

**OCCIDENTAL CHEMICAL CORPORATION
OLIN CORPORATION**

ENGINEERING REPORT

FINAL

VOLUME III

APPENDIX B

TECHNICAL SPECIFICATIONS

**102nd STREET LANDFILL SITE
NIAGARA FALLS, NEW YORK**

SEPTEMBER 9, 1995

Revised: FEBRUARY 5, 1996

**FLUOR DANIEL, INC.
MARLTON, NEW JERSEY
OCCIDENTAL CHEMICAL CORPORATION
OLIN CORPORATION**

Client Name: OxyChem/Olin
 Project Name: Remedial Action
 102nd Street Landfill Site

Project Specification
 Page 1 of 1
 2-5-96/Rev. No. 1

SPECIFICATIONS

The specifications have been revised as indicated below. Please replace all pages of this document and destroy the superseded copies.

Issue History:

Specification No.	Revision No.	Originator's Initials	Date
01340	1	EZ	2/5/96
01400	1	EZ	2/5/96
01540	1	EZ	2/5/96
02006	1	BB	2/5/96
02011	1	BB	2/5/96
02012	1	BB	2/5/96
02013	1	BB	2/5/96
02022	1	BB	2/5/96
02110	1	BB	2/5/96
02200	1	BB	2/5/96
02234	1	BB	2/5/96
02513	1	BB	2/5/96
02725	1	BB	2/5/96
02776	1	BB	2/5/96
02834	1	BB	2/5/96
02901	1	BB	2/5/96
02902	1	BB	2/5/96
03300	1	BB	2/5/96
03400	1	BB	2/5/96
11231	1	BB	2/5/96
15179	1	BB	2/5/96
50026	1	BB	2/5/96
58023	1	BB	2/5/96
59000	1	BB	2/5/96

New Issue _____

Revised Sheets Only Attached: _____

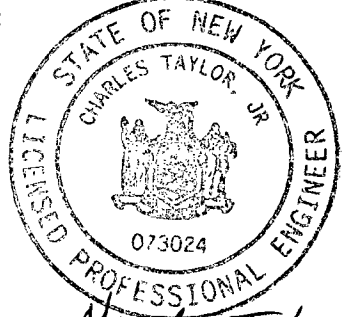
Entire Document Re-issues: _____

Client: _____
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 Project Manager: _____
 Date: _____

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 Issued for Construction: _____
 Project Manager: _____
 Date: _____

Permit Stamp:

Professional Stamp:



Discipline Approval:

Charles Taylor, Jr.
 2-5-96

LIST OF SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

- 01340 Submittals
- 01400 Quality Control
- 01540 Temporary Facilities

DIVISION 2 - SITE WORK

- 02006 Inspection and Testing Services
- 02011 Monitor Well and Piezometer Installation
- 02012 NAPL Recovery Well Installation
- 02013 APL Wet Well Installation
- 02022 Topographic Survey
- 02110 Clearing and Grubbing
- 02200 Earthwork
- 02234 Aggregate for Light Duty Access Roads and Bituminous Pavement Base
- 02513 Bituminous Concrete Paving
- 02725 Underground Piping Systems
- 02776 Geosynthetic Lining System
- 02834 Chain Link Fence - Galvanized
- 02901 Slurry Wall
- 02902 APL Collection Trench

DIVISION 3 - CONCRETE

- 03300 Cast-In-Place Concrete
- 03400 Precast Concrete

DIVISION 11 - EQUIPMENT

- Major Equipment List
- Data Sheets - Major Equipment
- 11231 Water Treatment System
- 59000 General Requirements - Equipment

DIVISION 15 - MECHANICAL

15179 Holding Tank
50026 General Requirements - Piping Installation
58023 FRP Tanks

DIVISION 16 - ELECTRICAL

65000 General Requirements - Electrical
70002 General Requirements - Instrument Installation
 Instrumentation Index Report
 Instrumentation Specifications
 Loop Drawings & Elementary Diagrams

DIVISION 1 - GENERAL REQUIREMENTS

01340	Submittals
01400	Quality Control
01540	Temporary Facilities

SUBMITTALS

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the quantity and form of submittals summarized in the Submittal Summary at the end of this specification section, or as required herein.

1.2 Submittals

- A. Employee OSHA Training Certificates** - Submit copies of OSHA 40-hour training certificate for each construction contractor employee or proposed subcontractor employee a minimum of 10 days before that employees performs on-site activity.
- B. Employee Certificate of Annual Physical** - Submit copies of Physicians annual physical examination certificate for each construction contractor employee or proposed subcontractor employee a minimum of 10 days before that employees performs on-site activity. Submit copies of follow-up Physicians physical examination certificate for each construction contractor employee or subcontractor employee within 30 days following demobilization from the site for each employee that performed on-site activity.
- C. Construction Schedules**
1. Submit an initial critical path method (CPM) construction schedule or a similar construction schedule with milestones and dates for principal items identified in the Scope of Work. Submit the initial construction schedule a minimum of 15 days before mobilization to the site.
 2. Submit an update of the construction schedule with each invoice for partial payment or change request and shall include the following items:
 - a. An updated construction schedule, signed and dated by the Construction Contractor's designated site superintendent, which reflects percentage complete to date and remaining duration to finish each activity.
 - b. An updated submittal log with areas of concern identified.
 - c. Estimated or actual quantities completed to date (cumulative) for each major portion of the Work.
- D. Contractor Health and Safety Plan** - Submit Construction Contractor's Health and Safety Plan a minimum of 15 days before mobilization to the site.
- E. Construction Phasing Plan** - Submit a proposed Construction Phasing Plan, for approval, if the proposed phasing plan is different from the suggested construction phasing plan included in the design drawings. Submit the proposed Construction Phasing Plan a minimum of 15 days before mobilization to the site.

SUBMITTALS

- F. **Fitness Statement** - Submit after loss time illness or injury of employee during contract period a fitness statement signed by a physician prior to allowing the employee to reenter the job site.

- G. **Maintain and submit on request a log of:**
 - Safety activities
 - Accident Investigations
 - Employee instruction
 - Training
 - Toolbox safety meetings
 - Equipment expectation, etc.

- H. **Inspection Procedures and Maintenance Record** -Contractor/subcontractors shall establish inspection procedures and maintain a record of maintenance for all equipment (tractors, excavators, trucks, etc. etc.) in accordance to OSHA Standards 1926. The completed inspection forms (both initial and monthly as required by specific 1926 standards) shall be maintained on site and provided to the Owner upon request.

- I. **Excavation Plan** - Contractor shall submit an Excavation Plan 15 days prior to performing any excavation activities, signed by a Professional Engineer in the State of New York. The Excavation Plan will identify trenching methods, layback requirements, sheeting, and/or shoring requirements. All excavations will be performed in accordance with OSHA requirements.

2.0 PRODUCTS

Not applicable.

3.0 EXECUTION

3.1 General - Construction Contractor shall assume risk and cost of rework for any work performed in association with a submittal required under this Specification until such submittal has been approved according to the requirements of this specification.

3.2 Submittal Requirements - Submittals required by this contract are summarized in the Submittal Summary attached at the end of this specification section.

A. Construction Contractor's Review of Submittals - As follows:

- 1. Construction Contractor shall affix its review stamp and shall date and sign each individual submittal, certifying that the item(s) submitted has been reviewed and is in accordance with contract requirements. Submittals received by Construction Manager directly from suppliers, vendors or manufacturers without Construction Contractor review will be considered incomplete and will be disapproved.

- 2. Test reports from independent testing firms, as required in the separate Specification Sections, shall be sent directly to Construction Manager without Construction Contractor review.

SUBMITTALS

3. Any revisions or options selected in manufacturers' literature or catalog drawings which Construction Contractor proposes shall be clearly indicated on the submittal.

B. Group of Submittals - Unless otherwise specified, Construction Contractor shall make submittals in groups containing all associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected. Such rejection shall not constitute grounds for a time extension.

1. When possible, submittals shall be grouped by specification section with all requested items submitted at one time. Construction Contractor's transmittal shall note any items from the submitted section remaining outstanding which are intended to be submitted at a later date.

C. Number of Submittal Copies - The following number of copies of each submittal shall be provided:

1. One copy to the Construction Manager's field office address.
2. Two copies to the Owners home office address. One marked up copy will remain in the permanent job files. The other marked up copy will be returned to the Construction Contractor noting the approval status as defined herein.

D. Identification of Submittals - Accompany each submittal or group of submittals with a transmittal form showing all information required for identification and checking.

1. On at least the first page of each individual submittal, and elsewhere as required for positive identification, show the submittal number (which shall be numbered in accordance with the submittal schedule), the project name, location, Construction Contractor name and project number. The legend for a typical submittal number is shown below:

02210-200A

"02210" - Applicable 5 digit specification number.

"-200" - Indicates sequence or item number shown in the Submittal Summary.

"A" - Indicates the submittal is the first resubmittal of a rejected and returned original submittal. The second resubmittal would be identified by "B", the third as "C" and so on. If the submittal is an original, no resubmittal character is to be shown after the sequence number.

2. Consecutively number all transmittals. When material is resubmitted for any reason, transmit under a new transmittal form with a new transmittal number. On resubmittals, cite the original submittal and transmittal numbers for reference.

SUBMITTALS

3. Maintain an accurate submittal log for the duration of the work, showing current status of all submittals at all times. Make the submittal log available to Construction Manager for review upon request.
 4. Packages containing submittals shall be marked: Attn: Engineering Submittals, Contract No. FP-E-NI-102, Remedial Action, 102nd Street Landfill Site.
- E. Review** - Submittal comments and/or approvals will be provided to the Construction Contractor within fourteen (14) calendar days after receipt by Construction Manager.
1. The following definitions will assist the Construction Contractor in understanding the approval status:
 - a. Approved (APP). Submittal is approved without comment.
 - b. Approved as Noted (AAN). Submittal is approved provided that the comments shown are followed for fabrication and installation. Typically, this type of approval provides some additional clarification, such as: (i) a reminder of related code or specification requirement affecting installation; (ii) specify a color selection; and/or (iii) provide an explanation about the desired product. Resubmittal of the document is not required.
 - c. Approved as Noted and Resubmit (ANR). Submittal is approved as discussed in AAN above; however, due to the extent or nature of the comments, Construction Contractor shall incorporate comments and resubmit document within 14 calendar days for final approval. If comments have been correctly interpreted and incorporated, the resubmitted document will be approved. If the comments have not been correctly interpreted and incorporated, the resubmitted document may be DISAPPROVED.
 - d. Disapproved (DIS). Submittal is disapproved for reasons shown on the documents. Construction Contractor shall correct problem and submit acceptable document within 14 calendar days.
 - e. Information Only (IO or I/O). Approval of submittal is not required by contract, however it is required/submitted "for the record."
 2. Review and approval of submittals is only for conformance with the design concept of the work. Approval of a specific item shall not indicate approval of an assembly of which the item is a component. Construction Contractor remains liable for accuracy of submittals, dimensions, quantities, and coordination with other trades. Approval is subject to all contract requirements and does not authorize any changes. If a change is inadvertently or purposefully indicated on a submittal, the change shall not be effective until ratified separately by a Contract Modification or Notice to Proceed.

SUBMITTALS

- F. **Summary of Submittals** - Submittals shall conform to the requirements described herein.
1. **Shop Drawings:** Construction Contractor shall prepare shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work. Review comments will be shown on a set of shop drawings to be returned to the Construction Contractor. Construction Contractor shall make and distribute copies as required for its purposes.
 2. **Manufacturers' Literature:** Where contents of submitted manufacturers' literature includes data not pertinent to the submittal, clearly show which portions of the contents are being submitted for review.
 3. **Samples:** Provide sample(s) identical to the precise article proposed to be provided. Identify as described under "Identification of Submittals" above.
 4. **Certificates of Compliance:** Provide certificates of compliance as required by these specifications. Certificates of compliance shall be signed by an official authorized to certify on behalf of a manufacturing company or an independent testing firm and shall contain 1) name and address of Construction Contractor, 2) project name, 3) reference to this project number, 4) description of product, 5) quantity and date of manufacture.
 5. **Operational Plans:** Provide a narrative description of the method, materials, and equipment that will be used to perform the Work described in the subject plan. Operational Plans are identified in various specifications, summarized in Attachment 01 to this Specification, and shall describe Work such as Waste Treatment, Contaminated Water Management, and Non-contaminated Water Management.

4.0 ATTACHMENTS

- Attachment 01 - Project Submittals
- Attachment 02 - Contractor Daily Report

End of Specification

QUALITY CONTROL

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the requirements to control and document the quality of Construction Contractor's Work and the work of its subcontractors.

B. Terminology

Terminology and definitions are also addressed in the Contract, Part I, Scope of Work; additions are as follows, and apply wherever such terms are used:

1. Construction Manager: Owners representative.
2. Construction Contractor or Contractor: Appropriate individual, partnership, company, or corporation as established by contract, and becomes contractually obligated to Prime Contractor.
3. Any: The term "any" in the Contract Documents shall be interpreted as "any and all" whenever more than 1 item would be applicable for completion of the Work of the Project; for example, "any other general expenses."
4. Design Drawings: Drawings, diagrams, schedules, and other data specifically issued for the work by the Owner, to illustrate some portion of the work.
5. Samples: Physical examples which illustrate materials, equipment, or workmanship, and establish standards by which the work will be judged.

1.2 Submittals

A. Independent Testing - When independent testing and/or inspection are required in other sections, submittals of tests, certificates or other required documents shall comply with the requirements of this Section and Specification 065.230.01340, Submittals.

1. For approval, submit the name, address, telephone number, qualifications (including references with names and phone numbers), and items to be tested/inspected for each firm the Construction Contractor plans to use. Construction Manager's approval of the firm is required prior to Construction Contractor use of any material or construction methods that requires testing/inspection.
2. Test reports prepared by the independent testing firm shall be sent directly to Construction Manager by the independent testing firm in the quantity of documents specified in Specification 01340, Submittals, within three calendar days after the test results are determined. Copies provided to Construction Manager are in addition to copies provided to the Construction Contractor.

QUALITY CONTROL

2.0 PRODUCTS
Not applicable.

3.0 EXECUTION

3.1 Requirements

- A. The requirements for sampling and testing or inspection are specified in the individual technical divisions of these Specifications. Construction Contractor shall maintain a complete and up-to-date file of all quality control documentation at the jobsite.
- B. Where no testing requirements are described or specified, and the Construction Manager deems that testing is required, the Construction Manager may request such tests be performed in accordance with the applicable or pertinent standards that may normally apply to the test. Payment for such testing will be made to the Construction Contractor through an executed Contract Modification.

3.2 Construction Contractor Inspection and Testing

Construction Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. Inspection and testing services to be provided by the Construction Contractor will include, but not necessarily limited to:

- A. Provide adequate personnel for routine inspections of work performed by the Construction Contractor's workforce, suppliers and subcontractors.
- B. Provide test reports, design mixes, certificates of analysis or other documents on products, assemblies or bulk materials as required the in Submittals section of the individual Specifications of this document.
- C. Provide compaction testing on installed select fill material, crushed limestone, gravel, and non-contaminated material used in the construction of fills.
- D. Provide testing of concrete including tests for slump, unit weight, temperature, air entrainment and compressive strength of molded cylinders.

3.3 Inspection and Testing by Construction Manager

Inspection and testing services to be provided by the Owners will include, but not necessarily limited to:

- A. Random inspections as the work is in progress. Inspection or non-inspection of the work by Construction Manager, or a representative thereof, does not relieve the Construction Contractor of his full obligation to ensure the work is performed as in accordance with the Design Drawings, Specification and Contract Documents.

QUALITY CONTROL

- B. When material is proposed for use which is specified to be either certified or tested, but cannot be identified with specific certification or test reports, the Construction Manager may, at his discretion, select random samples from the lot for testing. These samples shall be prepared in accordance with the referenced test specification and furnished by Construction Contractor to the Construction Contractor's testing firm at Construction Contractor's expense. The number of samples and tests will be at the discretion of the Construction Manager. The cost of testing the samples shall be solely the responsibility of Construction Contractor. Modifications to the Contract Time or Price will not be considered as a result of any delays that may be caused by the requirements of this paragraph.

