category.
3. Negative values from Average-1.96s calculations do not have practical meaning.

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area A-SMU 4&3 Index Test Results Summary (Top 1m within Dredging Zone)

								Gravel			Sand				Fines							
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity	Organic Content %
OL-VC-30088	OL-0654-14	1126589	917348.7	0.0	1.0	0.5															2.64	
OL-VC-30088	OL-0654-15	1126589	917348.7	1.0	2.0	1.5															2.61	
OL-VC-30088	OL-0654-16	1126589	917348.7	2.0	3.0	2.5															2.60	
OL-STA-40001-SS	OL-0100-21	1125717	915316.2	0.0	0.5	0.3	122												Non-Plastic			
OL-STA-40002-VC	OL-0118-27	1125857	916064.3	0.0	3.3	1.7	75	0	0	0	38.8	0	3.8	35	61.2	47.4	13.8		Non-Plastic		2.75	4.1
OL-STA-40003-SB	OL-0004-05	1126212	916643.3	2.0	4.0	3.0	64	0	0	0	47.8	0	4.8	43	52.2	42.1	10.2		Non-Plastic		2.65	2.9
OL-SB-40006-SS	OL-0100-18	1126049	915034.3	0.0	0.5	0.3	112												Non-Plastic			
OL-SB-40008-SS	OL-0100-20	1126054	915565	0.0	0.5	0.3	87												Non-Plastic			
OL-VC-40033	OL-0293-14	1126583	914154.8	0.0	3.3	1.7	71.6															
OL-VC-40034	OL-0293-18	1126272	914342.2	0.0	3.3	1.7	77.9															
OL-VC-40035	OL-0280-11	1125978	914699	0.0	3.3	1.7	86.6															
OL-VC-40036	OL-0280-03	1126013	914971.6	0.0	3.3	1.7	78.7															
OL-VC-40037	OL-0286-07	1126276	915058.3	0.0	3.3	1.7	56.1	0	0	0	5.1	0	1.1	4	94.9	78.9	16	42	33	9		
OL-VC-40038	OL-0286-10	1125836	915146.1	0.0	3.3	1.7	90.5	2.3	0	2.3	22.6	1.6	3	18	75.1	69.1	6	51	40	11		
OL-VC-40039	OL-0279-08	1126344	915408.9	0.0	3.3	1.7	56.3															
OL-VC-40040	OL-0292-12	1125964	915413.8	0.0	3.3	1.7	100.2															
OL-VC-40041	OL-0286-13	1125806	915733.8	0.0	3.3	1.7	81.7											53	35	18		
OL-VC-40205	OL-0656-09	1126120	914556.2	0.0	1.0	0.5															2.67	
OL-VC-40205	OL-0656-10	1126120	914556.2	1.0	2.0	1.5															2.69	
OL-VC-40205	OL-0656-11	1126120	914556.2	2.0	3.0	2.5															2.70	
OL-VC-40207	OL-0657-01	1126094	915230.3	0.0	1.0	0.5															2.65	
OL-VC-40207	OL-0657-02	1126094	915230.3	1.0	2.0	1.5															2.65	
OL-VC-40207	OL-0657-03	1126094	915230.3	2.0	3.0	2.5															2.66	
OL-VC-40207	OL-0657-04	1126094	915230.3	3.0	4.0	3.5															2.66	
OL-VC-40209	OL-0657-08	1125667	915229.8	0.0	1.0	0.5															2.70	
OL-VC-40209	OL-0657-09	1125667	915229.8	1.0	2.0	1.5															2.78	
OL-VC-40209	OL-0657-10	1125667	915229.8	2.0	3.0	2.5															2.73	
OL-VC-40211	OL-0658-10	1125592	915778.6	0.0	1.0	0.5															2.71	
OL-VC-40211	OL-0658-11	1125592	915778.6	1.0	2.0	1.5															2.73	
OL-VC-40211	OL-0658-12	1125592	915778.6	2.0	3.0	2.5															2.75	
S304	SF0052	1126196	915420.7	0.0	0.5	0.2		0	0	0	27	NA	NA	NA	73	63	10					
S304	SF0053	1126196	915420.7	0.5	1.0	0.7		0	0	0	62	NA	NA	NA	38	30	8					
S304	VC0025	1126196	915420.7	1.0	3.3	2.1		0	0	0	3	NA	NA	NA	97	87	10					
S358	SF0006	1126256	914359.8	0.0	0.5	0.2		0	0	0	58	NA	NA	NA	42	27	15					
S358	SF0007	1126256	914359.8	0.5	1.0	0.7		0	0	0	37	NA	NA	NA	63	42	21					
S360	SF0010	1125666	915765.9	0.0	0.1	0.0		0	0	0	42	NA	NA	NA	58	49	9					
S360	SF0066	1125666	915765.9	0.0	0.1	0.0		0	0	0	40	NA	NA	NA	60	53	7					
S360	SF0011	1125666	915765.9	0.1	0.5	0.3		0	0	0	22	NA	NA	NA	78	73	5					
S360	SF0164	1125666	915765.9	0.1	0.5	0.3		0	0	0	34	NA	NA	NA	66	62	4					
S360	SF0012	1125666	915765.9	0.5	1.0	0.7		0	0	0	55	NA	NA	NA	45	39	6					
S360	SF0169	1125666	915765.9	0.5	1.0	0.7		0	0	0	51	NA	NA	NA	49	43	6					
S81	S00520	1126367	915209.7	0.0	0.1	0.0	50.3	51.6	NA	NA	28.6	NA	NA	NA	19.8	18	1.8					
Average							80.7	3.4	0.0	0.2	35.9	0.4	3.2	25.0	60.8	51.5	9.3	49	36	13	2.68	3.5
Maximum						3.5	122.0	51.6	0.0	2.3	62.0	1.6	4.8	43.0	97.0	87.0	21.0	53	40	18	2.78	4.1
Minimum							50.3	0.0	0.0	0.0	3.0	0.0	1.1	4.0	19.8	18.0	1.8	42	33	9	2.60	2.9
Standard Deviation (σ)							20.3	12.9	0.0	0.6	17.3	0.8	1.6	17.5	20.3	19.4	5.0	6	4	5	0.05	0.8
Number of Samples							15	16	15	15	16	4	4	4	16	16	16	3	3	3	18	2
Average+1.96σ							120.4	28.6	0.0	1.3	69.8	2.0	6.2	59.2	100.5	89.5	19.2	60	43	22	2.78	5.2
Average-1.96σ							40.9	-21.9	0.0	-1.0	1.9	-1.2	0.1	-9.2	21.0	13.4	-0.6	37	29	3	2.59	1.8

Notes:

1. NA indicated that the full grain-size distribution curve is not available; therefore the coarse versus fine fractions of the gravel and sand are not available.
2. The Average, Minimum, Maximum and Standard Deviation are calculated based on the number of samples available for each category.
3. Negative values from Average-1.96σ calculations do not have practical meaning.

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area B-SMU 3 Index Test Results Summary (Top 1m within Dredging Zone)

								Gravel			Sand				Fines							
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity	Organic Content %
OL-STA-30012-VC	OL-0011-01	1123593	919124.6	0	3.3	1.65	82	0	0	0	41.8	0	11.8	30	58.2	40.7	17.5	63	40	23	2.55	2.4
OL-VC-30041	OL-0285-11	1124395	918100.9	0.0	3.3	1.7	256.7	0	0	0	3.3	0	2.3	1	96.7	89.7	7					
OL-VC-30042	OL-0285-10	1124361	918392	0.0	3.3	1.7	138	0	0	0	1.1	0	0	1.1	98.9	66.9	32	71	45	26		
OL-VC-30043	OL-0285-15	1124087	918489.4	0.0	3.3	1.7	195.8	0	0	0	2.8	0	1	1.8	97.2	91.2	6	105	79	26		
Average							168.1	0.0	0.0	0.0	12.3	0.0	3.8	8.5	87.8	72.1	15.6	80	55	25	2.55	2.4
Maximum						1.7	256.7	0.0	0.0	0.0	41.8	0.0	11.8	30.0	98.9	91.2	32.0	105	79	26	2.55	2.4
Minimum							82.0	0.0	0.0	0.0	1.1	0.0	0.0	1.0	58.2	40.7	6.0	63	40	23	2.55	2.4
Standard Deviation (σ)							75.1	0.0	0.0	0.0	19.7	0.0	5.4	14.4	19.7	23.7	12.1	22	21	2		
Number of Samples							4	4	4	4	4	4	4	4	4	4	4	3	3	3	1	1
Average+1.96σ							315.4	0.0	0.0	0.0	50.9	0.0	14.4	36.6	126.4	118.6	39.3	123	96	28		
Average-1.96σ							20.9	0.0	0.0	0.0	-26.4	0.0	-6.9	-19.7	49.1	25.6	-8.1	36	13	22		

Notes:
1. The Average, Minimum, Maximum and Standard Deviation are calculated based on the number of samples available for each category.
2. Negative values from Average-1.96σ calculations do not have practical meaning.

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area C- SMU 2 Index Test Results Summary (Top 1m within Dredging Zone, non-ILWD)

								Gravel			Sand				Fines						
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity
OL-STA-30019-VC	OL-0015-05	1120320	921110	0.0	3.3	1.7															
OL-VC-20068	OL-0290-05	1119832	921526	0	3.3	1.65	104.5														
OL-VC-20069	OL-0290-07	1119612	921377	0	3.3	1.65	79.4														
OL-VC-20070	OL-0289-15	1119473	921496	0	3.3	1.65	63.9	16.3	0	16.3	30	5	8	17	53.7	30.6	23.1				2.76
OL-VC-20071	OL-0289-18	1119429	921704	0	3.3	1.65	65.2	24.3	0	24.3	37.5	10.5	8	19	38.2	19.8	18.4	39	31	8	2.72
OL-VC-20072	OL-0232-09	1118947	922399	0	3.3	1.65	98.4	0	0	0	33.8	0	1.8	32	66.2	44.4	21.8				2.70
OL-VC-20080	OL-0289-20	1119415	921607	0	3.3	1.65	67.8	28.9	0	28.9	27.1	8	5	14.1	44	28.6	15.4				
OL-VC-20082	OL-0290-16	1119387	921635	0	3.3	1.65	73.7														
OL-VC-20135	OL-0594-01	1120106	921242	0.0	1.0	0.5															2.54
OL-VC-20135	OL-0594-02	1120106	921242	1.0	2.0	1.5															2.57
OL-VC-20135	OL-0594-03	1120106	921242	2.0	3.0	2.5															2.52
OL-VC-20135	OL-0594-04	1120106	921242	3.0	4.0	3.5															2.58
OL-VC-20136	OL-0594-11	1120048	921371	0.0	1.0	0.5															2.64
OL-VC-20136	OL-0594-12	1120048	921371	1.0	2.0	1.5															3.18
OL-VC-20136	OL-0594-13	1120048	921371	2.0	3.0	2.5															2.96
OL-VC-20136	OL-0594-14	1120048	921371	3.0	4.0	3.5															3.24
OL-VC-20136	OL-0594-15	1120048	921371	3.0	4.0	3.5															3.16
OL-VC-20137	OL-0595-01	1119972	921455	0.0	1.0	0.5															2.88
OL-VC-20137	OL-0595-02	1119972	921455	1.0	2.0	1.5															2.83
OL-VC-20137	OL-0595-03	1119972	921455	2.0	3.0	2.5															2.66
OL-VC-20137	OL-0595-04	1119972	921455	3.0	4.0	3.5															2.60
OL-VC-20138	OL-0595-08	1119882	921467	0.0	1.0	0.5															2.93
OL-VC-20138	OL-0595-09	1119882	921467	1.0	2.0	1.5															2.93
OL-VC-20138	OL-0595-10	1119882	921467	2.0	3.0	2.5															3.22
OL-VC-20138	OL-0595-11	1119882	921467	3.0	4.0	3.5															3.40
OL-VC-20138	OL-0595-12	1119882	921467	3.0	4.0	3.5															3.40
OL-VC-20139	OL-0596-01	1119753	921417	0.0	1.0	0.5															2.86
OL-VC-20139	OL-0596-02	1119753	921417	1.0	2.0	1.5															2.64
OL-VC-20139	OL-0596-03	1119753	921417	2.0	3.0	2.5															2.57
OL-VC-20139	OL-0596-04	1119753	921417	3.0	4.0	3.5															2.62
OL-VC-20140	OL-0596-10	1119700	921481	0.0	1.0	0.5															2.74
OL-VC-20140	OL-0596-11	1119700	921481	1.0	2.0	1.5															2.72
OL-VC-20140	OL-0596-12	1119700	921481	2.0	3.0	2.5															2.72
OL-VC-20140	OL-0596-13	1119700	921481	3.0	4.0	3.5															2.73
OL-VC-20141	OL-0598-01	1119589	921539	0.0	1.0	0.5															2.67
OL-VC-20141	OL-0598-02	1119589	921539	1.0	2.0	1.5															2.69
OL-VC-20141	OL-0598-03	1119589	921539	2.0	3.0	2.5															2.72
OL-VC-20141	OL-0598-04	1119589	921539	3.0	4.0	3.5															2.70
OL-VC-20147	OL-0597-01	1118812	922310	0.0	1.0	0.5															2.68
OL-VC-20147	OL-0597-02	1118812	922310	1.0	2.0	1.5															2.69
OL-VC-20147	OL-0597-03	1118812	922310	2.0	3.0	2.5															2.68
OL-VC-20147	OL-0597-04	1118812	922310	2.0	3.0	2.5															2.68
OL-VC-20147	OL-0597-05	1118812	922310	3.0	4.0	3.5															2.71
S307	VC0196	1119488	921648	0.0	0.5	0.2		0	0	0	61	NA	NA	NA	39	29	10				
S307	VC0197	1119488	921648	0.5	1.0	0.7		0	0	0	55	NA	NA	NA	45	32	13				
S307	VC0049	1119488	921648	1.0	3.3	2.1		0	0	0	46	NA	NA	NA	55	35	20				
S325	SF0094	1120083	921148	0.0	0.1	0.0		0	0	0	10	NA	NA	NA	90	82	8				
S325	SF0095	1120083	921148	0.1	0.5	0.3		0	0	0	8	NA	NA	NA	92	84	8				
S325	SF0096	1120083	921148	0.5	1.0	0.7		0	0	0	14	NA	NA	NA	86	78	8				
S325	SB0003	1120083	921148	1.0	3.3	2.1		0	0	0	10	NA	NA	NA	90	81	9				
S327	SF0099	1120008	921609	0.0	0.5	0.2		0	0	0	27	NA	NA	NA	73	65	8				
S327	SF0100	1120008	921609	0.5	1.0	0.7		0	0	0	29	NA	NA	NA	71	62	9				
S327	SB0007	1120008	921609	1.0	2.0	1.5		0	0	0	38	NA	NA	NA	62	53	9				
S327	SB0008	1120008	921609	2.0	4.6	3.3		0	0	0	46	NA	NA	NA	54	40	14				
S332	BC0001	1118912	922516	0.0	0.1	0.0		0	0	0	87	NA	NA	NA	13	10	3				
S332	SF0109	1118912	922516	0.0	0.5	0.2		0	0	0	29	NA	NA	NA	71	62	9				
S332	BC0002	1118912	922516	0.1	0.5	0.3		0	0	0	21	NA	NA	NA	79	71	8				
S332	SF0110	1118912	922516	0.5	1.0	0.7		0	0	0	42	NA	NA	NA	58	51	7				
S332	SB0017	1118912	922516	1.0	3.3	2.1		0	0	0	43	NA	NA	NA	57	49	8				
S35	S00535	1118845	922397	0.0	0.1	0.0	49.7	47.1	NA	NA	47.4	NA	NA	NA	5.5	4.4	1.1				
S36	S00532	1119518	921623	0.0	0.1	0.0	43.1	43.8	NA	NA	48.6	NA	NA	NA	7.6	6.9	0.7				
S37	S00521	1119606	921664	0.0	0.1	0.0	49.8	51.9	NA	NA	39.6	NA	NA	NA	8.5	5.6	2.9				
S435	SF0172	1119388	921636	0.0	0.2	0.1		0	0	0	86	NA	NA	NA	14	11	3				
S47	S00519	1120174	921174	0.0	0.1	0.0	57.4	58.2	NA	NA	17.5	NA	NA	NA	24.3	22.9	1.4				
Average							68.4	10.8	0.0	3.3	37.3	5.9	5.7	20.5	51.9	42.3	9.6	39	31	8	2.80
Maximum						3.5	104.5	58.2	0.0	28.9	87.0	10.5	8.0	32.0	92.0	84.0	23.1	39	31	8	3.40
Minimum							43.1	0.0	0.0	0.0	8.0	0.0	1.8	14.1	5.5	4.4	0.7	39	31	8	2.52
Standard Deviation (σ)							19.6	19.3	0.0	8.5	20.5	4.5	3.0	7.9	27.5	25.9	6.3				0.23
Number of Samples							11	25	21	21	25	4	4	4	25	25	25	1	1	1	38
Average+1.96σ							106.9	48.7	0.0	20.1	77.6	14.7	11.5	36.0	105.8	93.0	21.9				3.25
Average-1.96σ							30.0	-27.1	0.0	-13.4	-2.9	-3.0	-0.1	5.0	-2.0	-8.4	-2.8				2.34

Notes:
1. NA indicated that the full grain-size distribution curve is not available; therefore the coarse versus fine fractions of the gravel and sand are not available.
2. The Average, Minimum, Maximum and Standard Deviation are calculated based on the number of samples available for each category.
3. Negative values from Average-1.96σ calculations do not have practical meaning.

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area D - ILWD Index Test Results Summary (Top 2m within Dredging Zone)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity	Organic Content %	Carbonate Alkalinity %
OL-STA-10001-VC	OL-0118-14	1118518	923452	0.0	3.3	1.7	160	0.1	0	0.1	1.4	0	0.4	1	98.5	84.9	13.6	102	32	70	2.37	7	
OL-STA-10002-VC	OL-0118-09	1118312	924292	3.3	6.6	5.0	203	0	0	0	3.1	0	0	3.1	96.9	58.1	38.8	90	41	49	2.5	8.7	52
OL-STA-10003-VC	OL-0118-16	1118154	924908	0.0	3.3	1.7	137	0	0	0	1.6	0	0	1.6	98.4	73.3	25.1	76	35	41	2.75	3.2	61
OL-STA-10004-VC	OL-0118-18	1118356	924951	3.3	6.6	5.0	233	0.1	0	0.1	2.3	0	0	2.3	97.6	86.0	11.6	94	41	53	2.53	4.5	70
OL-STA-10005-VC	OL-0118-20	1117898	925576	0.0	3.3	1.7	178	0	0	0	2.4	0	0	2.4	97.6	80.5	17.1	114	53	61	2.38	2.9	52
OL-STA-10007-VC	OL-0118-07	1117647	926138	3.3	6.6	5.0	141	0	0	0	2.6	0	0	2.6	97.4	84.9	12.5	75	43	32	2.62	5.8	70
OL-STA-10010-VC	OL-0118-12	1117686	924774	3.3	6.6	5.0	89	0.2	0	0.2	33.9	1	12	21	65.9	49.5	16.4	58	42	16	2.41	6.9	61
OL-STA-10012-VC	OL-0118-05	1116801	925924	3.3	6.6	5.0	123	0	0	0	9.3	0	2	7.3	90.7	77.4	13.3	68	40	28	2.43	4.6	52
OL-STA-10014-SB	OL-0111-09	1118399	924596	0.0	2.0	1.0	87																
OL-STA-10016-SB	OL-0111-20	1117874	925906	0.0	2.0	1.0	124	0	0	0	1	0	0	1	99	72	27	60	38	22	2.34		
OL-STA-10016-SB	OL-0111-21	1117874	925906	5.0	7.0	6.0	61																
OL-STA-10016-VC	OL-0119-02	1117872	925899	0.0	3.3	1.7	108.3	0	0	0	1.5	0	0.5	1.0	98.5	66.8	31.7	45	31	23			
OL-STA-10017-VC	OL-0119-06	1118246	926104	0.0	3.3	1.7	152																
OL-STA-10018-SB	OL-0111-35	1117844	923784	0.0	2.0	1.0	121																
OL-STA-10019-SB	OL-0111-45	1118112	923848	0.0	2.0	1.0	71																
OL-STA-10019-SB	OL-0111-46	1118112	923848	5.0	7.0	6.0	151																
OL-STA-10020-SB	OL-0111-57	1117703	924383	0.0	2.0	1.0	19																
OL-STA-10021-SB	OL-0111-70	1117948	924470	0.0	2.0	1.0	133																
OL-STA-10022-SB	OL-0111-84	1118139	924560	0.0	2.0	1.0	151																
OL-STA-10023-SB	OL-0071-54	1117457	925020	0.0	2.0	1.0	173	0	0	0	35.4	12.1	7.1	16.2	64.6	47.4	17.2		Non-Plastic		2.61	8.3	70
OL-STA-10024-SB	OL-0071-66	1117849	925237	0.0	2.0	1.0	100																
OL-STA-10024-SB	OL-0071-67	1117849	925237	5.0	7.0	6.0	67																
OL-STA-10025-SB	OL-0071-31	1117211	925485	0.0	2.0	1.0	157	0	0	0	2.6	0	0.6	2	97.4	75.9	21.5		Non-Plastic		2.39	5	83
OL-STA-10026-VC	OL-0119-03	1117572	925702	3.3	6.6	5.0	54.7	0	0	0	55.3	12	17	26.3	44.7	26.7	18	69	45	24			
OL-VC-10034	OL-0236-08	1118060	923086	0.0	3.3	1.7	180.6																
OL-VC-10034	OL-0236-07	1118060	923086	3.3	6.6	5.0	213.1																
OL-VC-10037	OL-0236-13	1118399	923321	0.0	3.3	1.7	112.3																
OL-VC-10037	OL-0256-01	1118399	923321	3.3	6.6	5.0	161.4	0	0	0	1.6	0	0	1.6	98.4	54.4	44.0	78	59	19	2.45		
OL-VC-10038	OL-0250-19	1117948	923415	0.0	3.3	1.7	161.3	3	0	3	35.6	5.6	11	19	61.4	27.4	34.0	127	80	47			
OL-VC-10038	OL-0236-17	1117948	923415	3.3	6.6	5.0	215.2																
OL-VC-10040	OL-0237-01	1118352	923587	0.0	3.3	1.7	88.9																
OL-VC-10040	OL-0237-02	1118352	923587	3.3	6.6	5.0	114.3																
OL-VC-10046	OL-0237-03	1118047	924009	0.0	3.3	1.7	173.4																
OL-VC-10046	OL-0250-15	1118047	924009	3.3	6.6	5.0	153.6	0	0	0	4.2	0	1	3.2	95.8	66.8	29	108	70	38	2.67		
OL-VC-10047	OL-0237-07	1118465	924146	0.0	3.3	1.7	144.9																
OL-VC-10047	OL-0250-13	1118465	924146	3.3	6.6	5.0	151.3	0	0	0	4	0	1	3	96	64	32	91	56	35	2.63		
OL-VC-10054	OL-0237-15	1117824	924273	0.0	3.3	1.7	134.3																
OL-VC-10057	OL-0237-11	1118236	924432	0.0	3.3	1.7	143.7																
OL-VC-10057	OL-0250-09	1118236	924432	3.3	6.6	5.0	197.1	0	0	0	27.6	0.6	5	22	72.4	45.4	27	130	88	42			
OL-VC-10062	OL-0237-19	1117994	924727	0.0	3.3	1.7	177.8																
OL-VC-10062	OL-0250-07	1117994	924727	3.3	6.6	5.0	127.3	0	0	0	7.6	0	1.6	6	92.4	59.4	33	103	63	40			
OL-VC-10063	OL-0250-05	1118435	924795	0.0	3.3	1.7	221.6	0	0	0	1.2	0	0	1.2	98.8	68.8	30	88	60	28			
OL-VC-10063	OL-0238A-03	1118435	924795	3.3	6.6	5.0	209.4																
OL-VC-10066	OL-0238A-07	1117659	924773	0.0	3.3	1.7	131.7																
OL-VC-10066	OL-0249-12	1117659	924773	3.3	6.6	5.0	112.4	0	0	0	30.3	6	9	15.3	69.7	52.7	17	60	50	10			
OL-VC-10071	OL-0249-14	1118399	925184	0.0	3.3	1.7	169.7	0	0	0	1.1	0	0	1.1	98.9	56.9	42	86	47	39			
OL-VC-10071	OL-0238A-11	1118399	925184	3.3	6.6	5.0	186																
OL-VC-10073	OL-0245-01	1118025	925124	0.0	3.3	1.7	196.6																
OL-VC-10073	OL-0245-02	1118025	925124	3.3	6.6	5.0	147.7																
OL-VC-10076	OL-0245-06	1117526	925240	0.0	3.3	1.7	151.4																
OL-VC-10076	OL-0245-07	1117526	925240	3.3	6.6	5.0	154.2																
OL-VC-10077	OL-0249-18	1118080	925346	0.0	3.3	1.7	150.4	0	0	0	0.4	0	0	0.4	99.6	68.6	31	61	44	17			
OL-VC-10077	OL-0245-10	1118080	925346	3.3	6.6	5.0	187.5																
OL-VC-10078	OL-0248-05	1117846	925416	0.0	3.3	1.7	48.1																
OL-VC-10078	OL-0248-06	1117846	925416	3.3	6.6	5.0	108.5																
OL-VC-10080	OL-0245-14	1116981	925396	0.0	3.3	1.7	135.2																
OL-VC-10080	OL-0250-01	1116981	925396	3.3	6.6	5.0	94.6	0	0	0	9.2	1	3	5.2	90.8	64.8	26	56	40	16			
OL-VC-10081A	OL-0248-01	1117444	925497	0.0	3.3	1.7	132.6																
OL-VC-10081A	OL-0250-03	1117444	925497	3.3	6.6	5.0	172.1	0	0	0	3	0	1	2	97	59	38	122	67	55	2.69		
OL-VC-10089	OL-0248-10	1117288	925743	0.0	3.3	1.7	91.7																
OL-VC-10089	OL-0248-11	1117288	925743	3.3	6.6	5.0	135.7																
OL-VC-10090	OL-0248-15	1118132	925905	0.0	3.3	1.7	179.1																
OL-VC-10090	OL-0256-09	1118132	925905	3.3	6.6	5.0	104.3	0	0	0	1.7	0.7	0	1	98.3	78.3	20	52	35	17			
OL-VC-10094	OL-0248-20	1116632	925868	0.0	3.3	1.7	126.7																
OL-VC-10094	OL-0249-11	1116632	925868	3.3	6.6	5.0	86.3	0	0	0	11	0	2	9	89	73	16	46	31	15	2.58		
OL-VC-10095A	OL-0256-05	1118336	925975	0.0	3.3	1.7	193	0	0	0	2.7	0.7	1	1	97.3	73.3	24	109	38	71			
OL-VC-10095A	OL-0256-06	1118336	925975	3.3	6.6	5.0	140.2	0	0	0	1.9	0	0.9	1	98.1	79.1	19	101	41	60			