3.4 Non-conformance and Retesting

Retesting due to non-conformance with the Specifications shall be as follows:

- A. Retesting of non-complying products, assemblies or bulk materials as required in Submittals of the individual Specification Sections of this document shall be provided by the Construction Contractor at no cost to the Owner.
- B. The Owner may, at his discretion, require that an installed item or portion of work be uncovered or tested if he suspects non-compliance with the requirements of the contract documents. If uncovering or tests reveal non-compliance, all costs associated with securing compliance of the item or work, including replacement, repair, uncovering and covering shall be borne by the Construction Contractor at no cost to the Owner. However, if uncovering or testing reveals full compliance with the requirements of the contract documents, Owner shall be responsible for all costs associated with testing, uncovering and covering.

3.5 Quality Control

- A. Construction Contractor shall provide on-site quality control personnel for the duration of the project. The appointed quality control person shall be responsible for scheduling, requesting and monitoring tests as may be required of the Construction Contractor under this or other Specification Sections.
- B. Construction Contractor shall monitor quality control of suppliers and subcontractors to ensure the quality of work is as specified.
- C. Construction Contractor shall follow all manufacturer's instructions concerning handling, installation, fabrication and application.
- D. Construction Contractor shall contact Construction Manager concerning any conflicting requirements between the contract documents and manufacturer's instructions before proceeding with the work.
- E. Construction Contractor shall ensure that all work is performed by qualified craftsmen capable of producing the end product or service as specified.

3.6 Surveying

QUALITY CONTROL

A. Record and Quantity Surveys

1. The Owner is responsible for the initial and final surveys at the site which shall form the basis for final quantity determination.
2. The survey firm shall have sufficient equipment and personnel to accommodate and service the needs of this contract. The firm and its members shall not be an employee of, nor affiliated with the construction contractor's ownerships, own nor have stock interest in or in anyway related to the Construction Contractor.

B. Construction Surveys - Surveys to provide horizontal and vertical control for performance of the Work may be performed by the Construction Contractor's workforce. This representative shall have a minimum of two years experience in Construction Surveying layout and maintenance of as-built construction drawings with a record of performing horizontal and vertical control requirements as stated in this contract, and required by specific state Land Surveying Laws.

C. Horizontal Control - Establish site horizontal control and grid system as defined below as part of site mobilization:

1. Field survey work shall be performed with sufficient precision to ensure that the required accuracy of the finished map is achieved. The computed coordinate position of each horizontal control point used in compiling the map shall be correct within the limits of third order accuracy (that is, the horizontal error of closure of the control traverse shall not exceed 1 in 5,000, and the angular error of closure shall not exceed 1 minute times the square root of the number of instrument stations in the traverse, all before adjustment).

D. Vertical Control - Shall be as follows:

1. The elevation of control bench marks shall be correct within the limits of third order accuracy (that is, the vertical error of closure of the control level circuit shall not exceed plus or minus 0.05 feet times the square root of the length of the circuit in miles, before adjustment).
2. Elevations shall be tied to the bench mark elevation by looping or tying between two established benches. (Opened level nets not permitted.)

4.0 ATTACHMENTS

Not applicable.

End of Specification

TEMPORARY FACILITIES

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes requirements for the establishment, maintenance, and removal of temporary office and construction facilities as required herein for the entire duration of the project.

1.2 Submittals

Submit the following items in accordance with Specification 065.230.01340, Submittals. Submittals are for the record or approval, as indicated.

- Layout of the Personnel Decontamination Facility, for approval.
- Layout of Owner's office space, for approval.
- Layout of site support area and contamination reduction zone, for approval.

2.0 PRODUCTS

2.1 Facilities

Temporary construction facilities may be of used or new origin. If used facilities are provided, they shall be water tight (if designed to be so), clean and in good, usable condition. Facilities are subject to approval by the Construction Manager.

2.2 Construction Contractor's Office Facilities

Construction Contractor shall provide an on-site office facility for the entire duration of the project.

A. Office Space

Construction Contractor's office space shall be of size to promote the proper control and execution of the project.

1. Provided space shall be ample to properly store and view the contract documents.
2. Space shall be provided for first aid equipment and materials.

B. Communication

TEMPORARY FACILITIES

Construction Contractor shall provide at least one telephone in his office facility and two-way communication equipment to communicate with the Construction Contractor's equipment operators.

2.3 Parking area and Temporary roads.

Construction Contractor shall construct the parking area and temporary roads and cover it with a 3" to 4" gravel layer in accordance with specification 02225 "Backfill and Compaction of Excavated Areas", gravel cover material must be approved by the Construction Manager. The parking area and temporary roads shall be constructed in such a manner that they drain freely. Parking area shall be built to the lines shown on the drawings.

2.4 Personnel Decontamination Facility

Construction Contractor shall provide and make operational a personnel decontamination facility prior to commencement of clearing, grubbing, demolition or remediation work. General requirements and layout of a typical decontamination facility are as follows:

- A. The facility shall provide an organized process by which levels of contamination are reduced.
- B. Each level of decontamination shall be performed at separate stations to prevent cross-contamination.
- C. Stations shall be arranged in order of decreasing contamination, preferably in a straight line.
- D. Separate doorways to and from the Exclusion Zone shall be provided. Signs denoting the doorway purpose (ENTRY ONLY and EXIT ONLY) shall be posted as appropriate for the final arrangement of the facility.
- E. A separate doorway shall be provided from the "clean" zone inside the facility to the Support Zone outside the facility. Construction Contractor shall provide fencing as shown on the drawings at the Support Zone doorway to prevent entrance to the Exclusion Zone from this doorway.
- F. Dressing stations and lockers for personal protective equipment shall be provided.
- G. The facility shall be equipped with showers plumbed for hot and cold water to assist in the decontamination process.

TEMPORARY FACILITIES

- H. Water used in the personnel decontamination process shall be collected for treatment on site. Decontamination water shall not be discharged to sanitary sewer line or system.
- I. Air conditioning equipped with heating and cooling units shall be provided for the decontamination facility.
- J. The facility shall be provided with lighting normal for this type of facility.

2.5 Toilet Facilities

Construction Contractor shall provide and maintain temporary toilet facilities at the site for the entire duration of the project. Contractor shall provide at least one toilet for each gender, clearly marked with "MENS" and "LADIES", respectively. Contractor shall provide a minimum of 1 toilet per 10 people per gender.

- A. Construction Contractor shall be responsible for janitorial services, pumping and disposal of sewage. All portable toilets shall be regularly maintained and shall be in compliance with applicable health or local regulations. As a minimum, the toilets shall be cleaned and pumped twice a week.
- B. After work is completed, the portable toilets shall be removed from the site and their areas properly cleaned and disinfected.
- C. Installation of septic tanks and lateral field lines will not be permitted.

2.6 Owners Office Space (4 trailers)

Construction Contractor shall provide office space for Owners personnel which meets or exceeds the minimum requirements below:

- A. Office space (minimum 500 square feet) shall be provided for the entire duration of the project and shall
 - 1. include a conference room which will accommodate 10 persons. Shall be separated from the remaining office space by a full height partition with access from within the overall space and from the exterior;
 - 2. have at least one full height partitioned office (minimum 100 square feet); and
 - 3. have one separate indoor rest room with a toilet and a lavatory with hot and cold running water.

TEMPORARY FACILITIES

- B. Office shall be physically separate from Construction Contractor's office space. Project Site Manager shall hold all keys to the exterior doors.**
- C. Construction Contractor shall provide two (2) telephone lines per trailer, including telephone equipment, for the entire duration of the project. One of the furnished telephone lines per trailer shall be suitable for "FAX" transmission. Construction Manager shall be responsible for payment of local and long distance charges levied by the telephone company for these eight lines only.**
- D. The office space shall be provided with lighting normal for this type of use and hot/cold water supply service.**
- E. Heating and cooling units shall be provided for the office space. Heating and cooling units shall be sized to maintain a temperature of 68° in winter and 76° in summer.**
- F. Office space for each trailer shall include the following furniture and equipment:**

 - 1. Three (3) standard size desks.**
 - 2. Three (3) desk chairs on rollers.**
 - 3. Fourteen (14) chairs for conference room and visitor use.**
 - 4. A table(s) suitable for seating 10 persons in conference.**
 - 5. Drawing table or fabricated counter-top (minimum 6 feet long and 3 feet wide) for viewing drawings.**
 - 6. Equivalent of two four (4) drawer filing cabinet (may consist of 4 each 2 drawer cabinets or a combination of 2 and 4 drawer cabinets).**
 - 7. One (1) microwave oven and one (1) 6 cubic foot capacity refrigerator.**
 - 8. Two (2) trash cans.**
- G. Construction Contractor shall provide janitorial services twice a week.**
- H. Construction Contractor shall provide bottled drinking water and a cooler for the bottles.**

TEMPORARY FACILITIES

3.0 EXECUTION

3.1 General

A. Transportation

Construction Contractor shall be responsible for transportation of temporary construction facilities to and from the site including special permits, fees or escorts required for oversize loads.

B. Set-up

Construction Contractor shall be responsible for labor, material and equipment required for proper set-up of temporary construction facilities.

1. Install concrete footings and slabs necessary for proper set-up and construction of temporary facilities.
2. Install blocking required for stability of mobile structures.
3. Install tie-downs on mobile structure not anchored to a concrete footing or slab.
4. Install skirting around office trailers.

C. Dismantling

Construction Contractor shall be responsible for labor, material and equipment required to dismantle temporary construction facilities.

1. Remove blocking and tie-downs used in the set-up of temporary construction facility.
 2. Remove concrete footing and/or slab used in the construction of temporary facilities.
 3. Police the area occupied by the office trailers and restore the area to its original or intended final condition.
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Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 01540
Page 6 of 6
2-5-96/Rev. No. 1

TEMPORARY FACILITIES

D. Utilities

Construction Contractor shall be responsible for costs and arrangements for service required in procuring and maintaining, for the duration of the project, the utility services listed below. Construction Contractor shall install and remove temporary utility lines, meters, and other equipment necessary in accordance with all local building codes and requirements. Unless otherwise specified herein, Construction Contractor shall also be responsible for payment of periodic usage charges levied by the utility companies for the duration of the project.

1. Electrical service for construction facilities as specified herein.
2. Potable water service for construction facilities as specified herein.
3. Telephone service and equipment for construction facilities as specified herein.

4.0 ATTACHMENTS Not applicable.

End of Specification

DIVISION 2 - SITE WORK

02006	Inspection and Testing Services
02011	Monitor Well and Piezometer Installation
02012	NAPL Recovery Well Installation
02013	APL Wet Well Installation
02022	Topographic Survey
02110	Clearing and Grubbing
02200	Earthwork
02234	Aggregate for Light Duty Access Roads and Bituminous Pavement Base
02513	Bituminous Concrete Paving
02725	Underground Piping Systems
02776	Geosynthetic Lining System
02834	Chain Link Fence - Galvanized
02901	Slurry Wall
02902	APL Collection Trench

INSPECTION AND TESTING SERVICES

1.0 DESCRIPTION OF WORK - GENERAL

An Independent Inspection and Testing Agency will be engaged by the Contractor for the purpose of inspecting and/or testing portions of the Work. This specification prescribes the inspection and testing services required to verify that the following Work is completed in accordance with the drawings and specifications:

1. Material properties;
2. Quantities;
3. Mix; and
4. Compaction.

This specification identifies work to be accomplished by the Contractor, and his independent testing agency. OxyChem/Olin will retain a Quality Assurance Engineer who will review the Contractor's quality control activities.

1.1 References

The publications listed below form part of this specifications. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the Drawings, Work included in this specification shall conform to the applicable provisions of these publications.

A. ASTM (American Society for Testing and Materials)

1. ASTM C94 Standard Specification for Ready Mix Concrete.
2. ASTM C131 Standard Test Method for Resistance to Degradation of Small-size Coarse Aggregate By Abrasion and Impact in the Los Angeles Machine.
3. ASTM C136 Standard Test Method for Sieve Analysis of Fine and Course Aggregates.
4. ASTM C685 Standard Specification for Concrete made by Volumetric Batching and Continuous Mixing.
5. ASTM D698 Standard Test Method for Moisture-Density Relations of Soil and Soil Aggregate Mixtures using a 5.5-lb. Rammer and a 12-inch (305 mm) Drop.
6. ASTM D1556 Standard Test Method for Density of Soil In-Place by the Sand-Cone Method.

INSPECTION AND TESTING SERVICES

7. ASTM D2167 Standard Test Method for Density and Unit Weight of Soil In-Place by the Rubber Balloon Method.
8. ASTM D2172 Standard Method for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures.
9. ASTM D2487 Standard Test Method for Classification of Soils for Engineering Purposes.
10. ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
11. ASTM D2922 Standard Test Methods for Density of Soil and Soil-Aggregates In-Place by Nuclear Methods (Shallow Depth).
12. ASTM D3017 Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
13. ASTM D4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
14. ASTM D4253 Standard Test Methods for Maximum Index Density of Soils Using a Vibratory Table.
15. ASTM D4254 Standard Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.

B. The Contractor shall comply with the Construction Management Plan and the Construction Quality Assurance Project Plan included with the RFQ.

1.2 Submittals

Submit to OxyChem/Olin one copy of all Daily Inspection Logs, test reports and nonconformance reports. Daily Inspection Log copies shall be submitted no later than the second workday following the date. Test reports and nonconformance reports shall be submitted within 24 hours of the completion of the test. Nonconformance reports shall be submitted to OxyChem/Olin for remedial direction as soon as practical.

1.3 Qualifications

The Inspection and Testing Agency shall meet the technical criteria of ASTM D 3740 (Practice for Evaluation of Agencies Engaged in Testing and Inspection of Soil and

INSPECTION AND TESTING SERVICES

Rock as Used in Engineering Design and Construction) for agencies involved in soil and rock inspection.

2.0 EXECUTION

2.1 General

Monitor all jobsite Work to ascertain that all specifications, codes and standards applicable thereto are complied with. Plan for and perform inspections and tests in a timely manner so as to avoid delaying site development operations. Advise the responsible Contractor and OxyChem/Olin of any nonconforming condition detected as soon as practical.

A. Records and Reports

The Inspection and Testing Agency shall prepare written records of all inspections and tests made. Maintain a file of all records in a manner readily available at the jobsite.

1. **Daily Inspection Log**

Prepare and maintain a written log fully describing all Work inspected each day. As a minimum include in the daily log a summary of the Work inspected each day, the weather conditions under which the Work was performed, and a summary of any nonconforming conditions detected.

2. **Test Results**

Prepare and maintain written records of the results of all field and related laboratory tests performed.

3. **Nonconformance Report**

Any nonconforming conditions detected which are not immediately brought into conformance by the Contractor shall be documented in a written report submitted to OxyChem/Olin for disposition.

2.2 Quality Control - Inspection

OxyChem/Olin shall have access to the Work at all times.

The Contractor shall give timely notification requesting inspection of Work if it is designated for special tests, inspections or approvals or by instructions of OxyChem/Olin.