APPENDIX A
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Remediation Area D - ILWD Index Test Results Summary (Top 2m within Dredging Zone)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity	Organic Content %	Carbonate Alkalinity %
OL-VC-10096	OL-0256-03	1117842	925985	0.0	3.3	1.7	101.7	0	0	0	3.2	1	1	1.2	96.8	73.8	23	56	36	20			
OL-VC-10096	OL-0244A-08	1117842	925985	3.3	6.6	5.0	94.5																
OL-VC-10102	OL-0244A-12	1117485	926068	3.3	6.6	5.0	101.4																
OL-VC-10103	OL-0244A-16	1117084	926132	0.0	3.3	1.7	161.5																
OL-VC-10103	OL-0244A-17	1117084	926132	3.3	6.6	5.0	178																
OL-VC-10105	OL-0244A-01	1116859	926187	0.0	3.3	1.7	210.9																
OL-VC-10105	OL-0296-06	1116859	926187	0.0	3.3	1.7	215.3	0	0	0	11.7	1.7	4	6	88.3	53.8	34.5	89	55	34	2.6		
OL-VC-10105	OL-0256-12	1116859	926187	3.3	6.6	5.0	162.6	0	0	0	27	2	8	17	73	47	26	84	59	25			
OL-STA-20002-VC	OL-0071-03	1118665	922578	3.3	6.6	5.0	89	0	0	0	12.8	0	0.8	12	87.2	77.3	9.9	65	41	24	2.36	4.4	
OL-STA-20004-VC	OL-0118-25	1118299	922721	0.0	3.3	1.7															2.69		
OL-STA-20004-VC	OL-0071-08	1118299	922721	0.0	3.3	1.7	136	0	0	0	27	0	4	23	73	51.4	21.6	85	44	41		13.9	
OL-STA-20007-VC	OL-0071-17	1118055	922922	3.3	6.6	5.0	113	0	0	0	7.5	0.5	2	5	92.5	79.3	13.2	110	39	71		15.7	
OL-STA-20012-VC	OL-0071-25	1118395	922766	3.3	6.6	5.0	128	0	0	0	10.9	0	1.9	9	89.1	82.0	7.2	109	46	63		13.4	
OL-STA-20014-VC	OL-0071-28	1118322	922919	0.0	3.3	1.7	132	0	0	0	1.6	0	0	2	98.4	83.4	15	71	46	25		7	
OL-STA-20015-VC	OL-0071-30	1118145	922986	3.3	6.6	5.0	178	0	0	0	0.5	0	0	1	99.5	60	39.5	127	63	64		6.5	
OL-VC-20075	OL-0231-04	1118764	922723	0.0	3.3	1.7	242.2																
OL-VC-20075	OL-0232-17	1118764	922723	3.3	6.6	5.0	178.3	0	0	0	5.2	3.2	1	1	94.8	51.8	43.0	74	50	24			
OL-VC-20078	OL-0233-04	1118584	923176	0.0	3.3	1.7	219.1	0	0	0	1.6	0	0	1.6	98.4	87.4	11	122	66	56			
OL-VC-20078	OL-0231-15	1118584	923176	3.3	6.6	5.0	137.4																
OL-VC-20079	OL-0231-18	1118450	923077	0.0	3.3	1.7	140.9																
OL-VC-20079	OL-0297-02	1118450	923077	0.0	3.3	1.7	123.3	0	0	0	0.7	0	0	0.7	99.3	88.7	10.6	55	36	19	2.58		
OL-VC-20079	OL-0231-19	1118450	923077	3.3	6.6	5.0	153.6																
OL-VC-70017	OL-0233-12	1117926	926251	0.0	3.3	1.7	226.7																
OL-VC-70017	OL-0235-14	1117926	926251	3.3	6.6	5.0	207	0.3	0	0.3	1.4	0	0.7	0.7	98.3	63.3	35	109	60	49	2.59		
OL-VC-70021	OL-0234-09	1117331	926382	0.0	3.3	1.7	130.7																
OL-VC-70021	OL-0234-10	1117331	926382	3.3	6.6	5.0	103																
OL-VC-70023	OL-0234-18	1116854	926349	0.0	3.3	1.7	109.1																
OL-VC-70023	OL-0234-19	1116854	926349	3.3	6.6	5.0	69.7																
OL-VC-80029	OL-0281-08	1118587	924084	3.3	6.6	5.0	123.3	0	0	0	6	1	2	3	94	67	27	79	55	24	2.57		
OL-VC-80030	OL-0281-17	1118545	924726	3.3	6.6	5.0	232	0	0	0	1.5	0	0	1.5	98.5	69.5	29	99	61	38			
OL-VC-80031	OL-0272-07	1118458	925320	0.0	0.5	0.3	161.3																
OL-VC-80031	OL-0272-08	1118458	925320	0.5	3.3	1.9	238.1																
OL-VC-80031	OL-0272-09	1118458	925320	3.3	6.6	5.0	185.6																
OL-VC-80031	OL-0303-05	1118458	925320	3.3	6.6	5.0	179.4	0.4	0	0.4	1.3	0	0.5	0.8	98.3	64.4	33.9	80	45	35	2.55		
OL-VC-80033	OL-0281-09	1118853	923783	0.0	0.5	0.3	211.2	0	0	0	0.8	0	0	0.8	99.2	66.2	33	115	47	68	2.62		
OL-VC-80033	OL-0271-01	1118853	923783	3.3	6.6	5.0	147.9																
OL-VC-80034	OL-0281-10	1118809	924391	0.0	0.5	0.3	215.6	0	0	0	0.7	0	0	0.7	99.3	74.3	25	113	49	64			
OL-VC-80034	OL-0304-08	1118809	924391	0.5	3.3	1.9	232.5											161	49	112			
OL-VC-80034	OL-0271-06	1118809	924391	3.3	6.6	5.0	181.4																
OL-VC-80035	OL-0281-18	1118788	925064	0.0	0.5	0.3	219.2	0	0	0	2.1	1	0	1.1	97.9	72.9	25.0	103	48	55	2.73		
OL-VC-80035	OL-0273-11	1118788	925064	3.3	6.6	5.0	186.6																
S309	SF0062	1118178	923491	0.0	0.5	0.2		0.1	0	0.1	27.4	0.2	3.9	23.3	72.5	47.9	24.6	34.9	30.2	4.7	2.45		59.2
S309	SF0063	1118178	923491	0.5	1.0	0.7		0	0	0	7	0	1	6	93	76	17	35.3	32.3	3	2.48		57.8
S309	VC0087	1118178	923491	1.0	2.4	1.7		0			10				90	82	8						59.2
S309	VC0065	1118178	923491	2.4	5.7	4.1		0	0	0	7.1	0	2.5	4.6	92.9	67.9	25.0	36.3	33.7	2.6	2.54		59.4
S310	SF0064	1118393	924481	0.0	0.5	0.2		0	0	0	9.3	0	0.3	9	90.7	58.9	31.8	35.3	31.8	3.5	2.53		62.1
S310	SF0065	1118393	924481	0.5	1.0	0.7		0	0	0	5.1	0	0.4	4.7	94.9	71.0	23.9	34.7	32.8	1.9	2.57		61.5
S310	VC0073	1118393	924481	1.0	3.3	2.1		0	0	0	2.8	0	1.1	1.7	97.2	69.3	27.9	36.7	24.6	12.1	2.52		59
S310	VC0074	1118393	924481	3.3	6.6	4.9		0	0	0	1.2	0	0.4	0.8	98.8	72.2	26.6	37.7	32.8	4.9	2.58		58.7
S311	VC0207	1117120	925290	0.0	0.5	0.2		0	0	0	26	NA	NA	NA	74	66	8						59.2
S311	VC0208	1117120	925290	0.5	1.0	0.7		0	0	0	10	NA	NA	NA	90	84	6						58.8
S311	VC0081	1117120	925290	1.0	3.3	2.1		0	0	0	5.2	0	1	4.2	94.8	69.8	25	39.5	36.1	3.4	2.58		60.4
S311	VC0082	1117120	925290	3.3	6.6	4.9		0	0	0	7.1	0	0.7	6.4	92.9	68	24.9	44.5	40.8	3.7	2.62		61.9
S311	CT0003	1117120	925290	5.6	5.6	5.6	139.8														2.56		34
S312	SF0068	1117276	926023	0.0	0.5	0.2		0	0	0	4.9	0	1.1	3.8	95.1	83.9	11.2	31.2	29.3	1.9	2.57		56.9
S312	SF0069	1117276	926023	0.5	1.0	0.7		0	0	0	1.7	0	0.1	1.6	98.3	86.2	12.1	30.4	28.4	2	2.54		56.5
S312	VC0089	1117276	926023	1.0	3.3	2.1		0	0	0	5.5	0	1.2	4.3	94.5	62.8	31.7	39.3	35.8	3.5	2.58		59.5
S312	CT0004	1117276	926023	4.5	4.5	4.5	158.8	0	0	0	0.3	0	0.1	0.2	99.7	NA	NA				2.02		32
S312	VC0090	1117276	926023	3.3	6.6	4.9		0	0	0	4.9	0	0.4	4.5	95.1	69.6	25.5	34.1	29.9	4.2	2.56		61
S339	SF0124	1118149	922819	0.0	0.5	0.2		0	0	0	21.9	0	7.9	14	78.1	71.0	7.1	34	30.9	3.1	2.55		64.3
S339	SF0125	1118149	922819	0.5	1.0	0.7		0	0	0	15	0	4.7	10.3	85	75	10	37.4	32.5	4.9	2.53		63
S339	CT0005a	1118149	922819	1.2	1.2	1.2	135.2	0	0	0	3.9	0.1	0.5	3.3	96.1	91.1	5.0				2.54		32
S339	SB0031	1118149	922819	1.0	3.3	2.1		0	0	0	6.7	0	0.8	5.9	93.3	74.9	18.4	36.9	29.3	7.6	2.47		59.6
S339	SB0032	1118149	922819	3.3	5.5	4.4		0	0	0	2.6	0	0.3	2.3	97.4	70.8	26.6	35	30.3	4.7	2.53		60.3
S339	SF0123_E	1118149	922819	5.5	6.6	6.0		0	0	0	5.3	0.2	0.7	4.4	94.7	67.4	27.3	37.5	31	6.5	2.56		63
S339	CT0005b	1118149	922819	6.3	6.3	6.3	242.2	0	0	0	1.1	0.1	0.3	0.7	98.9	98.9	0				2.5		30
S340	SF0123	1117863	923498	0.0	0.1	0.0		36	35.1	0.9	1.6	0.8	0.1	0.7	62.4	54.7	7.7	36.4	34	2.4	2.61		57.6
S340	SF0123_R	1117863	923498	0.0	0.1	0.0		20.7	11	9.7	22.3	2.7	7.2	12.4	57	46.2	10.8	32.2	28.6	3.6	2.62		59.8