Vultafoam Technical Bulletin

402-6106 - ~~MICRO BLOWN~~ - ~~WATER BLOWN~~ - WORKMAN

Subject **PROBE FLOAT:**
CHEMICAL RESISTANCE TABLE
1-800-537-6725

CHEMICAL AND SOLVENT RESISTANCE DATA

Grade 5/1/49
419 557-2727

180° Top & up

POLYURETHANE FOAM

Active Material	Rating @ 75° F	Rating @ 125° F	Active Material	Rating @ 75° F	Rating @ 125° F
Diesel Oil	E	E	Acetone	F	--
Motor Oil	E	E	Perchloroethylene	E	E
Regular Gasoline	G	--	Water	G	G
Turpentine	E	--	Brine, Saturated	G	G
Kerosene	G	G	Brine, 10%	E	G
Linseed Oil	G	G	Sulfuric Acid, Concentrated	S	S
Benzene	E	--	Sulfuric Acid, 10%	G	G
Toluene	E	--	Nitric Acid, Concentrated	S	S
XYLENE "SHOULD BE SIMILAR" G. SPRING 11-17-89			Hydrochloric Acid, Concentrated	S	S
Methylene Chloride	F	--	Hydrochloric Acid, 10%	G	G
Ethyl Alcohol	F	F	Ammonium Hydroxide, Concentrated	G	--
Methyl Alcohol	F	F	Ammonium Hydroxide, 10%	G	G
Carbon Tetrachloride	E	E	Sodium Hydroxide, Concentrated	E	E
Methyl Ethyl Ketone	P	--	Sodium Hydroxide, 10%	E	G
Orthodichlorobenzene	E	E			

Ratings:

- E - Excellent Resistance
- G - Good Resistance
- S - Severe solvent action or chemical attack - not recommended for use.
- F - Fair Resistance
- P - Poor Resistance

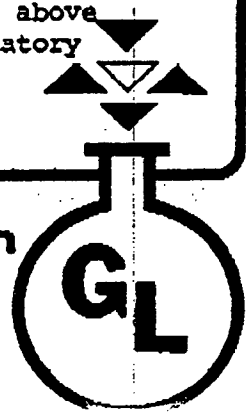
VULTAFOAM, unlike materials based on styrene, is not significantly affected by fuel oil, gasoline, acids, and alkalis in low concentrations. This property improves the quality of flotation medium in areas where fumes from chemicals would degrade the insulation and buoyant properties of the foam.

General Latex recommends that polyurethane foam parts being used in 'hostile' environments be tested to confirm suitability of the application. The above comparative table of data is a general representation of typical laboratory testing.

08/28/80

General Latex and Chemical Corporation

Recommendations for the use of our materials are based upon laboratory tests and evaluations believed to be reliable. However, there is no expressed or implied warranty as to results obtained or to be obtained by others who make use of this information or with respect to the absence, existence or validity of patent rights. If any of others involving any composition or process herein referred to; or an inducement or recommendation for the violation of any such patent rights, and responsibility and liability therefore is disclaimed.



AGGREGATE FOR LIGHT DUTY ACCESS ROADS AND BITUMINOUS PAVEMENT BASE

B. NYDOT (State of New York, Department of Transportation, Standard Specifications for Construction and Materials)

1. Section 203 Excavation and Embankment
2. Section 207 Geotextile
3. Section 304 Subbase Course
4. Section 703 Aggregate

1.3 Quality Assurance

An inspection and testing agency shall be retained by the Contractor to perform field and laboratory testing to verify compliance of the work with the requirements of this specification, and to ensure the achievement of the intents and purposes of work. The performance or lack of performance of such tests and inspections shall not be construed as granting relief from the requirements of these specifications or the other contract documents.

2.0 PRODUCTS

2.1 Aggregate for Bituminous Pavement Base Mix

Materials for aggregate pavement base mix shall consist of durable and sound crushed gravel or crushed stone. They shall be free from organic matter, lumps of clay, clay coatings, or other objectionable matter; and shall conform to NYDOT Section 703-02. Gradation shall conform to NYDOT Section 304 either Type 2 or 4.

2.2 Aggregate for Light Duty Access Road Mix

The roadway aggregate mix shall be densely graded and consist of broken stone or crushed gravel conforming to NYDOT Section 703 except that at least 90 percent of all fragments shall contain at least one face resulting from fracture, and shall conform to the following requirements and gradation:

- The moisture content of dense graded aggregate immediately prior to placement shall be 6 plus or minus 2 percent based on dry weight. If dense graded aggregate is to be paid for on a tonnage basis, the moisture content shall not exceed 8 percent when delivered to the Project. Aggregate for roadway mix shall conform to the following gradation:

Sieve Size	Percent Passing
1/2"	100
3/4"	55-90
No. 4	25-60
No. 50	5-25
No. 200	3-12

EARTHWORK

- b. ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- c. ASTM C150 Standard Specification for Portland Cement
- d. ASTM C535 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- e. ASTM D422 Standard Test Method for Particle-size Analysis of Soils
- f. ASTM D698 Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures using 5.5 pound (2.49 kg) Rammer and 12-inch (305mm) Drop
- g. ASTM D2216 Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
- h. ASTM D2434 Test Method for Permeability of Granular Soils (Constant Head)
- i. ASTM D2487 Standard Test Method for Classification for Soils for Engineering Purposes
- j. ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
- k. ASTM D2922 Standard Test Method for Density of Soil and Soil-Aggregate In Place by Nuclear Methods
- l. ASTM D3017 Standard Test Method for Water Content of Soil and Rock In Place by Nuclear Methods
- m. ASTM D4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

2. State of New York, Department of Transportation, Standard Specifications for Construction and Materials (NYDOT)

- Section 203 - Excavation and Embankment
- Section 610 - Turf and Wildflower Establishment
- Section 703 - Aggregates

EARTHWORK

3. City of Niagara Falls, Engineering Department, Standard Specifications (City of Niagara Falls Standards)
4. New York Guidelines for Urban Erosion and Sediment Control (NYUESC)
5. American Association of State Highway and Transportation Officials (AASHTO)

AASHTO T194: Determination of Organic Matter in Soils by Wet Combustion
6. Niagara River Borehole Drilling Program, Rev.1, May 1988
7. Bathymetric Survey of Niagara River, 102nd Street Landfill Site, July 1988
8. Monitoring Well/Borehole Stratigraphic and Instrumentation Log, April 1957

1.3 Quality Assurance

An inspection and testing agency will be retained by the Contractor to perform field and laboratory testing and soil evaluations to verify compliance of the work with the requirements of this specification and to ensure the achievement of the intents and purposes of the work. The performance or lack of performance of such tests and inspections shall not be construed as granting relief from the requirements of these specifications or the other contract documents.

1.4 Site Conditions

Existing site conditions have been investigated by Owner. Reports containing the findings, conclusions, and recommendations resulting from these previous site investigations are attached to the Contract and described in the Contract scope of Work. The information contained in the reports shall not be construed as a guarantee of the depth, extent, or character of materials actually present.

2.0 PRODUCTS

2.1 Materials

A. Bulk Fill (General Site Fill)

Non-hazardous (Classified by TCLP) materials imported by the Owner from other properties, primarily soils. These materials have been spread in lifts and compacted by the Owner. Some grading of these materials will be necessary to achieve the desired grades shown on the drawings.

EARTHWORK

B. Bulkhead Fill

Soil classified as GW, GP, GM, SW, SM compactable to at least 95 percent of Standard Proctor, within four (4) percentage points of optimum moisture content. The bulkhead fill must provide a minimum hydraulic conductivity of 1×10^{-4} cm/sec by ASTM D2434. SP soils are not acceptable because they do not provide the required friction angle for bulkhead stability.

C. Capping System

1. Subbase Material

Soil types CL, CH, ML, or SC with 100 percent passing the 3/4" sieve; rounded particles free of sharp or angular objects that could damage a geomembrane liner; free of organic or other deleterious matter. Soil excavated from other site activities may be used if it meets the above criteria.

2. Select Cover Fill

Soil types CL, CH, ML, or SC with 100 percent passing 3/4" sieve; material shall be free of roots, debris, trash or sharp objects, and be capable of sustaining vegetation. Select cover fill shall come from an approved off-site borrow source.

3. Topsoil

The topsoil shall consist of natural, friable, fertile, loamy soil containing 2.5 to six (6) percent of well-decomposed organic matter when tested according to AASHTO T194, representative of agriculturally productive soils in the vicinity, that has less than five (5) percent of hard clods, stiff clay, gravel, stones, brush, large roots, other objects larger than one (1) inch in any dimension and other deleterious materials, in accordance with NYUESC guidelines.

4. Geomembrane Liner

Refer to Specification 02776.

5. Seeding

Seed mixture, seedbed preparation, planting, mulching and fertilizing are discussed on Drawing 594000-10Q-04.

D. Select Granular Fill/Backfill for Structures or Piping

Any soil classified per ASTM D2487 or ASTM D2488 as GW, SW, GP, or SP with not over 12 percent passing the No. 200 sieve.

EARTHWORK

Fill/backfill material shall be free from frozen lumps, refuse, rocks larger than three (3) inches in any dimension, or other material that might prevent proper compaction or cause the completed fill/backfill to have insufficient bearing capacity for the expected superimposed loads.

E. Bedding Material for Piping

Bedding material shall be as indicated on drawing.

F. Backfill Under Buffalo Avenue Pavement

Backfill within the R.O.W. shall be in accordance with the City of Niagara Falls Standards, No. 2 Crusher Run Stone per NYDOT 703.02.

G. Fill/Backfill Outside of Limits of Slurry Wall

Acceptable backfill material for any excavation or fill for grading, outside the limits of the slurry wall and excluding the top six (6) inches of topsoil, shall consist of a fine grained material with a minimum of 50 percent passing the No. 200 sieve and shall be classified as CL or ML under the Unified Soil Classification System (ASTM D2487). The backfill material shall be free of unsuitable materials which include, but are not limited to:

1. frozen material or material containing ice lenses;
2. refuse or debris;
3. stones or rocks larger than three (3) inches in any dimension;
4. clays classified as CH or MH according to ASTM D2487;
5. frost susceptible soils;
6. swelling clays;
7. material containing organic matter or roots; and
8. organic soils classified as OL, OH or Pt according to ASTM D2487.

H. Plastic Marking Tape for Utilities

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6-inches wide with minimum thickness of 0.004 of an inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in Table 1 and shall bear a continuous printed inscription describing the specific utility.

EARTHWORK

TABLE 1 Plastic Marking Tape for Utilities	
<u>TAPE COLOR</u>	<u>UTILITY</u>
Red	Electric
Yellow	APL Collection System
Orange	Telephone, Telegraph, Television, Police, and Fire Communications

I. Portland Cement

Portland Cement shall be according to ASTM C150, Type I or II.

J. Bedding Sand

Sand shall be fine aggregate per ASTM C33.

K. Riprap

Riprap shall consist of durable, hard field stone or rough, unhewn quarry stone of approximately rectangular shape. The stones shall be reasonably free from cracks, seams, and other defects that may cause deterioration and they shall be reasonably free from earth and other foreign materials. Percentage of wear shall not exceed 35 percent after 1000 revolutions as determined by ASTM C535. The stones shall not have a loss of weight more than 15 percent after 5 cycles when tested for soundness with sodium sulfate or magnesium sulfate solution as determined by ASTM C88. The riprap shall be well graded with at least 50 percent of the gradation between the maximum stone size and the median stone size. The size of an individual stone shall be determined by measuring its long dimension. Riprap shall be tested by ASTM C535 and ASTM C88 for every 100 tons delivered to site.

The riprap shall be classified as follows:

	<u>CLASS I</u>	<u>CLASS II</u>
Maximum Stone Size	8 inches	12 inches
Median Stone Size	5 inches	8 inches
Minimum Layer Thickness	12 inches	18 inches

L. Riprap Bedding

Riprap bedding shall be No. 2 Coarse Aggregate per NYDOT Section 703.02. Material can be either crushed stone, crushed gravel, or screened gravel.

EARTHWORK

M. Geotextile Fabric

1. Temporary Access and Haul Roads

A non-woven geotextile fabric (Trevira 1120, Supac 8NP, TyPar 3601, or equivalent) shall be placed on the ground surface before placing the granular base course for the haul roads.

2. Dioxin-Containing Soil Placement Cell

After the excavated materials are placed in the Dioxin-Containing Soil Placement Cell, the materials shall be covered with a geotextile fabric. This fabric shall be Bon Terra CS2/C1 or equivalent.

3. Erosion Control Netting

Erosion Control Netting shall be HOLD/GRO (Gulf States Paper Corporation) or approved equal.

4. Bulkhead

A woven geotextile (Mirafi 700X, EXXON GTF-400E or equivalent) will be placed between the final outside slope of the embankment and the bedding material of the riprap.

5. Subdrain System

A non-woven geotextile (Trevira 1155 or equivalent) will be placed around the subdrain pipe bedding material as shown on Drawing 594000-10S-02.

6. Cap

The non-woven geotextile in the cap is discussed in Specification 02776.

N. Seeding

Temporary (if needed) and permanent grass seeding types and mixtures shall be submitted to OxyChem/Olin for approval prior to its use. Permanent grass mixture of seed, fertilizer, lime and mulch, application rate, planting dates and maintenance requirements shall be as specified in Section 610 of NYDOT Standard Specification for Construction and Materials.

Refer to Drawing 594000-10Q-04 for additional specific requirements.

O. Fertilizer

Fertilizer shall be uniform in composition, free flowing, and suitable for application with approved equipment. Use of liquid fertilizer is subject to approval of OxyChem/Olin prior to its use. The fertilizer shall be delivered to the

EARTHWORK

jobsite in bags or other convenient containers, each fully labeled, including the following information:

1. name and address of manufacturer,
2. name brand or trademark,
3. number of net pounds or ready mixed material in the package, and
4. chemical composition or analysis and guarantee of analysis.

If lime is required to adjust soil pH to 6.5, it shall be ground limestone containing no less than 85 percent of total carbonates and ground to such fineness that 50 percent will pass through a No. 100 sieve and 90 percent will pass through a No. 20 sieve.

Refer to Drawing 594000-10Q-04 for additional specific requirements.

P. Organic Mulches

Organic mulches, if required, shall consist of, but not be limited to the following:

1. straw from oats, wheat, barley, or rye;
2. hay from pangola, alfalfa, bermuda, or prairie grass.

Mulch all seeded areas in accordance with the requirements of the New York Guidelines for Urban Erosion and Sediment Control (NYUESC).

Q. Granular Base Course

Granular base course material will be required for construction of the haul roads at the jobsite and may be required to maintain existing and temporary access roads at the Site. Gradation of the base course for the haul and access roads shall be No. 2 Coarse Aggregate per NYDOT Section 703.02, which is within the following limits:

<u>SIZE DESIGNATION</u>	<u>% PASSING BY WEIGHT</u>
1 1/2"	100
1"	90 - 100
1/2"	0 - 15

Material can be either crushed stone, crushed gravel, or screened gravel.

R. Temporary Cover Soil

Upon completion of placing excavated material at the designated Dioxin-Containing Soil Placement Cell at the Site, cover the materials with a geotextile fabric and two (2) inches of soil to sustain vegetative growth. This material shall be obtained from an off-Site borrow source and shall be preapproved by

EARTHWORK

OxyChem/Olin prior to delivery to the Site. It shall consist of a CL, ML, or loamy soil capable of sustaining vegetation.

2.2 Mixtures

A. Lean Concrete for Mud Slabs

A mixture containing 1 part (by volume) Portland cement, 2 parts sand, and water. The amount of water shall be the minimum necessary to produce a mixture with a consistency suitable for proper placement.

3.0 EXECUTION

3.1 Examination

A. General - Site Examination

Before starting work, thoroughly examine the site to ascertain certain conditions under which the work must be performed. Notify the Owner of any existing conditions which might prevent the performance of the work indicated on the drawings.

3.2 Preparation

A. Erosion and Sediment Control

Before starting earthwork operations on any particular area of the project site, install measures for the control, prevention, and abatement of erosion and accumulation of silt for that area as required by the drawings and by any applicable federal, state, or local codes or regulations.

1. Install the silt fence along the north, east and west sides of the site as shown on Drawing 594000-10Q-01. Remove at job completion.
2. Construct the diversion berm and swale system shown on Drawing 594000-10Q-01, creating the sedimentation pond in the existing low-lying area. The filter trap from the sedimentation pond to the clear pond shall be constructed similar to the stone outlet sediment trap shown on Drawing 594000-10Q-04.
3. The water in the clear pond will be periodically sampled and discharged to the river pending satisfactory analytical results. The cost of analytical testing of the water in the clear pond will be paid by the Contractor. Sampling and discharge requirements are discussed in the Water Management Plan which is an attachment to Specification 11231.
4. Place hay bale filters as shown on Drawing 594000-10Q-04 around the drainage inlet grate for each catch basin. Remove at job completion.

EARTHWORK

5. Install the 12-inch diameter PVC culvert pipes in the swale as shown on Drawings 594000-10U-04 and 10U-05.
6. Permanent erosion control measures are discussed in Section 3.5.H.

B. Preceding Work

Before start of earthwork covered by this specification, complete required preceding work such as:

02110: Clearing and Grubbing

C. Grading General Site Fill

The Contractor will be required to perform final grading of the General Site Fill that has been imported, placed and compacted by the Owner.

D. Construction Layout

Unless otherwise stipulated elsewhere in the contract documents, the work covered by this specification shall include the performance of calculations, and the setting of marks and stakes necessary to ensure that the work conforms to the required lines, grades, and dimensions. Relate such layout to the coordinate grid system, elevation datum, and related survey control monuments and bench marks identified on the drawings or elsewhere in the contract documents.

E. Pavement Removal

Where trenches must be excavated in areas of existing paving, remove the pavement using neat, straight, and square or parallel saw cuts no less than one (1) foot outside of the line of intersection between the excavation sidewall and the pavement subgrade surface. In the case of Portland cement concrete pavement, the line of removal may be the nearest existing pavement joint outside of the one (1) foot limit. Cut steel reinforcement projecting within the removed area to allow for the lap splice with the new replacement reinforcement required for restoration of the pavement.

3.3 Protection

A. Survey Monuments

Locate and protect from damage survey monuments within the work area. Properly relocate or witness any monument that must be disturbed by the work. After completion of the work, restore monument witnesses.

B. Buffalo Avenue Utilities

Existing abandoned underground (as well as overhead) mechanical and electrical/telecommunications utilities will be encountered. Contractor is

EARTHWORK

responsible for assuring that the utilities have been abandoned or provide suitable protection for all utilities adjacent or within the work area. Active (none are expected) utilities shall be kept in service and properly protected. Any utilities damaged shall be repaired. Interruptions in service required to make tie-ins shall be coordinated with the impacted utility companies. Provide/install supports for all utilities uncovered or potentially undermined during installation of new work. Provide suitable cover to avoid damage from superimposed loads.

C. *Excavation Slopes*

1. Stabilize or lay back the side slopes of all excavations or trenches as necessary to prevent slope failure in conformance with OSHA regulations.
2. Shoring, sheeting and bracing, etc. (as may be required to support the side of the excavation and prevent any movement which may in any way endanger personnel, injure or delay the work or endanger adjacent building or other structures), shall be put in place and maintained. Trench sheeting shall remain in place until pipe has been laid, tested for defects, repaired if necessary and the fill material around it compacted to a depth 1 foot over the top of the pipe. Steel or wood sheeting and bracing shall be removed in such a manner as not to disturb or endanger the constructed sewer or other structures, utilities or property, whether public or private. A trench shield or trench box made of steel or wood adequately braced may be used. This shield shall be pulled along the trench and the pipe bedded and jointed inside the box. Care shall be exercised in moving the shield so that previously laid pipe and backfill are not disturbed. All work shall be in compliance with OSHA Construction Industry Standards, local, state and federal rules and regulations relating to this type of work.

3.4 Control of Construction Water

A. *General*

Prevent or control water flow into excavations, or other accumulation in excavations, to ensure that the bottoms and sides of all excavations remain in a firm and stable condition throughout construction operations.

B. *Surface Waters*

Precipitation/runoff shall not be allowed to accumulate in the excavations or trenches. Plan and conduct excavation operations so as to minimize the disruption of work. Provide diversion ditches, dikes, and other suitable measures to control and direct runoff around and away from the excavation. Protect the sides of excavations from erosion and sloughing caused by storm water runoff. Promptly remove any storm water accumulation from excavations. The systems and equipment for control of surface water shall be of sufficient capacity to accommodate the runoff rate that can be expected from the two (2) year (50 percent annual chance) rainfall event, with no significant disruption of

APL WET WELL INSTALLATION

contained and disposed of in accordance with Section 3.8. The Contractor shall ensure that spoils are not left in contact with the subbase materials of the landfill cap.

The excavating equipment and tools shall be steam cleaned prior to leaving the Site. The Contractor shall utilize the temporary decontamination pad (Specification 01120: Decontamination). The excavating equipment and tools shall be decontaminated using a powered steam system furnished by the Contractor. Detergent (Alconox) solutions may be used as necessary to properly clean equipment. Decontamination water shall be pumped to the storage tank furnished by the Contractor. The Contractor shall be responsible for containerizing used protective clothing during decontamination procedures and disposing of these materials following the procedures of Section 3.8 of this Specification.

3.5 APL Wet Well Installation Procedure

The APL wet wells will be installed at the locations shown on Drawings 594000-30K-01 and 594000-30K-06. A compacted concrete sub-base shall be poured to the dimensions shown on Drawing 594000-30K-06 around the precast concrete manhole. The precast concrete manhole shall conform to Specification 03400. The manhole shall be placed at the elevations shown in Table 1 on Drawing 594000-30K-06. A ladder shall be provided as called out in Specification 03400. The wet well pump installation is specified in Section 3.7.

The geomembrane boot shall be attached to the outside of the concrete manhole, which protects the APL wet well and associated pumps and piping, and welded to the liner as shown on the drawings and in accordance with the manufacturer's recommended procedures.

Excavation spoils will be placed in drums or other watertight containers during the operation and handled in accordance with Section 3.7 of this Specification.

3.6 APL Wet Well Pump Installation

The APL wet well pump and pump control probe shall be installed in the well. Details of the APL well installation are shown on the drawings and for pump, accessories, and controls, see equipment data sheets. The main equipment lists and data sheets are provided in Division 11 of these specifications. The APL pump intake should be no more than three (3) inches above the bottom of the well. All equipment shall be contained within the concrete manhole.

3.7 Procedures for Handling Program-Derived Wastes

All solid wastes and soils derived from the APL wet well installation shall be containerized in drums or watertight containers furnished by the Contractor for transportation to a designated section of the landfill for disposal. Solid waste and soils shall be placed in the landfill and the containers re-used until completion of the program.

The solid waste and soils shall have free-water decanted from them to the extent that is practical. The material shall then be stabilized as necessary by the addition of Portland Cement or blending with other soils that are available. The stabilized soils shall be placed in the portion of the landfill designated by the Owner and compacted as required to meet the provisions of Specification 02200: Earthwork.

Liquid wastes shall be stored in the tank furnished by the Contractor and transported by the Contractor, or his licensed hauler, to the Owner's designated Niagara Falls plant for treatment

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 02013

Page 5 of 5
2-5-96/Rev. No. 1

APL WET WELL INSTALLATION

and disposal. Liquid wastes shall include decontamination fluids collected from the decontamination pad.

End of Specification

TOPOGRAPHIC SURVEY

1.0 DESCRIPTION OF WORK - GENERAL

All Work shall be done to the lines, grades, and elevations indicated on the drawings.

The Contractor shall be required to perform surveys and computations as necessary to determine quantities of Work performed or placed by Contractor during each period for which a progress payment is to be made. The Contractor shall also make original surveys as required prior to commencing Work on jobsite.

The Contractor shall perform calculations and setting of survey control monuments and stakes as necessary to ensure that Work shown on the Drawings conforms to the required lines, grades, and dimensions. Relate such layout to the New York State Plane Coordinate Grid, elevation datum, and related survey control monuments and bench marks identified on the Drawings.

1.1 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the Drawings, Work included in this specification shall conform to the applicable provisions of these publications. Coordinate Work prescribed by this specification with Work prescribed by the documents, listed below.

- A. ANSI (American National Standards Institute)**
- B. United States National Map Accuracy Standards**

2.0 PRODUCTS

2.1 Certification of the Topographic Surveys

- A.** The Contractor shall use a New York licensed and registered Surveyor for all surveying activities.
- B.** Topographic surveys including surveys performed for determination of quantities shall be certified by the Surveyor and approved by the Contractor.

2.2 Equipment

References shall be set and measurements taken using standard accepted surveying methods and equipment.

All original field notes, computations, and other survey records for the purposes of layout, original, progress, and final surveys shall be recorded in duplicating field books, the original pages of which shall be furnished promptly in ring binders to OxyChem/Olin.

TOPOGRAPHIC SURVEY

3.0 EXECUTION

3.1 Requirements

A. General

Perform surveys and computations as necessary to determine quantities of Work performed or placed by Contractor during each period for which a progress payment is to be made.

Make computations as necessary to verify the quantities of Work including excavation and fill in place. Quantity surveys shall be made in the presence of a representative of the Owner. The accuracy of quantity survey points shall be ± 0.1 foot horizontal and vertical.

The cross-sectional average end area method shall be used to calculate the in-place volumes.

B. Topographic Map

Prepare a topographic map at a scale of one inch equals 50 feet with one foot contours of the top of the finished grade at the landfill area.

C. Construction Layout

Items of Work that require layout include, but are not limited to the following:

1. Limits of clearing and grubbing
2. Site erosion and sedimentation control measures
3. Slurry Wall and Bulkhead
4. Silt Curtain/Fish Screen
5. Cofferdam
6. Limits of sediment removal
7. Limits of Removal of Offsite Perimeter Soils
8. Limits and control for general Site excavation and fill
9. Limits of Landfill Capping System
10. Access Roads
11. Berms and Dikes
12. Fence and gate installations
13. Loadout facility
14. APL and NAPL collection systems
15. Wet wells, NAPL recovery wells, post closure monitoring wells, and piezometers
16. Subdrain collection piping
17. Removal of abandoned underground utilities to facilitate the installation of storm drainage
18. Storm drains and appurtenances
19. Retaining structure at Buffalo Avenue
20. Support facilities
21. Water Treatment System

END OF SPECIFICATION

CLEARING AND GRUBBING

11.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the procedure for the following:

1. Removal and proper disposition of all structures and inorganic materials designated for removal such as fences and concrete or asphalt pavement.
2. Removal and proper disposition of trees, stumps, brush shrubs, vines and roots or other vegetation designated for removal.
3. Protection of vegetation and survey monuments adjacent to or within the area to be cleared (or cleared and grubbed).
4. Transportation and placement of all materials cleared from the jobsite to the designated area/stockpiles identified by OxyChem/Olin on the 102nd Street Landfill Site.
5. Excavation for purposes of clearing and grubbing shall not be allowed within the limits of the landfill.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, Work included in this specification shall conform to the applicable provisions of these publications.

A. State of New York, Department of Transportation, Standard Specifications for Construction and Materials (NYDOT)

B. New York Guidelines for Urban Erosion and Sediment Control, 1991

2.0 PRODUCTS

Not applicable.

CLEARING AND GRUBBING

3.0 EXECUTION

3.1 Protection

A. General

Avoid damage to the site and to existing facilities, trees, and shrubs designated to remain. Contractor is advised that the Site is an existing landfill, with an earth cover. Contractor is to avoid any excavations to assist in the site clearing. Any problems encountered with the Work which might impact the landfill are to be brought to the OxyChem/Olin's attention and all work halted until such problems are resolved.

B. Monuments

1. Protect benchmarks, baseline monuments, property corners, and other temporary or permanent survey markers in the vicinity of the work from destruction or disturbance. Accurately restore at the earliest practical date any markers destroyed or disturbed.
2. Within the area to be cleared, properly relocate survey markers that interfere with the work, or witness the markers and then restore them after completing the work. Perform survey marker relocation or restoration work under the direct supervision of a registered land surveyor.

C. Vegetation

Before starting clearing operations, erect protective barriers around trees, shrubs, and other vegetation designated to remain. Barriers shall consist of 4 feet high woven wire fabric fencing supported by steel or wood posts spaced 6 feet on center (maximum). Erect barriers at or outside of the tree or shrub drip line. Do not use the area within protective barriers for traffic, storage, or any other purpose. After clearing and grubbing work is complete, remove and dispose of protective barriers at an approved offsite disposal facility.

D. Erosion and Sediment Control

Erosion and sediment control measures shall be provided in accordance with applicable state and local regulations and as shown on the drawings. All erosion control features shall be in place prior to removal of existing ground cover and shall be maintained throughout the duration of the earthwork operation. Obtain all necessary permits for site grading operations.

3.2 Clearing and Grubbing

All trees and shrubs contained within the Work Zone shall be removed. The portion of trees above ground shall be cut and felled in a manner to avoid disturbance of the

CLEARING AND GRUBBING

surficial soils. Measures such as cribbing with branches cut from the trees shall be employed to avoid disturbing the ground surface.

When felling trees, the Contractor shall protect personnel and equipment at the jobsite, and existing facilities including the overhead electric wires and poles.

Fallen trees shall be cut into sections and hauled onto the Site and stockpiled at a location identified by OxyChem/Olin.

Stumps and root systems shall be removed, as part of the excavation activity (Specification 02200), to a minimum depth of 18 inches and cut into sections. Care shall be taken to limit depth of root removal beyond a depth of 18 inches, or a greater depth as specified by OxyChem/Olin.

3.3 Fencing

Remove existing fencing and stockpile reusable or salvageable material in the designated area (Construction Support Area). Fabric may be reused after inspection and approval for such use by OxyChem/Olin. All materials unsuitable for reuse at the site shall be disposed of in an approved offsite facility.

3.4 Disposal

All materials (trees, shrubs, stumps, and roots) resulting from the clearing and grubbing operation shall remain on site. These materials shall be chipped. Chips may be temporarily stockpiled on the site in a location approved by OxyChem/Olin. These stockpiles shall be covered with tarps properly secured to withstand high winds. The chipped material shall be no larger than two inches in size (greatest dimension). Chips shall be blended with fill material.

Burning will not be permitted.

3.5 Smoothing of Terrain

In the area between the limits of clearing and the location of the future slurry wall, holes, depressions, ridges, and other irregular surface features shall be filled by grading and backfilling to achieve a surface suitable for subsequent construction operations. Shape the resulting surface for positive drainage of surface runoff. Backfill as necessary by filling holes and depressions with suitable imported material by compacting to a density equal to or greater than that of the surrounding undisturbed soil. Areas inside the location of the slurry wall need not be smoothed.

EARTHWORK

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the requirements for excavation and fill associated with the following:

1. Installation of sediment and erosion control features.
 2. Construction of Dioxin-Containing Soil Placement Cell for off-site perimeter soils containing dioxin.
 3. Excavation of soils and other material within the area delineated on the Drawings for removal of off-site perimeter soils to the minimum depth indicated by the sampling and testing program.
 4. Layout and excavation of storm drains and appurtenances.
 5. Construction of temporary access roads on existing cap.
 6. Construction of diversion berms, swales, and sedimentation pond.
 7. Transportation and placement of excavated off-site perimeter soils/materials containing dioxin in the designated Dioxin-Containing Soil Placement Cell at the Site.
 8. Transportation and placement of excavated off-site perimeter soils not containing dioxin to a designated location under the cap.
 9. Transportation and placement of excavated storm drain soil not suitable for reuse as backfill to a designated location under the cap.
 10. Installation of silt curtain and cofferdam in Niagara River.
 11. Backfill of excavation for perimeter soils and storm drain, grading and seeding.
 12. Excavation of embayment sediments.
 13. Construction of bulkhead.
 14. Grading/shaping of existing landfill and Owner imported general site fill.
 15. Transportation, placement, and mixing of excavated sediments under the cap.
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EARTHWORK

16. Transportation and placement of excavated slurry wall trench spoils, APL collection trench spoils, APL force main trench spoils, and well cuttings under the cap.
17. Placement of capping system including seeding.
18. Placement of riprap on bulkhead.
19. Excavation and backfill for installation of footings/foundation/slabs for loadout facility, APL wet wells and NAPL recovery wells.
20. Trenching and backfill for installation of underground piping, conduit, cable and appurtenances.
21. Install permanent erosion control features.
22. Quality Control Requirements.

B. Attachments

The following Attachments prescribe Work related procedures, protocols and requirements:

- Attachment A: Owner's Site Specific Health and Safety Plan (SSHSP)
- Attachment B: Health and Safety Plan (HASP) Addendum and Appendices

Coordinate Work prescribed by this specification with Work and requirements prescribed by the above listed specifications and attachments.