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area D - ILWD Index Test Results Summary (Top 2m within Dredging Zone)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity	Organic Content %	Carbonate Alkalinity %
S340	SF0126	1117863	923498	0.0	0.5	0.2		0	0	0	35.7	0	11.5	24.2	64.3	43.4	20.9	35.1	32.6	2.5	2.55		58.2
S340	SF0127	1117863	923498	0.5	1.0	0.7		0	0	0	12.6	0	3.7	8.9	87.4	61.4	26.0	37.5	34.1	3.4	2.58		59.8
S340	SB0033	1117863	923498	1.0	3.3	2.1		0	0	0	33.6	0	12.6	21	66.4	37.8	28.6	36.9	35.5	1.4	2.54		64.8
S340	SB0034	1117863	923498	3.3	6.6	4.9		0	0	0	18.7	0	3.1	15.6	81.3	68.0	13.3	40.3	36.3	4	2.52		64.9
S341	SF0128	1117794	923911	0.0	0.5	0.2		3.6	0	3.6	44.2	6.9	14.2	23.1	52.2	42.2	10.0	29.5	27.4	2.1	2.58		66.2
S341	SF0129	1117794	923911	0.5	1.0	0.7		1.5	0	1.5	44.6	13.4	13.1	18.1	53.9	43.8	10.1	47.2	44.3	2.9	2.71		71.9
S341	SB0063	1117794	923911	1.0	2.8	1.9		0	0	0	11.4	1	4.5	5.9	88.6	71.5	17.1	34.4	32.8	1.6	2.57		60.3
S341	SB0064	1117794	923911	2.8	5.2	4.0		0.3	0	0.3	4.5	0.5	0.7	3.3	95.2	69.6	25.6	33.6	31	2.6	2.53		57.6
S341	CT0006	1117794	923911	5.5	5.5	5.5	118.2	0.3	0	0.3	4.7	0.5	1.2	3	95.0	95	1.5				2.52		35
S341	SF0119	1117794	923911	5.2	6.6	5.9		0	0	0	3.3	0.3	0.5	2.5	96.7	63.4	33.3	38.6	35.7	2.9	2.53		57.2
S342	BC0011	1118375	923951	0.0	0.1	0.0		0	0	0	38	NA	NA	NA	62	55	7						
S342	BC0012	1118375	923951	0.1	0.3	0.2		0	0	0	66	NA	NA	NA	34	29	5						
S342	SF0130_T	1118375	923951	0.0	0.5	0.2		3.1	0.1	3	15.2	0.2	6.1	8.9	81.7	77.3	4.4	42.2	36.9	5.3	2.53		58.9
S342	SF0131	1118375	923951	0.5	1.0	0.7		0	0	0	7.9	0	1.2	6.7	92.1	64.7	27.4	39.8	34.4	5.4	2.59		49.3
S342	SB0037	1118375	923951	1.0	3.3	2.1		0	0	0	4.3	0	0.9	3.4	95.7	68.5	27.2	34.9	33	1.9	2.5		55.9
S342	SB0038	1118375	923951	3.3	6.6	4.9		0	0	0	2.2	0	0.5	1.7	97.8	64.8	33.0	38.7	33.3	5.4	2.56		52.8
S343	SF0132	1117698	924527	0.0	0.5	0.2		0.3	0	0.3	26.7	2.9	6.8	17	73	56.2	16.8	28.5	25.5	3	2.53		58.4
S343	SF0133	1117698	924527	0.5	1.0	0.7		0.2	0	0.2	16	0.4	2.8	12.8	83.8	63.9	19.9	31.9	27.5	4.4	2.57		60.5
S343	SB0039	1117698	924527	1.0	3.3	2.1		2.1	0	2.1	48.1	6.6	11	30.5	49.8	39.2	10.6	48.6	45	3.6	2.54		66.6
S343	SF0167	1117698	924527	1.0	3.3	2.1		0	0	0	45.8	0.4	12.3	33.1	54.2	43.8	10.4	42.9	40.7	2.2	2.55		66.8
S343	SB0040	1117698	924527	3.3	6.6	4.9		5	0	5	47.9	3.5	15.5	28.9	47.1	33.8	13.3	46.5	41	5.5	2.54		68.3
S344	BC0007	1118147	925066	0.0	0.1	0.0		0	0	0	78	NA	NA	NA	22	17	5						
S344	SF0111_T	1118147	925066	0.0	0.5	0.2		0	0	0	15	NA	NA	NA	85	78	7						
S344	BC0008	1118147	925066	0.1	0.5	0.3		0	0	0	17	NA	NA	NA	83	78	5						
S344	SF0112	1118147	925066	0.5	1.0	0.7		0	0	0	0.6	0	0.2	0.4	99.4	73.5	25.9	33.4	29.1	4.3	2.56		56.3
S344	CT0009	1118147	925066	2.1	2.1	2.1	90.6	0.1	0	0.1	3.4	0.3	1.1	2	96.5	92.5	4.0				2.32		33
S344	SB0019	1118147	925066	1.0	3.3	2.1		0	0	0	6.8	0	1.1	5.7	93.2	67.8	25.4	36.1	33	3.1	2.59		56.8
S344	SB0070	1118147	925066	1.0	3.3	2.1		0	0	0	5.5	0	0.7	4.8	94.5	69.8	24.7	37.6	32.6	5	2.59		58.9
S344	SB0020	1118147	925066	3.3	6.6	4.9		0	0	0	2.2	0	0.4	1.8	97.8	70.7	27.1	39.4	35.9	3.5	2.61		54
S346	SF0138	1117238	924923	0.0	0.5	0.2		10.3	6.8	3.5	23.2	8.4	8.6	6.2	66.5	52.1	14.4	26.1	24.7	1.4	2.63		61.8
S346	SF0139	1117238	924923	0.5	1.0	0.7		0.4	0	0	14.6	2.7	3.2	8.7	85	67.3	17.7	30.4	30.1	0.3	2.6		58.7
S346	SB0045	1117238	924923	1.0	5.2	3.1		0.1	0	0.1	12.4	0.2	1.6	10.6	87.5	65.0	22.5	36.5	35.3	1.2	2.56		60.6
S346	SB0046	1117238	924923	5.2	6.6	5.9		0.8	0	0.8	34.9	3.5	5.8	25.6	64.3	47.0	17.3	Non-Plastic			2.34		56.8
S347	SF0140	1117468	925224	0.0	0.5	0.2		2.2	0	2.2	53.9	6.1	21.6	26.2	43.9	30.2	13.7	Non-Plastic			2.45		63.4
S347	SF0141	1117468	925224	0.5	1.0	0.7		5.4	0	5.4	56	9.9	18.9	27.2	38.6	29.3	9.3	Non-Plastic			2.4		66.4
S347	SB0047	1117468	925224	1.0	3.3	2.1		9.2	0	9.2	24.8	5.7	6.4	12.7	66	49.3	16.7	Non-Plastic			2.45		62.8
S347	SB0048	1117468	925224	3.3	6.6	4.9		0.3	0	0.3	22.1	1.1	5.9	15.1	77.6	57.9	19.7	44.5	41.4	3.1	2.57		61.3
S348	SF0142	1116868	925641	0.0	0.5	0.2		0	0	0	7.4	0	2	5.4	92.6	62.5	30.1	40.3	35.2	5.1	2.55		60.2
S348	SF0143	1116868	925641	0.5	1.0	0.7		0	0	0	3.7	0	0.4	3.3	96.3	71.0	25.3	36.6	33.6	3	2.58		59.1
S348	SB0049	1116868	925641	1.0	3.6	2.3		0	0	0	19.9	0	6.2	13.7	80.1	59.8	20.3	46.3	36	10.3	2.57		62.3
S348	SB0050	1116868	925641	3.6	6.6	5.1		0	0	0	2.7	0	1.4	1.3	97.3	66.6	30.7	33.8	30.6	3.2	2.59		59.4
S350	SF0146	1116488	926012	0.0	0.5	0.2		0.5	0	0.5	9.6	0	2.8	6.8	89.9	57.8	32.1	38.2	33.5	4.7	2.68		60.1
S350	SF0147	1116488	926012	0.5	1.0	0.7		0	0	0	6.7	0	1.1	5.6	93.3	70.0	23.3	33.6	31.2	2.4	2.61		59.5
S350	SB0053	1116488	926012	1.0	3.0	2.0		0	0	0	5.3	0	1	4.3	94.7	72.9	21.8	40.6	32.8	7.8	2.63		61.4
S350	SB0054	1116488	926012	3.0	6.6	4.8		0	0	0	12	0.3	1.2	10.5	88	77.7	10.3	32.2	28.3	3.9	2.56		64.4
S350	SB0067	1116488	926012	3.0	6.6	4.8		0	0	0	11.5	0	1	10.5	88.5	70	18.5	34.1	30.2	3.9	2.55		65
S351	SF0173	1116245	926468	0.0	0.1	0.0		0	0	0	12.4	1.7	0.5	10.2	87.6	65	22.6	38	35	3	2.49		61.8
S351	SF0149	1116245	926468	0.0	0.5	0.2		21.7	0	21.7	34.6	6	11.6	17	43.7	33.0	10.7	Non-Plastic			2.45		64
S351	SF0150	1116245	926468	0.5	1.0	0.7		32.6	NA	NA	50.2	NA	NA	NA	17.2	12.6	4.6	Non-Plastic			2.52		68.2
S351	SB0055	1116245	926468	1.0	3.3	2.1		13.6	0	13.6	22.4	14.1	1.1	7.2	64	57	7	26.5	26.4	0.1	2.54		64.6
S351	SB0056	1116245	926468	3.3	6.6	4.9		0	0	0	28.6	0	17.9	10.7	71.4	60.2	11.2	34.4	31.1	3.3	2.5		63.1
S351	CT0010	1116245	926468	5.9	5.9	5.9	76.3	0.2	0	0.2	49.5	0.4	8.5	40.6	50.3	48.3	2				2.46		23
Average							148.5	1.4	0.4	0.7	14.4	1.3	3.4	8.2	84.2	64.0	20.1	60	40	20	2.54	7.4	58.5
Maximum						6.3	242.2	36.0	35.1	21.7	78.0	14.1	21.6	40.6	99.7	98.9	44.0	161	88	112	2.75	15.7	83.0
Minimum							19.0	0.0	0.0	0.0	0.3	0.0	0.0	0.2	17.2	12.6	0.0	26	25	0	2.02	2.9	23.0
Standard Deviation (σ)							47.5	5.3	3.3	2.7	16.4	2.9	4.7	8.6	18.3	16.2	10.1	32	12	23	0.10	3.9	9.7
Number of Samples							114	126	124	124	126	117	117	117	126	125	125	105	105	105	96	16	83
Average+1.96σ							241.6	11.7	7.0	6.0	46.4	7.0	12.7	25.1	120.0	95.7	39.9	122	64	65	2.73	14.9	77.5
Average-1.96σ							55.4	-9.0	-6.1	-4.5	-17.7	-4.4	-6.0	-8.7	48.4	32.2	0.4	-2	16	-25	2.35	-0.2	39.5