C. Terminology

The following terms are defined as stated, unless otherwise indicated:

1. *Soil Classification Symbols:* Symbols based on the Unified Soil Classification System as determined per ASTM D2487 or ASTM D2488 (such as GW, SW, and CH).
2. *Cohesive Materials:* Soils classified per ASTM D2487 or ASTM D2488 as GC, SC, ML, CL, MH, CH, or materials classified as GM or SM when their fine fraction (material passing a No. 40 sieve) has a plasticity index of 4 or greater.
3. *Cohesionless Materials:* Soils classified per ASTM D2487 or ASTM D2488 as GW, GP, SW, SP, and materials classified as GM or SM when their fine fraction (material passing a No. 40 sieve) is non-plastic or has a plasticity index less than 4.

EARTHWORK

4. *Proctor Density*: The maximum dry density achieved per ASTM D698 when testing a sample of material representative of that to be compacted in the field.
5. *Optimum Moisture Content*: The moisture content at which the Proctor Density is achieved.
6. *Inspection and Testing Agency*: The company, partnership, or corporation retained by OxyChem/Olin to perform the inspections and tests required to determine and verify compliance of the work with the requirements of this specification.
7. *Unyielding Subgrade*: Rock or soil containing large stones (over 3 inches in any dimension) that if allowed to remain at the trench bottom, would likely cause uneven or point loading on the pipe.
8. *Unstable Subgrade*: Material in the trench bottom that lacks sufficient firmness to maintain the alignment of the pipe, or to prevent joints in the pipe from separating during backfilling. This may be material that is otherwise satisfactory but has been disturbed or is saturated with water.
9. *Pipe Embedment Zone*: The area of the trench in the immediate vicinity of the installed pipe, including special foundations when required (see pipe bedding details on the drawings), where special materials and construction techniques are required by this specification to ensure proper installation of the pipeline.
10. *Load-bearing Subgrade*: The soil lying beneath and up to 5 feet outside of the edge of pavements and structures (either existing or to be constructed), and the soil lying within such other limits of load-bearing subgrade as may be indicated on the drawings or elsewhere in the contract documents.
11. *Personal Protective Equipment (PPE)*: Disposable outer coveralls, gloves, boots, etc. as required by the SSHSP and the HASP.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, Work included in this specification shall conform to the applicable provisions of these publications.

A. Applicable Codes

1. American Society for Testing and Materials (ASTM)
 - a. ASTM C33 Standard Specification for Concrete Aggregate

EARTHWORK

- b. ASTM C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
 - c. ASTM C150 Standard Specification for Portland Cement
 - d. ASTM C535 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 - e. ASTM D422 Standard Test Method for Particle-size Analysis of Soils
 - f. ASTM D698 Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures using 5.5 pound (2.49 kg) Rammer and 12-inch (305mm) Drop
 - g. ASTM D2216 Standard Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
 - h. ASTM D2434 Test Method for Permeability of Granular Soils (Constant Head)
 - i. ASTM D2487 Standard Test Method for Classification for Soils for Engineering Purposes
 - j. ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
 - k. ASTM D2922 Standard Test Method for Density of Soil and Soil-Aggregate In Place by Nuclear Methods
 - l. ASTM D3017 Standard Test Method for Water Content of Soil and Rock In Place by Nuclear Methods
 - m. ASTM D4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
2. State of New York, Department of Transportation, Standard Specifications for Construction and Materials (NYDOT)
- Section 203 - Excavation and Embankment
 - Section 610 - Turf and Wildflower Establishment
 - Section 703 - Aggregates

EARTHWORK

3. City of Niagara Falls, Engineering Department, Standard Specifications (City of Niagara Falls Standards)
4. New York Guidelines for Urban Erosion and Sediment Control (NYUESC)
5. American Association of State Highway and Transportation Officials (AASHTO)

AASHTO T194: Determination of Organic Matter in Soils by Wet Combustion
6. Niagara River Borehole Drilling Program, Rev.1, May 1988
7. Bathymetric Survey of Niagara River, 102nd Street Landfill Site, July 1988
8. Monitoring Well/Borehole Stratigraphic and Instrumentation Log, April 1957

1.3 Quality Assurance

An inspection and testing agency will be retained by the Contractor to perform field and laboratory testing and soil evaluations to verify compliance of the work with the requirements of this specification and to ensure the achievement of the intents and purposes of the work. The performance or lack of performance of such tests and inspections shall not be construed as granting relief from the requirements of these specifications or the other contract documents.

1.4 Site Conditions

Existing site conditions have been investigated by Owner. Reports containing the findings, conclusions, and recommendations resulting from these previous site investigations are attached to the Contract and described in the Contract scope of Work. The information contained in the reports shall not be construed as a guarantee of the depth, extent, or character of materials actually present.

2.0 PRODUCTS

2.1 Materials

A. Bulk Fill (General Site Fill)

Non-hazardous (Classified by TCLP) materials imported by the Owner from other properties, primarily soils. These materials have been spread in lifts and compacted by the Owner. Some grading of these materials will be necessary to achieve the desired grades shown on the drawings.

EARTHWORK

B. Bulkhead Fill

Soil classified as GW, GP, GM, SW, SM compactable to at least 95 percent of Standard Proctor, within four (4) percentage points of optimum moisture content. The bulkhead fill must provide a minimum hydraulic conductivity of 1×10^{-4} cm/sec by ASTM D2434. SP soils are not acceptable because they do not provide the required friction angle for bulkhead stability.

C. Capping System

1. Subbase Material

Soil types CL, CH, ML, or SC with 100 percent passing the 3/4" sieve; rounded particles free of sharp or angular objects that could damage a geomembrane liner; free of organic or other deleterious matter. Soil excavated from other site activities may be used if it meets the above criteria.

2. Select Cover Fill

Soil types CL, CH, ML, or SC with 100 percent passing 3/4" sieve; material shall be free of roots, debris, trash or sharp objects, and be capable of sustaining vegetation. Select cover fill shall come from an approved off-site borrow source.

3. Topsoil

The topsoil shall consist of natural, friable, fertile, loamy soil containing 2.5 to six (6) percent of well-decomposed organic matter when tested according to AASHTO T194, representative of agriculturally productive soils in the vicinity, that has less than five (5) percent of hard clods, stiff clay, gravel, stones, brush, large roots, other objects larger than one (1) inch in any dimension and other deleterious materials, in accordance with NYUESC guidelines.

4. Geomembrane Liner

Refer to Specification 02776.

5. Seeding

Seed mixture, seedbed preparation, planting, mulching and fertilizing are discussed on Drawing 594000-10Q-04.

D. Select Granular Fill/Backfill for Structures or Piping

Any soil classified per ASTM D2487 or ASTM D2488 as GW, SW, GP, or SP with not over 12 percent passing the No. 200 sieve.

EARTHWORK

Fill/backfill material shall be free from frozen lumps, refuse, rocks larger than three (3) inches in any dimension, or other material that might prevent proper compaction or cause the completed fill/backfill to have insufficient bearing capacity for the expected superimposed loads.

E. Bedding Material for Piping

Bedding material shall be as indicated on drawing.

F. Backfill Under Buffalo Avenue Pavement

Backfill within the R.O.W. shall be in accordance with the City of Niagara Falls Standards, No. 2 Crusher Run Stone per NYDOT 703.02.

G. Fill/Backfill Outside of Limits of Slurry Wall

Acceptable backfill material for any excavation or fill for grading, outside the limits of the slurry wall and excluding the top six (6) inches of topsoil, shall consist of a fine grained material with a minimum of 50 percent passing the No. 200 sieve and shall be classified as CL or ML under the Unified Soil Classification System (ASTM D2487). The backfill material shall be free of unsuitable materials which include, but are not limited to:

1. frozen material or material containing ice lenses;
2. refuse or debris;
3. stones or rocks larger than three (3) inches in any dimension;
4. clays classified as CH or MH according to ASTM D2487;
5. frost susceptible soils;
6. swelling clays;
7. material containing organic matter or roots; and
8. organic soils classified as OL, OH or Pt according to ASTM D2487.

H. Plastic Marking Tape for Utilities

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6-inches wide with minimum thickness of 0.004 of an inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in Table 1 and shall bear a continuous printed inscription describing the specific utility.

EARTHWORK

TABLE 1 Plastic Marking Tape for Utilities	
<u>TAPE COLOR</u>	<u>UTILITY</u>
Red	Electric
Yellow	APL Collection System
Orange	Telephone, Telegraph, Television, Police, and Fire Communications

I. Portland Cement

Portland Cement shall be according to ASTM C150, Type I or II.

J. Bedding Sand

Sand shall be fine aggregate per ASTM C33.

K. Riprap

Riprap shall consist of durable, hard field stone or rough, unhewn quarry stone of approximately rectangular shape. The stones shall be reasonably free from cracks, seams, and other defects that may cause deterioration and they shall be reasonably free from earth and other foreign materials. Percentage of wear shall not exceed 35 percent after 1000 revolutions as determined by ASTM C535. The stones shall not have a loss of weight more than 15 percent after 5 cycles when tested for soundness with sodium sulfate or magnesium sulfate solution as determined by ASTM C88. The riprap shall be well graded with at least 50 percent of the gradation between the maximum stone size and the median stone size. The size of an individual stone shall be determined by measuring its long dimension. Riprap shall be tested by ASTM C535 and ASTM C88 for every 100 tons delivered to site.

The riprap shall be classified as follows:

	<u>CLASS I</u>	<u>CLASS II</u>
Maximum Stone Size	8 inches	12 inches
Median Stone Size	5 inches	8 inches
Minimum Layer Thickness	12 inches	18 inches

L. Riprap Bedding

Riprap bedding shall be No. 2 Coarse Aggregate per NYDOT Section 703.02. Material can be either crushed stone, crushed gravel, or screened gravel.

EARTHWORK

M. Geotextile Fabric

1. Temporary Access and Haul Roads

A non-woven geotextile fabric (Trevira 1120, Supac 8NP, TyPar 3601, or equivalent) shall be placed on the ground surface before placing the granular base course for the haul roads.

2. Dioxin-Containing Soil Placement Cell

After the excavated materials are placed in the Dioxin-Containing Soil Placement Cell, the materials shall be covered with a geotextile fabric. This fabric shall be Bon Terra CS2/C1 or equivalent.

3. Erosion Control Netting

Erosion Control Netting shall be HOLD/GRO (Gulf States Paper Corporation) or approved equal.

4. Bulkhead

A woven geotextile (Mirafi 700X, EXXON GTF-400E or equivalent) will be placed between the final outside slope of the embankment and the bedding material of the riprap.

5. Subdrain System

A non-woven geotextile (Trevira 1155 or equivalent) will be placed around the subdrain pipe bedding material as shown on Drawing 594000-10S-02.

6. Cap

The non-woven geotextile in the cap is discussed in Specification 02776.

N. Seeding

Temporary (if needed) and permanent grass seeding types and mixtures shall be submitted to OxyChem/Olin for approval prior to its use. Permanent grass mixture of seed, fertilizer, lime and mulch, application rate, planting dates and maintenance requirements shall be as specified in Section 610 of NYDOT Standard Specification for Construction and Materials.

Refer to Drawing 594000-10Q-04 for additional specific requirements.

O. Fertilizer

Fertilizer shall be uniform in composition, free flowing, and suitable for application with approved equipment. Use of liquid fertilizer is subject to approval of OxyChem/Olin prior to its use. The fertilizer shall be delivered to the

EARTHWORK

jobsite in bags or other convenient containers, each fully labeled, including the following information:

1. name and address of manufacturer,
2. name brand or trademark,
3. number of net pounds or ready mixed material in the package, and
4. chemical composition or analysis and guarantee of analysis.

If lime is required to adjust soil pH to 6.5, it shall be ground limestone containing no less than 85 percent of total carbonates and ground to such fineness that 50 percent will pass through a No. 100 sieve and 90 percent will pass through a No. 20 sieve.

Refer to Drawing 594000-10Q-04 for additional specific requirements.

P. Organic Mulches

Organic mulches, if required, shall consist of, but not be limited to the following:

1. straw from oats, wheat, barley, or rye;
2. hay from pangola, alfalfa, bermuda, or prairie grass.

Mulch all seeded areas in accordance with the requirements of the New York Guidelines for Urban Erosion and Sediment Control (NYUESC).

Q. Granular Base Course

Granular base course material will be required for construction of the haul roads at the jobsite and may be required to maintain existing and temporary access roads at the Site. Gradation of the base course for the haul and access roads shall be No. 2 Coarse Aggregate per NYDOT Section 703.02, which is within the following limits:

<u>SIZE DESIGNATION</u>	<u>% PASSING BY WEIGHT</u>
1 1/2"	100
1"	90 - 100
1/2"	0 - 15

Material can be either crushed stone, crushed gravel, or screened gravel.

R. Temporary Cover Soil

Upon completion of placing excavated material at the designated Dioxin-Containing Soil Placement Cell at the Site, cover the materials with a geotextile fabric and two (2) inches of soil to sustain vegetative growth. This material shall be obtained from an off-Site borrow source and shall be preapproved by

EARTHWORK

OxyChem/Olin prior to delivery to the Site. It shall consist of a CL, ML, or loamy soil capable of sustaining vegetation.

2.2 Mixtures

A. Lean Concrete for Mud Slabs

A mixture containing 1 part (by volume) Portland cement, 2 parts sand, and water. The amount of water shall be the minimum necessary to produce a mixture with a consistency suitable for proper placement.

3.0 EXECUTION

3.1 Examination

A. General - Site Examination

Before starting work, thoroughly examine the site to ascertain certain conditions under which the work must be performed. Notify the Owner of any existing conditions which might prevent the performance of the work indicated on the drawings.

3.2 Preparation

A. Erosion and Sediment Control

Before starting earthwork operations on any particular area of the project site, install measures for the control, prevention, and abatement of erosion and accumulation of silt for that area as required by the drawings and by any applicable federal, state, or local codes or regulations.

1. Install the silt fence along the north, east and west sides of the site as shown on Drawing 594000-10Q-01. Remove at job completion.
2. Construct the diversion berm and swale system shown on Drawing 594000-10Q-01, creating the sedimentation pond in the existing low-lying area. The filter trap from the sedimentation pond to the clear pond shall be constructed similar to the stone outlet sediment trap shown on Drawing 594000-10Q-04.
3. The water in the clear pond will be periodically sampled and discharged to the river pending satisfactory analytical results. The cost of analytical testing of the water in the clear pond will be paid by the Contractor. Sampling and discharge requirements are discussed in the Water Management Plan which is an attachment to Specification 11231.
4. Place hay bale filters as shown on Drawing 594000-10Q-04 around the drainage inlet grate for each catch basin. Remove at job completion.

EARTHWORK

5. Install the 12-inch diameter PVC culvert pipes in the swale as shown on Drawings 594000-10U-04 and 10U-05.
6. Permanent erosion control measures are discussed in Section 3.5.H.

B. Preceding Work

Before start of earthwork covered by this specification, complete required preceding work such as:

02110: Clearing and Grubbing

C. Grading General Site Fill

The Contractor will be required to perform final grading of the General Site Fill that has been imported, placed and compacted by the Owner.

D. Construction Layout

Unless otherwise stipulated elsewhere in the contract documents, the work covered by this specification shall include the performance of calculations, and the setting of marks and stakes necessary to ensure that the work conforms to the required lines, grades, and dimensions. Relate such layout to the coordinate grid system, elevation datum, and related survey control monuments and bench marks identified on the drawings or elsewhere in the contract documents.

E. Pavement Removal

Where trenches must be excavated in areas of existing paving, remove the pavement using neat, straight, and square or parallel saw cuts no less than one (1) foot outside of the line of intersection between the excavation sidewall and the pavement subgrade surface. In the case of Portland cement concrete pavement, the line of removal may be the nearest existing pavement joint outside of the one (1) foot limit. Cut steel reinforcement projecting within the removed area to allow for the lap splice with the new replacement reinforcement required for restoration of the pavement.

3.3 Protection

A. Survey Monuments

Locate and protect from damage survey monuments within the work area. Properly relocate or witness any monument that must be disturbed by the work. After completion of the work, restore monument witnesses.