Note:
1. NA indicated that the full grain-size distribution curve is not available; therefore the coarse versus fine fractions of the gravel and sand are not available.
2. The Average, Minimum, Maximum and Standard Deviation are calculated based on the number of samples available for each category.
3. Negative values from Average-1.96σ calculations do not have practical meaning

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area E - SMUs 6 and 7 Index Test Results Summary (Top 1m within Dredging Zone, Non-ILWD)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity	Organic Content %	Carbonate Alkalinity %
OL-SB-60007-VC	OL-0023-01	1119195	928698	0.0	3.3	1.7	32	0.2	0	0.2	65.5	2	8	55.5	34.3	29	5.3		Non-Plastic		2.67	0.7	
OL-SB-60013-VC	OL-0020-01	1117305	928031	0.0	3.3	1.7	47	0.4	0	0.4	49.7	0	1.7	48	49.9	42.7	7.2		Non-Plastic		2.63	1.2	
OL-STA-60016-SB	OL-0071-44	1120195	928826	2.0	4.0	3.0	75																
OL-STA-60017-SB	OL-0009-05	1120228	928663	2.0	4.0	3.0	85	0	0	0	43	0	4	39	57	42.5	14.5		Non-Plastic		2.60	2.4	
OL-STA-60019-SB	OL-0009-09	1118229	928296	2.0	4.0	3.0																	
OL-STA-60098	OL-0338-01	1117362	927889	0.0	3.2	1.6	52.3	3	0	3	70.5	6	25	39	26.5	14	12.4		Non-Plastic		2.61	2.8	
OL-VC-60059	OL-0283-04	1121126	927881	0	3.3	1.65	96.8	0	0	0	37.2	1.2	4	32	62.8	46.8	16	49	40	9	2.67		
OL-VC-60067	OL-0274-03	1120674	928359	0.0	3.3	1.7	91.6																
OL-VC-60068	OL-0283-09	1119471	928330	0.0	3.3	1.7	50.4	0.5	0	0.5	71.7	3.7	15	53	27.8	18.8	9	36	27	9			
OL-VC-60069	OL-0283-12	1118853	928238	0.0	3.3	1.7	39.8	0	0	0	87.1	0	4	83.1	12.9	7.9	5						
OL-VC-60070	OL-0282-13	1117648	927621	0.0	3.3	1.7	80.4	0.1	0	0.1	58.2	1.2	6	51	41.7	33.7	8						
OL-VC-60195	OL-0642-01	1120427	928400	0	1	0.5															2.63		
OL-VC-60195	OL-0642-02	1120427	928400	1	2	1.5															2.57		
OL-VC-60195	OL-0642-03	1120427	928400	2	3	2.5															2.71		
OL-VC-60200	OL-0600-01	1118702	928540	0	1	0.5															2.70		
OL-VC-60200	OL-0600-02	1118702	928540	1	2	1.5															2.68		
OL-VC-60200	OL-0600-03	1118702	928540	2	3	2.5															2.69		
OL-VC-60200	OL-0600-04	1118702	928540	3	4	3.5															2.70		
OL-VC-60201	OL-0600-07	1118495	928281	0	1	0.5															2.70		
OL-VC-60201	OL-0600-08	1118495	928281	1	2	1.5															2.70		
OL-VC-60201	OL-0600-09	1118495	928281	2	3	2.5															2.68		
OL-VC-60201	OL-0600-10	1118495	928281	3	4	3.5															2.70		
OL-VC-60202	OL-0600-15	1118347	928418	0	1	0.5															2.67		
OL-VC-60202	OL-0600-16	1118347	928418	1	2	1.5															2.68		
OL-VC-60202	OL-0600-17	1118347	928418	2	3	2.5															2.69		
OL-VC-60202	OL-0600-18	1118347	928418	3	4	3.5															2.70		
OL-STA-60100	OL-0338-02	1119575	928597	0.0	3.3	1.7	66.6	0	0	0	41.2	1	2	38	58.8	48	11.3	53	34	19	2.60	2.7	
OL-SB-70002-VC	OL-0032-01	1116473	927021	0.0	3.3	1.7	77	0.1	0	0	62.4	0	15	47.4	37.5	30.2	7.3		Non-Plastic		2.67	2.4	
OL-SB-70003-VC	OL-0026-05	1116492	927305	0.0	3.3	1.7	63	0	0	0	35.6	0	2	34	64.4	49.9	14.5		Non-Plastic		2.70	1.3	
OL-STA-70005-SB	OL-0028-01	1116458	926838	0.0	2.0	1.0	67	0	0	0	20.4	1	3	16	79.6	60	19	54	36	18	2.50	12.2	
OL-STA-70006-SB	OL-0112-04	1116573	926791	2	4	3	61.1	0.3	0	0.3	26.2	0.8	2.8	22.6	73.5	47.4	26.1	58	33	25	2.52		
OL-SB-70012-SS	OL-0100-31	1116663	926520	0.0	0.5	0.3	94												Non-Plastic				
OL-SB-70013-SS	OL-0100-32	1116727	926908	0.0	0.5	0.3	123											59	34	25			
OL-STA-70015-SS	OL-0100-35	1116570	926452	0.0	0.5	0.3	146											69	43	26			
OL-VC-70024	OL-0235-02	1116858	926641	0.0	3.3	1.7	133.9																
OL-VC-70025	OL-0290-19	1116331	926720	0.0	3.3	1.7	81.8																
OL-VC-70026	OL-0291-01	1116387	926928	0.0	3.3	1.7	64.2																
OL-VC-70027	OL-0291-04	1116246	926946	0.0	3.3	1.7	61.7																
OL-VC-70028	OL-0289-03	1116368	927229	0.0	3.3	1.7	50.8	0	0	0	65.8	1.8	10	54	34.2	26.2	8						
OL-VC-70029	OL-0291-09	1116560	927423	0.0	3.3	1.7	66																
OL-VC-70030	OL-0288-16	1116809	927658	0.0	3.3	1.7	84.8	1.2	0	1	37.3	2.3	10	25	61.5	40.5	21.0	50	36	14			
OL-VC-70112	OL-0597-11	1116565	926681	0.0	1.0	0.5															2.44		
OL-VC-70112	OL-0597-12	1116565	926681	1.0	2.0	1.5															2.54		
OL-VC-70112	OL-0597-13	1116565	926681	2.0	3.0	2.5															2.61		
OL-VC-70112	OL-0597-14	1116565	926681	3.0	4.0	3.5															2.60		
OL-VC-70113	OL-0598-12	1116658	926915	0	1	0.5															2.53		
OL-VC-70113	OL-0598-13	1116658	926915	1	2	1.5															2.63		
OL-VC-70113	OL-0598-14	1116658	926915	2	3	2.5															2.67		
OL-VC-70113	OL-0598-15	1116658	926915	3	4	3.5															2.69		
OL-VC-70114	OL-0599-10	1116813	927141	0	1	0.5															2.62		
OL-VC-70114	OL-0599-11	1116813	927141	1	2	1.5															2.67		
OL-VC-70114	OL-0599-12	1116813	927141	2	3	2.5															2.68		
OL-VC-70114	OL-0599-13	1116813	927141	3	4	3.5															2.69		
OL-VC-70115	OL-0599-01	1116954	927417	0	1	0.5															2.66		
OL-VC-70115	OL-0599-02	1116954	927417	1	2	1.5															2.68		
OL-VC-70115	OL-0599-03	1116954	927417	2	3	2.5															2.70		
OL-VC-70115	OL-0599-04	1116954	927417	3	4	3.5															2.69		
OL-S1	S00556	1116419	926536	0.0	0.1	0.0	37.4	38.5	NA	NA	52.1	NA	NA	NA	9.4	8.7	0.7						
OL-S1	S00557	1116419	926536	0.0	0.1	0.0	39.7	39.5	NA	NA	49.3	NA	NA	NA	11.2	10.2	1						
OL-S1	S00558	1116419	926536	0.0	0.1	0.0	46.2	46.2	NA	NA	40.9	NA	NA	NA	12.9	11.8	1.1						
OL-S2	S00546	1116760	926601	0.0	0.1	0.0	52.5	52.7	NA	NA	30	NA	NA	NA	17.3	14.9	2.4						
OL-S3	S00613	1116801	926609	0.0	0.1	0.0	53	53.2	NA	NA	28.8	NA	NA	NA	18	15	3						