B. Buffalo Avenue Utilities

Existing abandoned underground (as well as overhead) mechanical and electrical/telecommunications utilities will be encountered. Contractor is

EARTHWORK

responsible for assuring that the utilities have been abandoned or provide suitable protection for all utilities adjacent or within the work area. Active (none are expected) utilities shall be kept in service and properly protected. Any utilities damaged shall be repaired. Interruptions in service required to make tie-ins shall be coordinated with the impacted utility companies. Provide/install supports for all utilities uncovered or potentially undermined during installation of new work. Provide suitable cover to avoid damage from superimposed loads.

C. Excavation Slopes

1. Stabilize or lay back the side slopes of all excavations or trenches as necessary to prevent slope failure in conformance with OSHA regulations.
2. Shoring, sheeting and bracing, etc. (as may be required to support the side of the excavation and prevent any movement which may in any way endanger personnel, injure or delay the work or endanger adjacent building or other structures), shall be put in place and maintained. Trench sheeting shall remain in place until pipe has been laid, tested for defects, repaired if necessary and the fill material around it compacted to a depth 1 foot over the top of the pipe. Steel or wood sheeting and bracing shall be removed in such a manner as not to disturb or endanger the constructed sewer or other structures, utilities or property, whether public or private. A trench shield or trench box made of steel or wood adequately braced may be used. This shield shall be pulled along the trench and the pipe bedded and jointed inside the box. Care shall be exercised in moving the shield so that previously laid pipe and backfill are not disturbed. All work shall be in compliance with OSHA Construction Industry Standards, local, state and federal rules and regulations relating to this type of work.

3.4 Control of Construction Water

A. General

Prevent or control water flow into excavations, or other accumulation in excavations, to ensure that the bottoms and sides of all excavations remain in a firm and stable condition throughout construction operations.

B. Surface Waters

Precipitation/runoff shall not be allowed to accumulate in the excavations or trenches. Plan and conduct excavation operations so as to minimize the disruption of work. Provide diversion ditches, dikes, and other suitable measures to control and direct runoff around and away from the excavation. Protect the sides of excavations from erosion and sloughing caused by storm water runoff. Promptly remove any storm water accumulation from excavations. The systems and equipment for control of surface water shall be of sufficient capacity to accommodate the runoff rate that can be expected from the two (2) year (50 percent annual chance) rainfall event, with no significant disruption of

PRECAST CONCRETE

B. ASTM (American Society for Testing and Materials)

1. ASTM A36/A36M Standard Specification for Structural Steel
2. ASTM A82 Standard Specification for Steel Wire, Plain; for Concrete Reinforcement
3. ASTM A325-93 Standard Specification for Structural Bolts, Steel, and Heat-Treated
4. ASTM A615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
5. ASTM C33 Standard Specification for Concrete Aggregates
6. ASTM C150 Standard Specification for Portland Cement
7. ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete
8. ASTM C443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
9. ASTM C478 Specification for Precast Reinforced Concrete Manhole Sections.
10. ASTM C494 Standard Specification for Chemical Admixtures for Concrete
11. ASTM C915 Standard Specification for Precast Reinforced Concrete Cribwall Members.

1.3 System Description

In summary, the Supplier shall perform structural design for the cribwall, prepare shop drawings, fabricate precast concrete components, and deliver and erect the precast concrete items as shown on the drawings and specified herein.

1.4 Cribwall Submittals

A. Specifications, Design Calculation, Installation Instructions

Submit 2 copies of the Supplier's specifications, design calculations, and installation instructions.

B. Erection Drawings

Erection drawings shall be signed and sealed by a Professional Engineer, registered in the state of New York.

PRECAST CONCRETE

1.5 Product Delivery And Handling

A. Delivery

Deliver precast units to the Project site in quantities and times as shall ensure the continuity of installation.

B. Storage and Handling

Store and transport units to ensure against cracking, distortion, staining, or other physical damage, and so that identification marks are visible. Lift and support units at the designated lift points only.

1.6 Site Conditions

Examine the site, existing facility and the conditions under which the work is to be performed, and notify Fluor Daniel in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

1.7 Design Requirements

A. Cribwall shall be designed to support landfill cap along Buffalo Avenue as shown on Drawing 594000-10S-02 to carry all dead and super imposed loads indicated.

B. Design modifications may be made only as necessary to meet field conditions and to ensure proper fitting of the work, and as acceptable to Owner. Maintain the general design concept as shown.

2.0 PRODUCTS

2.1 Materials

A. Reinforcing Materials

Provide the following as may be required for the design of precast units:

1. Reinforcing bars: ASTM A615, grade as required.
2. Steel wire: ASTM A82, plain, cold-drawn steel.
3. Welded wire fabric: ASTM A185.
4. Supports for Reinforcement: Devices for supporting, spacing, and fastening reinforcement shall comply with CRSI recommendations. Devices shall be concealed in the fabricated work to the greatest extent possible and, where exposed, shall be corrosion protected, stainless steel, or have at least 1/8 of an inch plastic sheathing.

PRECAST CONCRETE

B. Concrete Materials

1. Cement

Portland Cement shall be Type I conforming to ASTM C150, unless otherwise specified. Cement for exposed surfaces shall be 1 type and obtained from 1 source throughout the entire Project to maintain uniform color and to establish undivided responsibility.

2. Aggregates

a. Fine Aggregate shall be sand conforming to ASTM C33 (normal weight) and shall be composed of clean, uncoated grains of sound materials free from clay, mineral dust, organic impurities, and particles containing iron oxide.

b. Coarse aggregates shall be clean, crushed stone or gravel conforming to ASTM C33 (normal weight).

3. Water

Mixing water shall be potable, clean, fresh, and free from injurious amounts of oil, acids, alkalis, organic materials, or other impurities.

4. Admixtures

Admixtures, except air entraining, water reducing and retarding admixtures, shall not be used without the approval of Fluor Daniel. Calcium chloride or admixtures containing calcium chloride shall not be used. Air entraining admixtures shall conform to ASTM C260 and water reducing and retarding admixtures shall conform to ASTM C494.

5. Grout

Grout shall be nonmetallic, nonshrinking, nongas forming, noncorrosive, and moisture resistant such as Five Star, as manufactured by U.S. Grout Corporation or equal.

C. Manhole Steps

Neenah R-1982W Aluminum or approved equal.

D. Castings

1. Storm Drain Manholes

Gray cast iron, ASTM A48-83, Class 35, Neenah R-1764-0001 frame and Neenah R-1764-0002 cover or equal.

2. Inline Cleanouts

Ductile iron frame and cover, Neenah R1792 FL or equal.

PRECAST CONCRETE

3. Castings shall be free from cracks, holes, swells, cold shuts, and patches.

E. Gasket Materials

Rubber O-ring gaskets conforming to ASTM C443. Project requires both square and round gaskets.

F. Precast Structures

Conform with ASTM C478. Openings shall be preformed. Walls shall have a minimum thickness of 5 inches. 4000 psi concrete.

Storm drain manholes 6 through 11 are round. Inline cleanouts and APL wet well vaults are square.

G. Pullboxes

Pullboxes for site electrical and telephone shall be Pre-cast Manufacturing Co. No. E-3 1/2 or No. E-7 State Pull box SPB Series with steel diamond plate bolt down cover. Top of box to be one inch above finished grade.

H. Cribwall System

Cribwall system shall be mini-Criblock[®] as manufactured by Retaining Walls Company (770) 662-5206 or approved equal.

I. Sewer Pipe

Reinforced concrete sewer pipe is discussed in Specification 02725.

2.2 Fabrication And Manufacture

A. All precast concrete shall be cast in watertight forms of metal, wood, hardboard, concrete or other suitable materials to provide a finish with a dense texture, free of honeycombing and excess air holes. Surface texture shall be uniform and shall be standard finish of concrete placed against steel or other dense surface.

B. Any precast members where the reinforcement protrudes through the surface or where shadow lines caused by reinforcement too near the surface shall be rejected.

3.0 EXECUTION

3.1 Storm Drain Manholes, Inline Cleanouts, APL Wet Well Vaults

A. Place where shown on Drawings and in accordance with details.

B. Excavate, backfill, and compact in accordance with Section 02200.

PRECAST CONCRETE

C. Pipe Connections

1. Inline Cleanouts and APL wet well vaults: Center pipe in hole through base section and pack annular space with non-shrink grout.
2. Storm Drain Manholes: Refer to detail on Drawing 594000-30K-13.
3. Annular space shall be uniform around pipe and gasket material evenly distributed.
4. Ensure watertight connection.

D. Provide rubber O-ring gasket material between manhole or inline cleanout sections as necessary for watertight joint.

E. Place succeeding manhole sections so steps remain in true vertical alignment.

F. Place appropriate top section, cone or flat top, as indicated on Drawing.

G. Place concrete brick on manhole and inline cleanout top. Bring completed manhole to finished grade.

H. Install frame and cover.

I. Pour invert in storm drain manholes.

1. Provide poured-in-place channels (if manholes not furnished with precast inverts) to direct flows from incoming pipes to outgoing pipes. Channels shall smoothly blend flows.
2. Make channel horseshoe shaped. Width and depth equal to size of outlet sewer.
3. To maintain flexibility of pipe connection boot, plug annular space between pipe and boot which falls in area where invert to be poured with extrudible preformed plastic gasket material. Plug shall prevent concrete from entering space between pipe and boot.
4. Invert channels may be placed after manhole base section (and connecting pipes) backfilled.

3.2 Cribwall

Install cribwall (retaining structure) in the areas designated on Drawings 594000-10U-02 and 10U-04. Detail for retaining structure is on Drawing 594000-10S-02.

Install in accordance with approved erection drawings and installation instructions.

3.3 Pullboxes

Install pullboxes for site electrical and telephone at the locations shown on Drawings 594000-65U-01 and 65U-02, and in accordance with Specification 65000.

PRECAST CONCRETE

3.4 Field Quality Control

- A. Precast reinforced concrete bases, risers, tops, cribwall members, vaults, and gray or ductile iron castings shall be subject to rejection for failure to conform to Specifications.
- B. Individual sections of bases, risers, tops, and cribwall members may be rejected for following.
 - 1. Fractures or cracks passing through bell, except for single end crack not exceeding joint depth.
 - 2. Excessive patching.
 - 3. Grouted pipe openings.
 - 4. Defects indicating imperfect proportioning, mixing, and molding.
 - 5. Surface defects indicating honeycombed or open texture.
 - 6. Damaged ends, where such damage prevents making satisfactory joint.
 - 7. Manhole steps out of line, not properly spaced or damaged.
 - 8. Continuous crack having surface width of 0.01 in. or more and extending for length of 12 in. or more, regardless of position.
- C. Installation may be rejected for following.
 - 1. Use of individual components subject to rejection.
 - 2. Failure to conform to installation requirements.
 - 3. Visible infiltration (manholes, cleanouts, vaults).
 - 4. Variation from true vertical alignment by more than 2% of depth.
 - 5. Variations in pipe and rim elevations greater than 0.5 in. from elevations shown on drawings.

4.0 ATTACHMENTS

Not applicable.

END OF SPECIFICATION

DIVISION 11 - EQUIPMENT

	Major Equipment List
	Data Sheets - Major Equipment
11231	Water Treatment System
59000	General Requirements - Equipment

MAJOR EQUIPMENT LIST

102nd Street Landfill, Niagara Falls, NY
OXYCHEM/OLIN

REV: B
DATE: 09/08/95

Equip. No	Equipment Description	Capacity	Material of Construction	HP*	Vendor	Comments
P-201	APL Pump	5.6 gpm 105 ft TDH	304 SS	1/3	GRUNDFOS	Packaged system with controls
P-202	APL Pump	5.6 gpm 105 ft TDH	304 SS	1/3	GRUNDFOS	Packaged system with controls
P-203	APL Pump	5.6 gpm 105 ft TDH	304 SS	1/3	GRUNDFOS	Packaged system with controls
P-204	APL Pump	5.6 gpm 105 ft TDH	304 SS	1/3	GRUNDFOS	Packaged system with controls
P-205	APL Transfer Pum	75 gpm 25 ft. TDH	316 SS	2	DURCO	Centrifugal pump
P-206	Sump Pump	50 gpm 30 ft. TDH	316 SS	1.5	DURCO	Self priming centrifugal pump
P-301	NAPL Pump	0.2 gpm 60 psi TDH	316 SS	**	TUTHILL	Gear pump pkg. with controls & wiring
P-302	NAPL Pump	0.2 gpm 60 psi TDH	316 SS	**	TUTHILL	Gear pump pkg. with controls & wiring
P-303	NAPL Pump	0.2 gpm 60 psi TDH	316 SS	**	TUTHILL	Gear pump pkg. with controls & wiring
P-304	NAPL Pump	0.2 gpm 60 psi TDH	316 SS	**	TUTHILL	Gear pump pkg. with controls & wiring
P-305	NAPL Pump	0.2 gpm 60 psi TDH	316 SS	**	TUTHILL	Gear pump pkg. with controls & wiring
P-306	NAPL Pump	0.2 gpm 60 psi TDH	316 SS	**	TUTHILL	Gear pump pkg. with controls & wiring
P-307	NAPL Pump	0.2 gpm 60 psi TDH	316 SS	**	TUTHILL	Gear pump pkg. with controls & wiring
P-308	NAPL Pump	0.2 gpm 60 psi TDH	316 SS	**	TUTHILL	Gear pump pkg. with controls & wiring
P-309	NAPL Pump	0.2 gpm 60 psi TDH	316 SS	**	TUTHILL	Gear pump pkg. with controls & wiring
P310	NAPL Pump	0.2 gpm 60 psi TDH	316 SS	**	TUTHILL	Gear pump pkg. with controls & wiring
P-311	Future NAPL Transfer Pump	20 gpm 30 ft. TDH	316 SS	2	WAUKESHA	Lobe pump
P-312	Future NAPL Drum Pump	5 gpm 20 ft. TDH	316 SS	1	LUTZ	Electric
T-201-A	APL Storage Tank	10,000 gallo	FRP	-	COASTAL TECH. SALE	Horizontal, 9'-0" Dia x 24'-6" long w/electric panel heater and removable insulation blank
T-201-B	APL Storage Tank	10,000 gallo	FRP	-	COASTAL TECH. SALE	Horizontal, 9'-0" Dia x 24'-6" long w/electric panel heater and removable insulation blank
T-301	Future NAPL Storage Tank	500 gallon	FRP	-	EDWARDS	Horizontal, 4'-0" Dia x 6'-6" long w/electric panel heater and removable insulation blank

* Horsepowers listed are preliminary, all are single phase, 110 or 230 volt unless noted otherwise.

** These motors are 12 VDC, 5 AMP.

SLURRY WALL

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This Specification prescribes requirements for the construction of a slurry wall cutoff at the Owner's 102nd Street Landfill Site (Site) in Niagara Falls, New York. The Work shall be complete and shall include preparation of the Site to provide a proper working platform, the mixing and placement of the trench backfill, and finishing of the slurry wall with a soil cap. The Contractor shall furnish all materials, labor, tools, supervision and equipment necessary to complete the Work of this Specification.

The work shall be complete, and all work incidental to the construction of the slurry wall shall be provided as though specified in detail.

B. Attachments

The following attachments prescribe Work related procedures, protocols and requirements:

- Attachment A: Owner's Site Specific Health and Safety Plan (SSHSP)
- Attachment B: Health and Safety Plan (HASP) Addendum and Appendices

Coordinate Work prescribed by this Specification with Work and requirements prescribed by the above listed attachments.

C. Terminology

The following terms are defined as stated unless otherwise indicated:

Slurry Wall: Three (3)-foot minimum width trench excavated in the natural ground by the slurry method, and backfilled with a specified soil and bentonite mixture to form an impervious cut-off wall.

Slurry Method of Excavation: Process of excavating a vertical walled trench and at the same time keeping the trench filled with slurry. The purpose is to support the wall of the trench and prevent movement of ground water.

Slurry: Stable colloidal suspension of pulverized bentonite in water.

Bentonite: Ultrafine clay whose principal mineral constituent is sodium cation montmorillonite.

Slurry Wall Specialist: Specialist experienced in the use and control of bentonite slurry to construct a slurry wall and the Quality Control testing necessary to ensure the satisfactory completion of the slurry wall.