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area E - SMUs 6 and 7 Index Test Results Summary (Top 1m within Dredging Zone, Non-ILWD)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity	Organic Content %	Carbonate Alkalinity %
OL-S5	S00547	1116893	927107	0.0	0.1	0.0	53.9	54.7	NA	NA	22.2	NA	NA	NA	23.1	19.3	3.8						
OL-S6	S00582	1117218	927545	0.0	0.1	0.0	28.9	28.3	NA	NA	70.8	NA	NA	NA	0.9	0.3	0.6						
OL-S7	S00555	1117251	927378	0.0	0.1	0.0	31.4	31	NA	NA	66.1	NA	NA	NA	2.9	1.9	1						
P1	S00014	1116419	926536	0.0	1.0	0.5	45.4	43.6	NA	NA	35.3	NA	NA	NA	21.1	19.3	1.8						
P1	S00015	1116419	926536	1.0	2.0	1.5	50.7	51.4	NA	NA	3	NA	NA	NA	45.6	42.6	3						
P1	S00016	1116419	926536	2.0	3.0	2.5	47.5	48.3	NA	NA	4.2	NA	NA	NA	47.5	43	4.5						
P11	S00162	1118691	927781	0.0	1.0	0.5	60.1	59.8	NA	NA	11.8	NA	NA	NA	28.4	25.6	2.8						
P11	S00163	1118691	927781	1.0	2.0	1.5	54.2	59.3	NA	NA	4.1	NA	NA	NA	36.6	30.7	5.9						
P11	S00164	1118691	927781	2.0	3.0	2.5	53.4	55.9	NA	NA	5.6	NA	NA	NA	38.5	31.1	7.4						
P16	S00062	1120323	928588	0.0	1.0	0.5	54.2	54	NA	NA	17.8	NA	NA	NA	28.2	23	5.2						
P16	S00065	1120323	928588	0.0	1.0	0.5	52.1	47.8	NA	NA	22.8	NA	NA	NA	29.4	23.6	5.8						
P16	S00066	1120323	928588	0.0	1.0	0.5	48.7	41.5	NA	NA	29.4	NA	NA	NA	29.1	23.6	5.5						
P16	S00063	1120323	928588	1.0	2.0	1.5	49.5	62	NA	NA	6.8	NA	NA	NA	31.2	22	9.2						
P16	S00064	1120323	928588	2.0	3.0	2.5	49.4	50.8	NA	NA	10.7	NA	NA	NA	38.5	33.8	4.7						
P3	S00340	1116857	926636	0.0	1.0	0.5	55.4	54.8	NA	NA	20.3	NA	NA	NA	24.9	22.7	2.2						
P3	S00341	1116857	926636	1.0	2.0	1.5	51.5	53.3	NA	NA	17.9	NA	NA	NA	28.8	26.5	2.3						
P3	S00342	1116857	926636	2.0	3.0	2.5	51.5	54	NA	NA	4.7	NA	NA	NA	41.3	36.9	4.4						
P3	S00343	1116857	926636	3.0	3.9	3.4	48.9	50.8	NA	NA	3.1	NA	NA	NA	46.1	42.2	3.9						
S10	S00572	1118187	928281	0.0	0.1	0.0	39.8	39.3	NA	NA	52.2	NA	NA	NA	8.5	7.1	1.4						
S11	S00567	1117954	927958	0.0	0.1	0.0	31.2	29.5	NA	NA	67.7	NA	NA	NA	2.8	2	0.8						
S13	S00565	1119850	928512	0.0	0.1	0.0	50.4	51.8	NA	NA	17.5	NA	NA	NA	30.7	24.1	6.6						
S313	VC0187	1116312	926501	0.0	0.5	0.2		0	0	0	50	NA	NA	NA	50	41	9						
S313	VC0188	1116312	926501	0.5	1.0	0.7		0	0	0	71	NA	NA	NA	29	22	7						
S313	VC0097	1116312	926501	1.0	3.3	2.1		0	0	0	2	NA	NA	NA	98	91	7						
S313	VC0194	1116312	926501	1.0	3.3	2.1		0	0	0	2	NA	NA	NA	98	91	7						
S314	SF0072	1116583	926449	0.0	0.5	0.2		0.2	0.1	0	20.1	0.5	2.1	17.5	79.7	58.4	21.3		Non-Plastic		2.35		56.5
S314	SF0073	1116583	926449	0.5	1.0	0.7		0	0	0	4.5	0	0.2	4.3	95.5	64.8	30.7	33.8	31.6	2.2	2.42		56.5
S314	VC0105	1116583	926449	1.0	3.3	2.1		0	0	0	3	0	0.4	2.6	97	65.3	31.7	37.2	30	7.2	2.50		56.7
S314	VC0200	1116583	926449	1.0	3.3	2.1		0	0	0	1.4	0	0.5	0.9	98.6	48.9	49.7	38.5	29.8	8.7	2.61		56.2
S316	SF0076	1117543	927405	0.0	0.5	0.2		0	0	0	91	NA	NA	NA	9	5	4						
S316	SF0077	1117543	927405	0.5	1.0	0.7		0	0	0	93	NA	NA	NA	7	5	2						
S316	VC0121	1117543	927405	1.0	3.3	2.2		0	0	0	87	NA	NA	NA	13	10	3						
S318	VC0189	1118023	928074	0.0	0.5	0.2		0	0	0	91	NA	NA	NA	9	8	1						
S318	VC0190	1118023	928074	0.5	1.0	0.7		0	0	0	92	NA	NA	NA	8	6	2						
S318	VC0137	1118023	928074	1.0	3.3	2.1		0	0	0	91	NA	NA	NA	9	6	3						
S321	SF0086	1118749	928457	0.0	0.5	0.2		0	0	0	93	NA	NA	NA	7	3	4						
S321	SF0087	1118749	928457	0.5	1.0	0.7		0	0	0	92	NA	NA	NA	8	5	3						
S321	VC0161	1118749	928457	1.0	3.3	2.1		0	0	0	83	NA	NA	NA	17	15	2						
S322	SF0088	1120176	928436	0.0	0.5	0.2		0	0	0	19	NA	NA	NA	81	81	0						
S322	SF0089	1120176	928436	0.5	1.0	0.7		0	0	0	8	NA	NA	NA	92	69	23						
S322	VC0169	1120176	928436	1.0	3.3	2.1		0	0	0	30	NA	NA	NA	70	52	18						
S352	SF0151	1116216	926825	0.0	0.5	0.2		1.1	0	1	39	2.4	9.3	27.3	59.9	44.1	15.8		Non-Plastic		2.50		67.9
S352	SF0152	1116216	926825	0.5	1.0	0.7		0.0	0	0	2.2	0.2	0.4	1.6	97.8	71.4	26.4	29.7	27.7	2	2.57		63.2
S352	SB0057	1116216	926825	1.0	3.3	2.1		0	0	0	26.5	0	1.1	25.4	73.5	66.2	7.3	26.1	24.1	2	2.59		67.9
S353	SF0113	1116583	927268	0.0	0.5	0.2		0	0	0	92	NA	NA	NA	8	5	3						
S353	SF0114	1116583	927268	0.5	1.0	0.7		0	0	0	90	NA	NA	NA	10	7	3						
S353	SB0021	1116583	927268	1.0	3.3	2.1		0	0	0	72	NA	NA	NA	28	22	6						
Average							61.3	18.8	0.0	0.2	42.0	1.1	5.8	32.6	39.2	30.8	8.4	46	33	13	2.63	3.2	60.7
Maximum						3.5	146.0	62.0	0.1	3.0	93.0	6.0	25.0	83.1	98.6	91.0	49.7	69	43	26	2.71	12.2	67.9
Minimum							28.9	0.0	0.0	0.0	1.4	0.0	0.2	0.9	0.9	0.3	0.0	26	24	2	2.35	0.7	56.2
Standard Deviation (σ)							24.6	24.2	0.0	0.5	31.0	1.5	6.2	21.0	29.0	22.8	9.2	13	5	9	0.08	3.7	5.5
Number of Samples							51	67	41	41	67	22	22	22	67	67	67	13	13	13	48	8	7
Average+1.96σ							109.6	66.3	0.0	1.2	102.8	4.0	18.0	73.8	96.1	75.5	26.5	71	43	30	2.79	10.5	71.5
Average-1.96σ							13.1	-28.7	0.0	-0.9	-18.9	-1.8	-6.5	-8.6	-17.6	-13.9	-9.6	20	22	-5	2.46	-4.1	49.9

Notes:

1. NA indicated that the full grain-size distribution curve is not available; therefore the coarse versus fine fractions of the gravel and sand are not available.
2. The Average, Minimum, Maximum and Standard Deviation are calculated based on the number of samples available for each category.
3. Negative values from Average-1.96σ calculations do not have practical meaning.
4. OL-STA-60019-SB, OL-0009-09, 2-4 ft (RA-E) is not included in the calculations because it has 5.6% of fines and is not divided into percent of silt and clay.

APPENDIX A
LAKE SEDIMENT PHYSICAL CHARACTERISTICS & GEOTECHNICAL PROPERTIES

Remediation Area F - SMU 5 Index Test Results Summary (Top 2m within Dredging Zone)

								Gravel			Sand				Fines								
Location	Field Sample ID	Northing ft	Easting ft	Start Depth ft	End Depth ft	Average Depth ft	Water Content %	Percent Gravel %	Percent Coarse Gravel (19mm-75mm) %	Percent Fine Gravel (4.75mm-19mm) %	Percent Sand %	Percent Coarse Sand (2mm-4.75mm) %	Percent Medium Sand (0.425mm-2mm) %	Percent Fine Sand (0.075mm-0.425mm) %	Percent Fines (Silt and Clay) %	Percent Silt %	Percent Clay %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Solids Specific Gravity	Organic Content %	Carbonate Alkalinity %
S95	S00607	1128240	913243	0.0	0.1	0.0	51.8	51.3	NA	NA	45.7	NA	NA	NA	3	2	1						
S111	S00575	1133033	910699	0.0	0.1	0.0	52.1	52	NA	NA	45.3	NA	NA	NA	2.7	1.8	0.9						

Notes:
1. NA indicated that the full grain-size distribution curve is not available; therefore the coarse versus fine fractions of the gravel and sand are not available.

APPENDIX B

DREDGE PRODUCTIVITY CALCULATIONS

Appendix B
Dredging Productivity Calculations

1. 0 Introduction

This calculation presents the dredging productivity of 5000 gpm slurry at 10% solids content by weight. Calculations under other slurry flow rate and solids content use the same set of equations and procedures and the results are summarized in **Section 2.1.2** .

2. 0 Assumptions

Water density: $\rho_w := 62.4 \frac{lb}{ft^3}$

Maximum flow rate: $q := 5000gpm$

Slurry solids content by weight: $P_s := 10\%$

Average specific gravity, based on Appendix A:

Remediation Area A: $Gs_A := 2.68$

Remediation Area B: $Gs_B := 2.80$

Remediation Area C: $Gs_C := 2.80$

Remediation Area D: $Gs_D := 2.54$

Remediation Area E: $Gs_E := 2.63$

In-situ average water content, based on Appendix A:

Remediation Area A: $WC_A := 80.7\%$

Remediation Area B: $WC_B := 68.4\%$

Remediation Area C: $WC_C := 68.4\%$

Remediation Area D: $WC_D := 148.5\%$

Remediation Area E: $WC_E := 61.3\%$

Note: Specific gravity and water content of Remediation Area B are assumed to be the same as Remediation Area C.