Slurry Wall Superintendent: Superintendent or engineer who has had proven and successful experience in slurry wall construction and is knowledgeable with all facets of the construction including:

SLURRY WALL

- (1) The proper mixing methods employed to mix the slurry and soil.
- (2) Excavation and backfill operations.
- (3) A thorough knowledge of construction methods and testing requirements needed for slurry wall construction.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings. Work included in this specification shall conform to the applicable provisions of these publications.

A. American Petroleum Institute (API) Standard Specifications

1. API Specification 13A Specification for Drilling Fluid Materials
Sections 3, 5, 6, 7, and 8 Latest Revision
2. API RP13B Recommended Practice Standard Procedure for
Field Testing Drilling Fluids

B. American Society for Testing and Materials (ASTM) Standards

1. ASTM C143 Slump of Portland Cement Concrete
 2. ASTM D422 Standard Method for Particle Size Analysis of
Soils
 3. ASTM D698 Test for Moisture Density Relations of Soils and
Soil-Aggregate Mixture, Using 5.5-Pound
Hammer and 12-in. Drop
 4. ASTM D1140 Materials Finer than 75 UM (No. 200) Sieve in
Mineral Aggregates by Washing
 5. ASTM D1587 Thin Walled Tube Sampling of Soils
 6. ASTM D2217 Wet Preparation Method
 7. ASTM D2487 Standard Test Method of Classification of Soils
for Engineering Purposes
 8. ASTM D2922 Standard Test Methods for Density of Soil and
Soil-Aggregate in-place by Nuclear Methods
(Shallow Depth)
 9. ASTM D4318 Standard Test Method of Liquid Limit, Plastic
Limit, and Plasticity Index of Soils
-

SLURRY WALL

10. ASTM D5084 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials using a Flexible Wall Permeameter.

1.3 Submittals

The Contractor shall submit for review his slurry and backfill design mix demonstrating compliance with this specification. The backfill design mix will be based upon the results of laboratory hydraulic conductivity testing of the slurry backfill mixtures by flexible wall permeameter and using the on-site groundwater as the permeate (ASTM D5084). The backfill design mix will be required as part of the design submittal prior to mobilizing for slurry wall construction. Samples of the off-site borrow material to be used for the slurry wall will be made available to the Owner. Perform analytical testing Target Analyte List (TAL)/Target Compound List (TCL) of proposed off-site borrow material.

The Contractor shall develop a backfill mixture using backfill material obtained from an approved off-site borrow area and shall determine the following parameters for the mixture:

- Grain size distribution of borrow soils;
- Bentonite content, by weight;
- Slump of mixture;
- Density of mixture;
- Listing of admixtures used, by weight; and
- Permeability of mixture (1×10^{-7} cm/sec. max.)

The permeability test results must be based on a minimum of one pore volume of site groundwater as permeant, passing through the sample.

The Owner has made available for Contractor review, the results of compatibility testing conducted at a site in the Vicinity of the 102nd Street Landfill Site.

The Contractor shall prepare and submit for approval by the Owner, his plan of operations, showing the proposed location of his facilities, storage areas, mixing areas, and access routes to the slurry trenching operations, which shall conform to the space limitations described above.

1.4 Records Required

The following records and documentation of the slurry wall work shall be maintained by the slurry wall Specialist, in a form which allows for reproduction and distribution.

- A. Copies of the certification data sheets for each batch of bentonite material received, and the reaches of the slurry wall in which it was used, by approximate stations.
- B. Record of excavation depth, trench width, and verticality of trench at 10-foot intervals, together with records of surface elevation, proposed and actual bottom of trench elevation; this information shall be submitted to the Owner as daily profiles.
- C. Grain size analyses (ASTM D422, ASTM D1140) and Atterberg Limits (ASTM D4318) of off-site borrow material to be used as backfill, at intervals not exceeding 100 feet length along the alignment of slurry wall.

SLURRY WALL

- D. For each batch of the initial slurry used to stabilize the trench during excavation, (but not less than one test per 50 feet of trench length):

Density of slurry, as mixed for placement;
Viscosity of slurry;
Bentonite content of slurry, by weight; and
Record of all admixtures used, including proportions and placement location.

- E. For each backfill batch of 150 cubic yards or less,

Bentonite content, by weight;
Slump;
Density;
Permeability of mixture as placed; and
Admixtures used, and proportioning thereof.

- F. Test of density of slurry in trench before placement of backfill, for each batch of backfill placed.

Records of trench sounding and depth, prior to backfill placement, to assure removal of material which would result in "windows" in the backfill.

- H. Records of daily excavation and backfill soundings in the form of a profile.

- I. Records of soil used to cover the slurry wall, together with density test results on compaction of the cover.

- J. A construction log indicating daily progress, and noting any delays in slurry placement, including cause, location and extent of each delay. A record of unusual conditions and construction problems encountered, and disposition of each.

- K. Draft copies of the records shall be submitted daily to the Owner. Final copies of the records shall be submitted concurrently with claims for payment.

1.5 Qualifications of Contractor

The Contractor, or slurry wall Subcontractor, shall submit evidence that they are competent and proficient in slurry wall construction, and that the organization which will undertake this slurry wall project has performed similar work on at least two (2) projects successfully within the past two (2) years.

The Contractor, or slurry wall Subcontractor shall provide the services of a slurry wall Specialist, who will direct all of his activities to Quality Control/Quality Assurance, and who shall be responsible for the monitoring and performance tests required by these specifications as necessary to control the construction work adequately. The slurry wall Specialist shall be responsible for maintaining the records of the construction work specified in this item.

The Contractor, or slurry wall Subcontractor shall provide the services of a slurry wall Superintendent, who shall direct, supervise, and control the excavation of the trench, preparation, and handling of the slurry and backfill mixtures, and the placement of the backfill.

GEOSYNTHETIC LINING SYSTEM

For a period of not less than 30 seconds, examine the geomembrane through the viewing window for pressure of soap bubbles.

If no bubbles appear after 30 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum of 3 inches overlap and repeat the process.

All areas where soap bubbles appear shall be marked and repaired.

6. Air Pressure Testing

The following procedures are applicable to those processes which produce a double seam with an enclosed space. The equipment shall be comprised of the following.

- a. An air pump (manual or motor driven) equipped with a pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi (160 and 200 kPa) and mounted on a cushion to protect the geomembrane;
- b. A rubber hose with fittings and connections;
- c. A sharp hollow needle, or other approved pressure feed device.

The following procedures shall be followed:

- a. Seal both ends of seam to be tested;
- b. Insert needle or other approved pressure feed device into the tunnel created by the fusion weld;
- c. Insert a protective cushion between the air pump and the geomembrane;
- d. Energize the air pump to a pressure between 25 and 30 psi (160 and 200 kPa), close valve and sustain pressure for approximately 5 minutes.
- e. At the conclusion of the air test, the opposite end of the seam shall be split and the subsequent drop in pressure shall be monitored. This will insure that the entire seam was completely tested;
- f. If loss of pressure exceeds 2 psi or 10mm mercury (15kPa) or does not stabilize, locate faulty area and repair.
- g. Remove needle or other approved pressure feed device and seal. Vacuum test patch.

C. Destructive Field Seam Testing

1. A minimum of one destructive test sample per 500 feet of seam length shall be provided from a location specified by the QA Engineer. The Contractor shall not be informed in advance of the sample location. In order to obtain test results

GEOSYNTHETIC LINING SYSTEM

prior to completion of geomembrane installation, samples shall be cut by the Contractor as the seaming progresses.

2. Sampling times and locations shall be determined by the QA Engineer. QA Engineer shall witness the collection of all field samples and the Contractor shall mark all samples with their location roll and seam number. The Contractor shall also record in written form the date, time, location, roll seam number, ambient temperatures, and pass or fail description. A copy of the information must be attached to each sample portion. The Contractor shall repair all holes in the geomembrane resulting from obtaining the seam samples. All patches shall be vacuum tested.
3. The sample shall be 12 inches wide by 24 inches long with the seam centered lengthwise. The sample shall be cut into two equal pieces, one-half submitted to the QA Engineer and the other half to the Inspection and Testing Agency's QA Laboratory. If the Contractor desires a sample, the size should be increased to 12 inches wide by 36 inches long. A one inch wide strip shall be cut from each end of the sample and tested in the field for peel and shear, and shall not fail in the seam.
4. For Laboratory Testing, the QA Laboratory shall die-cut 10 one-inch wide replicate specimens from his sample. The QA Laboratory shall test five specimens for seam strength and five for peel strength. To be acceptable, four out of the five replicate test specimens must pass the criteria defined in Sections 3.5.A.4 and 3.5.A.5 of this specification. Any specimen that fails through the weld or by adhesion at the weldsheet interface is a Non-FTB break and shall be considered a failure.
5. The samples shall be examined for holes, grooves, melt through, wavering welds, small welds, and any other unusual characteristics. The laboratory tests to be performed include "Bonded Seam Strength" and "Peel Adhesion" as recommended in the National Sanitation Foundation's (NSF) Standard Number 54 for Flexible Membrane Liners. At least three sub-samples transverse to the seam shall be tested for each laboratory test. A report or a series of reports shall be prepared by the QA Laboratory of the results of examination and testing. This report or reports shall be submitted to the QA Engineer on a timely basis for review and consideration of further action.

D. Identification of Defects

1. All seams and non-seam areas of the geomembranes shall be inspected for identification of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter.
2. The surface of the geomembrane shall be clean at the time of inspection. Brooming and/or washing of the geomembrane surface shall be required if the amount of surface dust or mud inhibits inspection.

- E. Evaluation of Defects:** Each suspect location both in seam and non-seam areas shall be non-destructively tested using the methods described herein. Each location which fails the non-destructive testing shall be marked and repaired.
-

GEOSYNTHETIC LINING SYSTEM

- F.** Repair Procedures on Seams: Defective seams shall be repaired by reseaming or applying a capstrip. Tears or holes shall be repaired by seaming or patching. Blisters, larger holes, undispersed raw materials, and contamination by foreign matter shall be repaired by patches. Each patch shall be numbered. Patches shall be round or oval in shape, made of the same generic geomembrane, and extend a minimum of six inches beyond the edge of defects.
- G.** Verification of Repairs on Seams: Each repair shall be non-destructively tested using the methods described herein. Tests which pass the non-destructive test shall be taken as an indication of an adequate repair. Failed tests shall be reseamed and retested until a passing test results. The Construction Manager will observe all non-destructive testing of repairs. The Geomembrane Installer shall record the number of each patch, date, location, patcher and test outcome.
- H.** Daily Field Installation Reports: The Geomembrane Installer shall provide the QA Engineer with daily report of: the total amount and location of geomembrane placed; total amount and location of seams completed and names of individuals doing seaming and units used; changes in layout drawings; results of test seams; location and results of non-destructive testing; location and results of repairs; and location of destructive test samples.

3.5 Liner Acceptance

- A.** The geomembrane liner will be accepted when: the installation is finished; all documentation of installation is completed; and verification of the adequacy of all field seams and repairs, and associated testing is complete.
- B.** A passing test seam shall be an indicator of the adequacy of the seaming unit and seamer working under prevailing site conditions, but not necessarily an indicator of field seam adequacy. The test seam must also pass the laboratory tests under the destructive testing criteria.
- C.** For field seams, if the laboratory test fail, that shall be considered as an indicator of the possible inadequacy of the entire seamed length corresponding to the test seam. More destructive test portions shall then be taken by the Geomembrane Installer at locations indicated by the QA Engineer and the same laboratory tests required of test seams shall be performed. Passing tests shall be an indicator of adequate seams. Failing tests shall be an indicator of non-adequate seams and all seams represented by the destructive test location shall be repaired with a cap-strip. The cap-strip shall be non-destructively tested and repaired, as required, until adequacy of the seams is achieved.
- D.** A passing non-destructive test of field seams and repairs shall be considered to indicate the adequacy of field seams and repairs.

3.6 Disposal of Scrap Materials

On completion of installation, the contractor shall be responsible for disposal of all trash and scrap material generated by his activities, remove equipment used in connection with the work herein, and shall leave the premises in neat and acceptable manner.

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 02776
Page 12 of 12
2-5-96/Rev. No. 1

GEOSYNTHETIC LINING SYSTEM

3.7 The Manufacturer/Installation

Contractor shall provide a written warranty that the installed liner system is free from defects in materials and workmanship and will continue to serve the intended purpose from the date of completion for a period of 20 years under normal service conditions.

End of Specification

CHAIN LINK FENCE - GALVANIZED

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the requirements for the materials and installation of chain link fence (galvanized) and the associated posts, rails, braces, terminal posts, gates, barbed wire, controls, grounding and other related materials.

B. Terminology

1. Chain Link Fence Classification: Chain link fencing shall be classified by fabric category as galvanized (zinc coated). Wire to be referred to as galvanized.
2. Barbed Wire: Barbed wire for additional security shall be classified as galvanized (zinc coated).
3. NPS: Nominal pipe size.

C. Existing Perimeter Fence and Temporary Security Fencing

1. The existing fencing shall be used to the extent feasible for construction of the security fencing around the perimeter of the Site. Posts shall be cut flush with the ground surface. After the permanent fencing is complete, the Contractor shall remove the existing perimeter fence and accessories and dispose of them off-site as scrap.
2. The Contractor shall install new fence as indicated on the drawings (Permanent Fence) and where additional materials are necessary for expansion of the temporary perimeter security. Any existing sections of fence found to be in poor condition, as determined by the Owner, shall also be replaced with new fence.
3. The Contractor shall maintain the fences in good condition and repair at no cost to the Owner until completion and acceptance of the work by the Owner.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect at the time of the project's execution unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, all Work included in this specification shall conform to the applicable provisions of these publications.

A. ASTM (American Society For Testing and Materials)

1. ASTM A53 Specification for Pipe - Steel, Black, and Hot Dipped, Zinc-Coated, Welded, and Seamless
 2. ASTM A116 Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
-

CHAIN LINK FENCE - GALVANIZED

3. ASTM A120 Specification for Pipe, Steel, Black, and Hot Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary uses.
4. ASTM A121 Specification for Zinc-Coated (Galvanized) Steel Barbed Wire
5. ASTM A123 Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
6. ASTM A143 Recommended Practice for Safeguarding Against Embrittlement of Hot Dipped (Galvanized) Structural Steel Products and Procedure for Detecting Embrittleness
7. ASTM A153 Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
8. ASTM A392 Specification for Zinc-Coated Steel Chain Link Fence Fabric
9. ASTM A475 Specification for Zinc-Coated Steel Wire Strand
10. ASTM A525 Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process
11. ASTM A570 Specification for Steel, sheet and strip, carbon, Hot-Rolled, Structural Quality
12. ASTM A641 Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
13. ASTM A817 Specification for Metallic Coated Steel Wire for Chain Link Fence Fabric
14. ASTM C33 Standard Specification for Concrete Aggregates
15. ASTM C150 Standard Specification for Portland Cement
16. ASTM F567 Practice For Installation of Chain Link Fence
17. ASTM F626 Specification for Fence Fittings
18. ASTM F669 Specification for Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence
19. ASTM F1083 Specification for Pipe, Steel, Hot-Dipped, Zinc-Coated (Galvanized), Welded for Fence Structures

1.3 Storage and Protection

A. Blocking

Store materials 12 inches off the ground or slab by using wood blocking or other approved materials.

CHAIN LINK FENCE - GALVANIZED

B. Storage Area

Store materials in areas of the job site designated or approved by Owner.

1.4 Scheduling and Sequencing

Certain portions of the work are specified to be completed and operational prior to completion of all Work. Sequence equipment and gate installation, and properly protect equipment to prevent contamination or damage to equipment in adjacent work areas. Phasing and sequencing shall be subject to the approval of Owner.

2.0 PRODUCTS

2.1 Materials

A. General

Fence fabric, posts, top rail, tension wire, corner posts, barbed wire, and appurtenances shall conform to the ASTM codes and standards for the appropriate type of materials as listed under Section 1.2 of this specification, and more specifically listed in the sections below.