Dredge volume (base plus contingency volume):

$cy := 27ft^3$

Remediation Area A: $V_A := 171000cy$

Remediation Area B: $V_B := 25000cy$

Remediation Area C: $V_C := 49000cy$

Remediation Area D: $V_D := 1204000cy$

Remediation Area E: $V_E := 723000cy$

Total volume: $V_T := V_A + V_B + V_C + V_D + V_E$ $\quad V_T = 2.172 \times 10^6 cy$

3.0 Slurry Water Content

$$WC_{slurry} := \frac{1 - P_s}{P_s} \qquad WC_{slurry} = 900\%$$

4.0 In-situ Dry Density

Remediation Area A: $\rho_{d_A} := \frac{\rho_w}{\frac{1}{Gs_A} + WC_A} \qquad \rho_{d_A} = 52.9 \frac{lb}{ft^3}$

Remediation Area B: $\rho_{d_B} := \frac{\rho_w}{\frac{1}{Gs_B} + WC_B} \qquad \rho_{d_B} = 59.9 \frac{lb}{ft^3}$

Remediation Area C: $\rho_{d_C} := \frac{\rho_w}{\frac{1}{Gs_C} + WC_C} \qquad \rho_{d_C} = 59.9 \frac{lb}{ft^3}$

Remediation Area D: $\rho_{d_D} := \frac{\rho_w}{\frac{1}{Gs_D} + WC_D} \qquad \rho_{d_D} = 33.2 \frac{lb}{ft^3}$

Remediation Area E: $\rho_{d_E} := \frac{\rho_w}{\frac{1}{Gs_E} + WC_E} \qquad \rho_{d_E} = 62.8 \frac{lb}{ft^3}$

5.0 Weight of Total Dry Solids

Remediation Area A: $W_{s_A} := V_A \cdot \rho_{d_A} \qquad W_{s_A} = 1.221 \times 10^5 ton$

Remediation Area B: $W_{s_B} := V_B \cdot \rho_{d_B} \qquad W_{s_B} = 2.023 \times 10^4 ton$

Remediation Area C: $W_{s_C} := V_C \cdot \rho_{d_C} \qquad W_{s_C} = 3.965 \times 10^4 ton$

Remediation Area D: $W_{s_D} := V_D \cdot \rho_{d_D} \qquad W_{s_D} = 5.399 \times 10^5 ton$

Remediation Area E: $W_{s_E} := V_E \cdot \rho_{d_E} \qquad W_{s_E} = 6.132 \times 10^5 ton$

6.0 Slurry Specific Gravity

Remediation Area A: $Gsm_A := \frac{1 + WC_{slurry}}{\frac{1}{Gs_A} + WC_{slurry}} \qquad Gsm_A = 1.07$

Remediation Area B: $Gsm_B := \frac{1 + WC_{slurry}}{\frac{1}{Gs_B} + WC_{slurry}} \qquad Gsm_B = 1.07$

Remediation Area C: $Gsm_C := \frac{1 + WC_{slurry}}{\frac{1}{Gs_C} + WC_{slurry}}$ $Gsm_C = 1.07$

Remediation Area D: $Gsm_D := \frac{1 + WC_{slurry}}{\frac{1}{Gs_D} + WC_{slurry}}$ $Gsm_D = 1.06$

Remediation Area E: $Gsm_E := \frac{1 + WC_{slurry}}{\frac{1}{Gs_E} + WC_{slurry}}$ $Gsm_E = 1.07$

7.0 Dry Solids Flow Rate

Remediation Area A: $Solids_A := q \cdot Gsm_A \cdot \rho_w \cdot P_s$ $Solids_A = 2.67 \times 10^5 \frac{lb}{hr}$

Remediation Area B: $Solids_B := q \cdot Gsm_B \cdot \rho_w \cdot P_s$ $Solids_B = 2.674 \times 10^5 \frac{lb}{hr}$

Remediation Area C: $Solids_C := q \cdot Gsm_C \cdot \rho_w \cdot P_s$ $Solids_C = 2.674 \times 10^5 \frac{lb}{hr}$

Remediation Area D: $Solids_D := q \cdot Gsm_D \cdot \rho_w \cdot P_s$ $Solids_D = 2.664 \times 10^5 \frac{lb}{hr}$

Remediation Area E: $Solids_E := q \cdot Gsm_E \cdot \rho_w \cdot P_s$ $Solids_E = 2.668 \times 10^5 \frac{lb}{hr}$

8.0 Production Rate

Remediation Area A: $PR_A := \frac{Solids_A}{\rho_{d_A}}$ $PR_A = 187 \frac{cy}{hr}$

Remediation Area B: $PR_B := \frac{Solids_B}{\rho_{d_B}}$ $PR_B = 165 \frac{cy}{hr}$

Remediation Area C: $PR_C := \frac{Solids_C}{\rho_{d_C}}$ $PR_C = 165 \frac{cy}{hr}$

Remediation Area D: $PR_D := \frac{Solids_D}{\rho_{d_D}}$ $PR_D = 297 \frac{cy}{hr}$

Remediation Area E: $PR_E := \frac{Solids_E}{\rho_{d_E}}$ $PR_E = 157 \frac{cy}{hr}$

9.0 Dredging Time Required

9.1 Dredge days for each Remediation Area

Assuming 17 working hours per day, which is approximately 70%.

Remediation Area A: $DAY_A := \frac{V_A}{PR_A \cdot 70\%}$ $DAY_A = 54\,day$

Remediation Area B: $DAY_B := \frac{V_B}{PR_B \cdot 70\%}$ $DAY_B = 9\,day$

Remediation Area C: $DAY_C := \frac{V_C}{PR_C \cdot 70\%}$ $DAY_C = 18\,day$

Remediation Area D: $DAY_D := \frac{V_D}{PR_D \cdot 70\%}$ $DAY_D = 241\,day$

Remediation Area E: $DAY_E := \frac{V_E}{PR_E \cdot 70\%}$ $DAY_E = 274\,day$

9.2 Total dredge days

$week := 7day$

$DAY_T := DAY_A + DAY_B + DAY_C + DAY_D + DAY_E$ $DAY_T = 596\,day$ $DAY_T = 85.1\,week$

9.3 Total working days in one season

Assume each dredge season is 30 weeks (Apr. 15 to Nov. 15), total 210 days.
Assume 32 Metro shutdown days

$Season := 210day - 32day$ $Season = 178\,day$

9.4 Total seasons required

$Season_T := \frac{DAY_T}{Season}$ $Season_T = 3.35$

APPENDIX C

WET WEATHER SHUTDOWN STATISTICAL ANALYSIS

Metro Influent Flow Statistical Analysis

Metro Process Evaluation
Honeywell International, Inc.
Syracuse, New York

1.1. General

It has been estimated that a nominal capacity of 10-11 MGD is available at the Onondaga County Metropolitan Wastewater Treatment Plant (Metro), on an average basis, to accept the SCA effluent and comply with the current pre-draft SPDES discharge. Since average daily influent flow to Metro is well below the 126.3 MGD secondary and tertiary treatment capacity, discharging an additional 6.5 MGD on an average basis should be acceptable under average conditions. However, during wet weather events, storm related flow can cause Metro to exceed 126.3 MGD and preclude additional discharge from the SCA. To evaluate the frequency and duration of wet weather events that result in Metro flow exceeding 126.3 MGD, a statistical analysis of the most recent seven years of influent data was performed. This seven-year period was selected as the most reliable and representative dataset, based on conversations with the County. The current computer system, that records influent flow, was installed in 2001 and several industrial customers permanently terminated discharge to Metro either prior to or during this period.

1.2. Statistical Analysis

The statistical analysis focused primarily on the daily data, since decisions on whether to allow discharge to Metro are likely made on a timeframe longer than an hour. Furthermore, the analysis of daily data led to more conservative results with respect to frequency and duration of wet weather events.

Utilizing an estimated average SCA supernatant discharge of 6.5 MGD to Metro, the influent flow threshold considered in this analysis was 118 MGD (126.3 – 6.5 SCA – 1.0 DestiNY). An exceedance event ("event") was defined as a calendar day or series of consecutive calendar days with maximum hourly influent flow greater than or equal to 118 MGD. On such days, the SCA would be unable to discharge to Metro because the resulting combined influent flow would exceed the plant's 126.3 MGD secondary and tertiary treatment capacity. Note that if two events were separated by a single day with maximum hourly influent flow less than 118 MGD, the two events were grouped as a single event.

The objective of the statistical analysis was to answer the following questions, which will allow Honeywell to design in accommodations for the periods when discharge of the SCA effluent is not allowed:

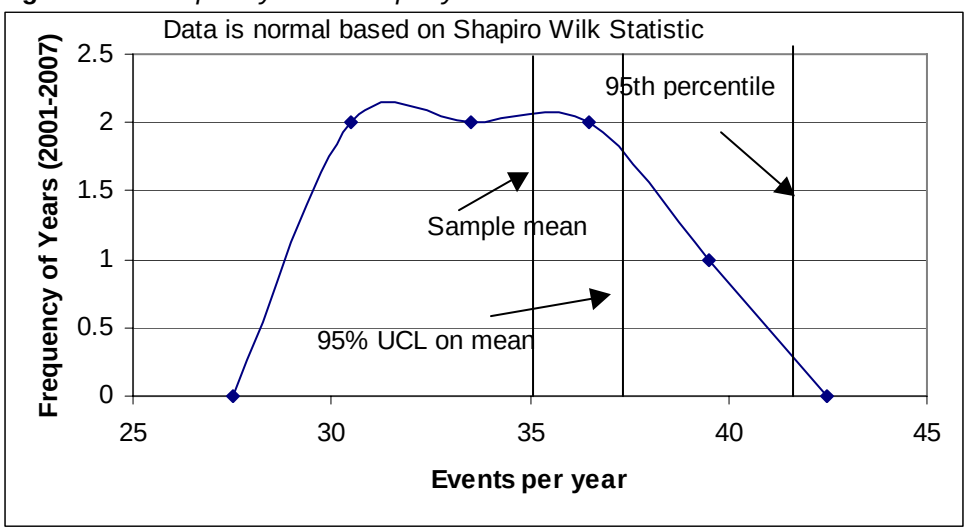
- How many events per year are expected?
- During what months are events expected?
- How long is an event expected to last?
- How often are events expected to occur?

To answer these questions, the flow data was evaluated statistically using USEPA ProUCL software (USEPA, 2007, ProUCL, Version 4.0, National Exposure Research Laboratory, Characterization and Monitoring Branch: Las Vegas, Nevada).

1.3. Expected Number of Events Per Year

Over the period 2001-2007, there were between 32 and 39 events per year, with each event ranging in duration from 1 day to 11 days long. A frequency distribution of events per year is shown in Figure 1-1. The data is normally distributed based on the Shapiro Wilk test statistic (USEPA ProUCL V. 4).

Figure 1-1. *Frequency of events per year over 2001-2007.*



On average, there were approximately 35 events per year. The 95% upper confidence limit (UCL) on that average is approximately 37 events per year, calculated using the Student's-t statistic, appropriate for a normal distribution (USEPA ProUCL V. 4). Furthermore, the 95th percentile of the distribution is approximately 42 events per year (i.e., 95% of all the data fall below 42 events per year). The 95th percentile was calculated using the Z score (standard normal variate) corresponding to the 95th percentile of a normal distribution:

$$95^{th}\ percentile = \mu + (\sigma \bullet Z_{0.95})$$

where:

μ is the 95% UCL on the mean of the data (37.3 events per year)

σ is the standard deviation of the data (2.8 events per year)

$Z_{0.95}$ is the standard normal variate corresponding to the 95th percentile of a normal distribution (1.64)

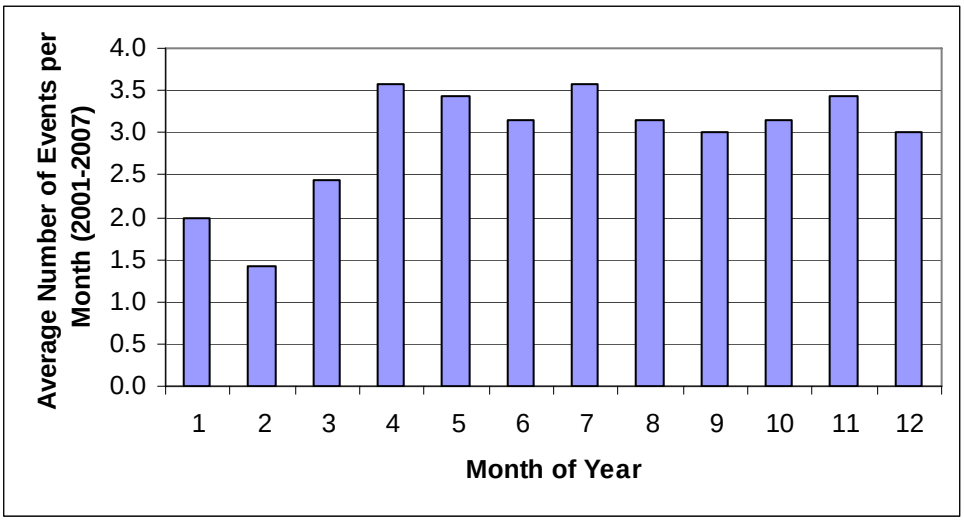
In summary, it can be stated with 95% confidence that:

- On average, approximately 37 events are expected per year
- No more than 42 events are expected per year.

1.4. Months of the Year that Events are Expected

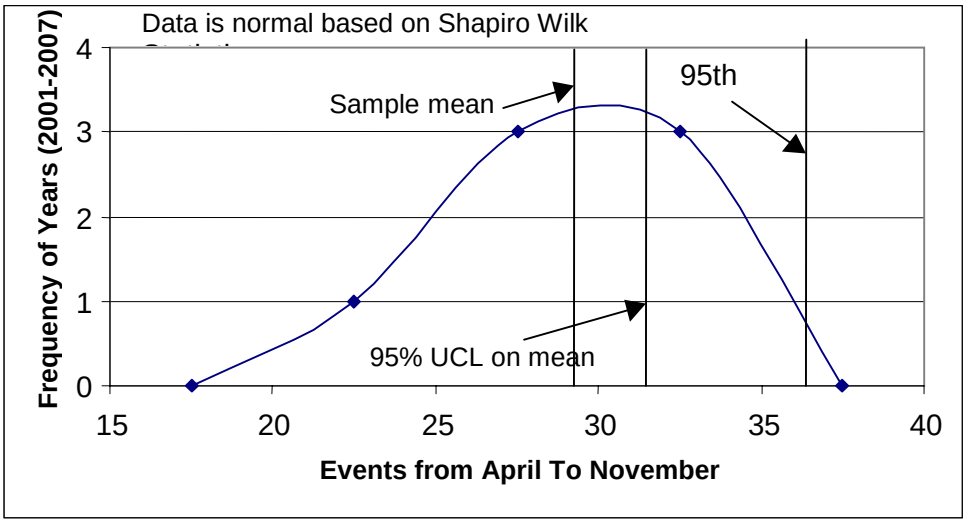
From April to November, there are on average 3 to 4 events per month. The months of November to March incur fewer events on average, ranging between 1 to 3 per month.

Figure 1-2. *Bar chart of average number of events per month over 2001-2007.*



Based on preliminary concepts, dredging at the SCA is expected to be active from April to November over a period of four years (2012-2015). Separate statistical analyses were conducted for the period April to November for comparison with analyses for the entire year. For example, the analysis of frequency of events per year yielded the frequency distribution shown in Figure 1-3 if only the period April to November is considered.

Figure 1-3. *Frequency of events over the period April to November for 2001-2007.*



Using the same approach as in Section 1.3, it can be concluded with 95% confidence that:

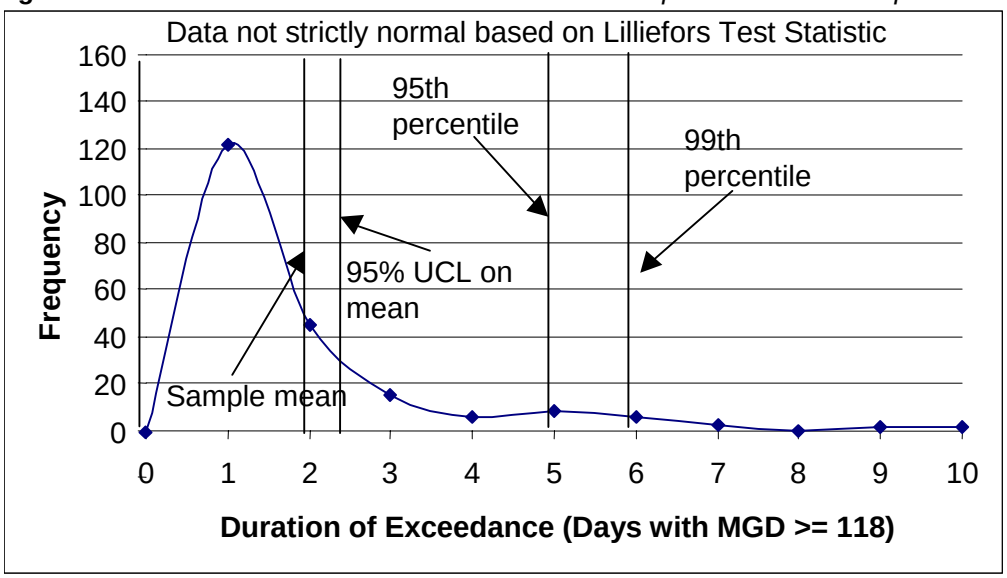
- On average, approximately 32 events are expected for the period April to November.
- No more than about 37 events are expected for the period April to November.

In general, the statistical analyses presented below are based on the April–November period since these months are considered to be representative of the period that the dredge at the SCA is expected to be active.

1.5. Duration of Events

Events for the period April–November over 2001-2007 lasted between 1 and 10 days long. Figure 1-4 presents a frequency distribution of event duration over 2001-2007 for the April-November time period. Note that the data is not strictly normally distributed based on the Lilliefors test statistic (USEPA ProUCL V. 4).

Figure 1-4. *Duration of events over 2001-2007 for the April-November time period.*



On average, an event lasts less than 2 days. When rounded to the nearest whole day, the upper bound (95% UCL) on that average is also about 2 days, calculated using the Chebyshev Theorem, which is recommended for non-parametric data (data with unknown distribution; USEPA ProUCL V. 4). Even though the data does not strictly follow a normal distribution, the 95th percentile of the distribution can be approximated as 5 days and the 99th percentile of the distribution can be approximated as 6 days, when rounding to the nearest whole day. The 95th and 99th percentiles are calculated using the Z scores (standard normal variate) corresponding to the 95th and 99th percentiles of a normal distribution, respectively:

$$\alpha^{th}\, percentile = \mu + (\sigma \bullet Z_{\alpha})$$

where:

μ is the 95% UCL on the mean of the data (2.4 days)

σ is the standard deviation of the data (1.5 days)

Z_{α} is the standard normal variate corresponding to the αth percentile of a normal distribution ($Z_{0.95}$ = 1.64; $Z_{0.99}$ = 2.3).

In summary, it can be stated with 95% confidence that:

- On average, an event lasts approximately 2 days over the April to November period.
- An event will last no more than about 5 days over the April to November period.

Furthermore, we can state with 99% confidence that:

- An event will last no more than about 6 days over the April to November period.

Because the 95th and 99th percentiles of the distribution derived above assume that the data is normally distributed, which is not strictly true, an alternative analysis was performed to derive the upper percentiles of the data. Table 1-1 presents the frequency of event durations from 2001-2007 for the April-November time period.

Table 1-1. *Frequency of event duration over 2001-2007 for April-November time period.*

Event Duration (days)	Frequency	Cumulative Frequency
1	59%	59%
2	22%	81%
3	7%	88%
4	3%	91%
5	4%	95%
6	3%	98%
7	1%	99%
8	0%	99%
9	0%	100%
10	0%	100%

Events are predominantly between 1 and 2 days in duration, accounting for 81% of the 206 events that occurred during the April-November months of 2001-2007.

Furthermore, based on the 2001-2007 data for the April-November time period:

- 95% of events are less than 5 days in duration.
- 99% of events are less than 7 days in duration.

1.6. Frequency of Event Occurrence

In order to evaluate how often events are expected to occur, the inferences made thus far are summarized:

- In Section 1.4, it was found with 95% confidence that no more than approximately 37 events are expected over the period April to November.
- In Section 1.5, it was found with 95% confidence that an event will last less than 5 days over the period April to November; in other words, only 5% of events will last 5 or more days over the period April to November.

- In Section 1.5, it was found with 99% confidence that an event will last less than 7 days over the period April to November; in other words, only 1% of events will last 7 or more days over the period April to November.

If only 5% of events will last 5 or more days and there are no more than approximately 37 events expected over the period April to November, then only 2 events lasting 5 or more days are expected over the period April to November (2 = 5% of 37). In other words, an event lasting 5 or more days is expected 2 times per April-November period.

If only 1% of events will last 7 or more days and there are no more than approximately 37 events expected over the period April to November, then only 0.4 events lasting 7 or more days are expected over the period April to November (0.4 = 1% of 37). In other words, an event lasting 7 or more days is expected every two and a half April-November periods (1/0.4 events per April-November period).

1.7. Water Pretreatment Plant Effluent Holding Capacity

The design of the water pretreatment plant (WPTP) will include provisions for effluent flow retention so that the effluent discharge can be discontinued during periods when Metro is experiencing wet weather, high flow conditions. Effluent holding capacities of 1 day and 2 days were evaluated to estimate the number of events and duration that the SCA would need to shutdown.

Based on the frequency of event duration data presented in Table 1-1, assuming a 1 day effluent holding capacity (6.5 MG), the number of events and duration of shutdown of the SCA for the period April – November are estimated in Table 1-2.

Table 1-2. *SCA shutdown, WPTP effluent holding capacity of 1 day (6.5 MG)*

No. and % events when Metro Influent Flow >= 126 MGD						Assume WTP Effluent Holding Capacity = 1 day No. of events and duration shutdown SCA		
duration (days)	% of events	# of events	duration (days)	% of events	# of events	# of events	duration (days)	Total duration (days)
< 1	59	22	>= 1	41	15	8	0 to 1	0 to 8
< 2	81	30	>= 2	19	7	3	1 to 2	3 to 6
< 3	88	33	>= 3	12	4	1	2 to 3	2 to 3
< 4	91	34	>= 4	9	3	1	3 to 4	3 to 4
< 5	95	35	>= 5	5	2	1	4 to 5	4 to 5
< 6	98	36	>= 6	2	1	1	5 to 6	5 to 6
< 7	99	37	>= 7	1	0	0	6 to 7	0 to 0
Total						**15**	**Events**	**17 to 32 days**

Based on the frequency of event duration data presented in Table 1-1, assuming a 2 day effluent holding capacity (13 MG), the number of events and duration of shutdown of the SCA for the period April – November are estimated in Table 1-3.

Table 1-3. *SCA shutdown, WPTP effluent holding capacity of 2 days (13 MG)*

No. and % events when Metro Influent Flow >= 126 MGD						Assume WTP Effluent Holding Capacity = 2 days No. of events and duration shutdown SCA		
duration (days)	% of events	# of events	duration (days)	% of events	# of events	# of events	duration (days)	Total duration (days)
< 2	81	30	>= 2	19	7	3	0 to 1	0 to 3
< 3	88	33	>= 3	12	4	1	1 to 2	1 to 2
< 4	91	34	>= 4	9	3	1	2 to 3	2 to 3
< 5	95	35	>= 5	5	2	1	3 to 4	3 to 4
< 6	98	36	>= 6	2	1	1	4 to 5	4 to 5
< 7	99	37	>= 7	1	0	0	5 to 6	0 to 0
Total						**7**	**Events**	**10 to 17 days**

1.8. Summary and Conclusions

The statistical analysis focused on wet weather influent flow events, where an event is defined as a calendar day or series of consecutive calendar days with maximum hourly influent flow greater than or equal to 118 MGD (per previous discussion in Section 1.2). Note that if two events were separated by a single day with maximum hourly influent flow less than 118 MGD, the two events were grouped as a single event. The analysis considered daily influent flow data from 2001-2007 for the period April to November, over which the dredging operations at the SCA are anticipated to be active. Overall, the objective of the analysis was to provide Honeywell with design development information for the SCA. A summary of the statistical analyses performed is presented in Table 1-4.

Table 1-4. *Summary of Statistical Analyses.*

	April-November Analysis
Events per year (95% confidence level)	32 avg 37 max
Duration of events (95% confidence level)	2 days avg 5 days max
Duration of events (99% confidence level)	7 days max
Frequency of events	2 per year (>=5 days duration) every two and a half years (>=7 days duration)
SCA shutdown, 1 day WPTP holding capacity	15 events, total duration 17 to 32 days
SCA shutdown, 2 day WPTP holding capacity	7 events, total duration 10 to 17 days