B. Materials shall be uniform, consistent, and meet the following requirements:

1. Fabric shall be 6 feet high, heavy galvanized chain link fence, conforming to ASTM A392, Class II, of 2 inch mesh 9 gage wire (0.148 inches in diameter), with the top and bottom selvages twisted and barbed.

2. Line Posts

For fabric up to 8 feet high, line posts shall be 2 inch NPS schedule 40 galvanized steel pipe with an outside diameter of 2.375 inches or in accordance with ASTM A120.

3. End Corner and Pull Posts

End corner and pull posts 8 feet high or less shall be 2- 1/2 inch NPS schedule 40 galvanized steel pipe in accordance with ASTM A120.

4. Top Rails

Top rails shall conform to 1- 1/4 inch NPS schedule 40 galvanized steel pipe in accordance with ASTM A120. Top rail is required for permanent fencing.

5. Tension Wire

Tension wire shall be 7 gage US Steel wire galvanized in accordance with ASTM A116 Coating Class III. The tension wire shall be stretched near the bottom of the fence and attached at 2 foot intervals. For temporary fencing, the tension wire shall be stretched at the top also.

CHAIN LINK FENCE - GALVANIZED

6. Appurtenances

Brace bands, tension bands, and tension bars shall be fabricated of 1/8 inch by 7/8 inch galvanized steel with galvanized steel carriage bolts and nuts in accordance with ASTM A123. Tension bars shall be 1/4 by 3/4 inch galvanized steel bar in accordance with ASTM A153. Couplings joining top rails shall be 6" long, 0.070" min. wall thickness, designed to permit expansion and contraction of pipe.

7. Fabric Ties

Fabric ties shall be Class I galvanized steel wire no less than 9 gage.

8. Post Tops

One post top shall be provided for each post, with openings to permit through passage of top rail. Materials shall be pressed steel or malleable iron that is designed as watertight closure cap for tubular posts and shall be galvanized per ASTM A153.

9. Barbed Wire

Barbed wire shall consist of double stranded, 12- 1/2 gage wire ASTM A121, Class III, with 4 point barbs spaced 3 to 6 inches apart. The top 1 foot of the fence shall consist of 3 strands of barbed wire attached to 45 degree angle extension arms capable of withstanding without failure 300 pounds downward pull at the outermost end of the arm. The top strand shall be 12" above top of fabric and 12" from fence line.

10. Gates

Gate materials such as fabric, bolts, nuts, tension bars, and barbed wire, shall be consistent with fence materials. Gates shall be double roller-slide gates as shown on Drawing 594000-10S-01.

Provide latches which are accessible from either side and can be padlocked open or closed. Provide plunger-bar type latch which engages stop plate embedded in concrete.

Gates shall be manually operated. Shop drawings for gates over 12 feet wide shall be submitted for approval. The location of the temporary gates are shown on Drawing 594000 10Q-01. The location of the final gates are shown on Drawing 594000 10U-04.

11. Concrete

Provide 3000 psi concrete consisting of Portland Cement (ASTM C150), aggregates (ASTM C33) and clean water.

CHAIN LINK FENCE - GALVANIZED

3.0 EXECUTION

3.1 Examination

The physical locations of features such as fence lines, gates, terminal posts shall be in accordance with the plans. Removal of trees, shrubs, or landscape areas is subject to prior approval unless specifically shown to be removed on the drawing.

3.2 Layout

Contractor shall be responsible for layout of temporary and final fencing and gates.

3.3 Preparation

Provide a reasonably smooth profile at the fence line. The bottom of the fence shall not be more than 2 inches above the finished ground line. Where the fence crosses features such as streams and drainage ditches and it is impractical to conform the fence to the ground contour, the fence shall span the depression, unless otherwise shown on the plans. Close the space below the bottom of the fence with extra fence fabric or barbed wire. If extra length fence posts are required at such locations, they shall be furnished and installed in lieu of standard length posts, together with any intermediate posts, stakes, braces, extra fabric, or wire as may be required.

3.4 Installation

A. Post Spacing

Install line posts and brace posts at intervals not to exceed 10 feet. Posts shall be evenly spaced. Locate corner and terminal posts on the construction plans. Install corner or slope posts where changes in grade exceed a 30 degree deflection.

B. Installation of Line, Corner, Pull, and Terminal Posts

1. Set line, corner, pull, and terminal posts vertically in cylindrical concrete foundation in accordance with the schedule in Table 1 and in accordance with ASTM F567.

TABLE 1 LINE, CORNER, PULL, AND TERMINAL POST INSTALLATION SCHEDULE			
	Foundation Diameter	Foundation Depth	Post Embedment
Final Line Post	0' - 9"	3' - 6"	3' - 0"
Temporary Line Post	none	none	3' - 0"
Terminal Post	1' - 0"	3' - 6"	3' - 0"
Gate Post	1' - 0"	3' - 6"	3' - 0"

CHAIN LINK FENCE - GALVANIZED

2. The exposed surface of the concrete foundation shall be smooth 1 inch crown, sloping away from the post. The post shall be 6 inches from the bottom of the concrete pour.
3. Holes may be hand augured or drilled. Spread soil from the excavations uniformly adjacent to the fence line or as directed by Construction Manager. If rock is encountered, drill into the rock for at least 12 inches for line posts, and 18 inches for corner or terminal posts. Drill holes 1 inch larger than the diameters as per the schedule (Refer to Table 1). If solid rock is below soil overburden, drill to full depth required, except penetration into rock need not exceed minimum depths specified.

C. Setting Posts

Remove any loose and foreign materials from the sides and bottoms of the holes; moisten the soil prior to placing the concrete. Center and align posts in the holes. Place the concrete in a continuous pour in the hole around the posts, and tamp to consolidate. Check post for vertical and horizontal alignment, and secure to allow proper curing of the concrete.

1. Extend footings for gate posts to the underside of the bottom of the roller track. Keep concrete surfaces moist for at least 7 days after placement, or cure with membrane curing material or other approved method.
2. Posts that are set in sleeved holes shall be grouted in place using a non-shrink portland cement grout approved by the engineer.
3. Prior to placing components such as fabric, rails, tension wire, and gates, ensure that the concrete has reached at least 75 percent of its design strength as prescribed on the plan details, or has cured a minimum of 7 days after setting the posts.

D. Rails and Bracing

Install final fence with a top rail and bottom tension wire. For the temporary fence, install only a top tension wire and omit the top rail. Top rails shall be continuous through post caps or extension arms bending to the radius for wired runs. Space 9 gage minimum fabric tie wire at 2 feet on centers.

1. Install tension wires parallel to the line of fabric by weaving no less than 6 gage wire of the appropriate type through the fabric and tying to each post.
2. Install top rail and tension wire prior to installation of the chain link fabric. Provide an expansion/contraction coupling, standard with the manufacturer, every 100 feet on straight runs, installed within 2 feet of a line post. Use end clamps for attaching the top rail or tension wire, and braces to the brace terminal and gate posts. Use corner clamps for attaching top rails or tension wire and braces to corner posts.

E. Installing Fabric

1. Install the chain link fence fabric so that the posts are enclosed. Stretch the fabric taut, approximately 2 inches above the ground, and fasten securely to the posts.
-

CHAIN LINK FENCE - GALVANIZED

2. Cut the fabric and attach each span independently at all terminal and corner posts. Use stretcher bars with fabric bands spaced at a maximum 14 inch intervals to fasten fabric to terminal posts. Use tie wire, metal bands, or other approved material attached at maximum 14 inch intervals to fasten fabric to line posts. Fasten the top edge of the fabric to the top rail or tension wire with wire ties at intervals not exceeding 24 inches. Fasten the bottom edge of fabric to the bottom tension wire with wire ties at intervals not exceeding 15 inches.

F. Barbed Wire

Install barbed wire on gates to match that installed on the line fence. To accommodate barbed wire, extend the end members of gates 1 foot above the horizontal section of the gate frame. Space strands uniformly and attach to frame with bands, clips, or eyebolts. Incline extension arms on line posts and corner posts toward the property enclosed at approximately 45 degrees. Stretch the strands of barbed wire to remove sag, and anchor firmly to extension arms. Use 3 strands of barbed wire.

G. Installing Gates

1. Install gates according to the locations, type, and size indicated on the plans.
2. Gates shall be properly braced and trussed to prevent sagging, buckling, and weaving, and shall be covered with same type of fabric as the fence. Vertical members of the gate shall carry the top of 3 strands of barbed wire. Fixed end ratchet bands shall be furnished for fastening the barbed wire. Furnish gates with necessary fittings and hardware. Latches provided for use with padlocks. Plunger bars shall have top, bottom, and middle locking points with the middle point arranged for padlocking. Gates shall have keepers that engage automatically when the gate is opened.
3. Install gates plumb, level, and secure for the full opening without interferences.
4. Install stop plate for plunger bar in concrete minimum 9" diameter and 3 ft. - 6" deep. Inspect all parts and attachments for defects; and install, lubricate, and adjust equipment to ensure smooth operation.

H. Miscellaneous Installation

Use U-shaped tie wires, conforming to the diameters of pipe, that clasp the pipe and fabric firmly with ends twisted at least 2 full turns.

1. Bend ends of exposed wires to minimize hazards to persons or clothing.
2. Install nuts for fasteners on tension bands and hardware bolts on the side of the fence opposite the fabric. The ends of bolts, once secure and checked for smooth operation, shall be peened to prevent removal of nuts.
3. Repair coatings damaged in the field with methods and techniques as recommended by the manufacturer.

CHAIN LINK FENCE - GALVANIZED

3.5 Grounding

A. Fence

Fence shall be grounded at each side of every gate, at points 150 feet each side of overhead power-transmission lines, at intervals of every 1,000 to 1,500 feet of length when fences are located in isolated place, and every 500 to 750 feet when in close proximity (100 feet or less) to public road, highways, and buildings. Fence shall be grounded at location where the fence alignment changes more than 15 degrees.

B. Fence Posts

Each fence post to be grounded shall be connected to a ground electrode consisting of a copper-clad steel ground rod 3/4 inch in diameter and 10 feet long, driven not less than 11 feet into the ground with rod located at the fence line or as near the fence line as is practicable. Connection of fence post to ground electrode shall be made below grade with not less than No. 4 AWG stranded-cooper wire with TW insulation by approved molded exothermic weld process or approved clamp-type fitting of cooper on fence post and electrode. Each gate panel shall be bonded with a flexible bond strap to its gate post.

3.6 Clearing

Clearing and grubbing shall be in accordance with Specification 02110. The Contractor shall perform clearing to a width of at least 2 feet on each side of the fence line as necessary to allow a proper fence installation.

3.7 Owner's Inspection

Materials and workmanship are subject to inspection in field by Owner. Failure of Owner to reject defective material or inferior workmanship does not absolve Contractor of complying with the requirements of this Specification.

3.8 Guarantee

A guarantee shall be furnished for all materials, installation, and workmanship to be free of defects for a period of 1 year from the date of acceptance unless noted otherwise in the contract documents. Any defect in installation or workmanship shall be repaired, and defective materials shall be replaced during the guarantee period without any cost to the owner.

4.0 ATTACHMENTS

Not applicable.

END OF SPECIFICATION

SLURRY WALL

The slurry wall Specialist and the slurry wall Superintendent shall each have not less than five (5) years of experience in similar positions in slurry wall operations, including at least one project of the size and complexity of this project.

The Contractor shall submit the qualifications of the slurry wall Specialist and the slurry wall Superintendent concurrently with the submission of his own qualifications; the slurry wall Specialist and the slurry wall Superintendent shall be regular employees of the Contractor, or slurry wall Subcontractor, and shall not be engaged for this project only.

2.0 PRODUCTS AND MATERIALS

The requirements for the materials to be utilized in the slurry trench construction are as follows:

2.1 Water

The Contractor shall supply all water required for mixing with bentonite to produce slurry. The water shall be clean, fresh, and comply with the standards specified below:

- A. A pH between 6.0 and 8.0 - standard units.
- B. Total dissolved solids not greater than 500 parts per million (ppm).
Oil, organics, acids, alkali, or other deleterious substances not greater than 50 ppm each.
- D. Hardness less than or equal to 100 ppm.
- E. Water containing more than 500 ppm sodium chloride (NaCl) or more than 100 ppm calcium chloride (CaCl₂) shall not be used.

Water drawn from the Niagara River adjacent to the site has been tested during the investigation of the Site and appears to have characteristics satisfactory for mixing with bentonite. The Contractor may use Niagara River water for mixing bentonites provided he tests the characteristics and finds the results in the specified range. Any permits and approval of jurisdictional agencies required to draw water from the Niagara River shall be obtained by the Owner before beginning slurry wall construction. The Contractor shall identify the permits and approvals to the Owner. The Contractor, at his option may transport water from off-site source at no additional cost to the Owner.

2.2 Bentonite

The bentonite shall be sodium cation base montmorillonite powder (Premium Grade Wyoming-type bentonite) that conforms to the standards set forth in API Specification 13A, Sections 3, 5, 6, 7 and 8 as last revised. The Contractor shall furnish to the Owner a certificate of compliance and a copy of the test reports from the bentonite manufacturer for each lot of bentonite shipped to the site stating that the bentonite complies with all applicable standards. All bentonite will be subject to inspection, sampling, and verification of quality by testing. Bentonite not meeting specifications shall be promptly removed from the site of the work and replaced with bentonite conforming to specification requirements at the Contractor's expense. Bentonite shall be protected from moisture during transit and storage.

SLURRY WALL

2.3 Additives

Admixtures of the types used in the control of oil field drilling muds such as thinners, dispersants, and flocculants may be used to control standard properties of the slurry such as apparent viscosity and filtration characteristics, subject to the approval of the Owner. Peptizing or bulking agents shall not be mixed with the slurry.

2.4 Imported Backfill Materials

The trench backfill shall consist of bentonite slurry and borrow material from an off-site borrow area that has been identified by the Owner, or other off-site sources identified by the Contractor. Trench backfill material shall be approved by the Owner before beginning of slurry wall construction. No materials excavated from the trench will be used in the mixing of backfill.

The imported backfill soils shall be graded with a maximum particle size of 0.5 inch and a minimum of 20 percent finer than the No. 200 sieve (ASTM D422, D1140). The imported backfill soil shall be free of roots, organic material, lumps, trash, debris or other deleterious materials. The soil shall be suitable for mixing to produce a homogenous backfill with no clods or clumps of soil.

The Contractor will identify his source of backfill soils and conduct permeability testing of his proposed mix per ASTM D5084 prior to the mobilization of the slurry wall construction equipment.

The Contractor will be responsible for the transportation of all borrow material to the Site.

2.5 Slurry for Excavation

The slurry shall be a colloidal suspension of bentonite in water.

At the time of introducing bentonite slurry into the trench excavation, the slurry mixture shall have a minimum apparent viscosity of 40 seconds as measured by the Marsh funnel and a minimum bentonite content of six (6) percent. The slurry density shall be a minimum of 65 pounds per cubic foot as determined by measurement at bulk density. The water loss shall not be greater than 20 cubic centimeters in 30 minutes as measured by a filter press at 100 pounds per square inch.

The minimum apparent viscosity of the bentonite slurry mixture in the trench at any time shall not be less than 40 seconds as measured by the Marsh funnel. The density of the slurry in the trench at any level shall not be less than 65 pounds per cubic foot nor exceed 85 pounds per cubic foot at any time. It shall be the responsibility of the Contractor to regulate the density to maintain the stability of the trench at all times. The water loss shall not be greater than 20 cubic centimeters in 30 minutes as measured by the filter press at 100 pounds per square inch.

The slurry density shall not exceed 85 pounds per cubic foot during placement of backfill.

2.6 Soil-Bentonite Backfill

The in-place soil bentonite backfill shall have a maximum hydraulic conductivity of 1×10^{-7} cm/sec.

SLURRY WALL

The soil-bentonite backfill shall consist of properly graded backfill mixed with bentonite slurry and additional bentonite, if necessary to achieve the Contractor's approved design mix. The backfill may be mixed with grading equipment (bulldozer, grader, etc.) or by a pug mill to a uniform composition and consistency. The mixture shall have a slump of three (3) to six (6) inches, a bentonite content not less than three (3) percent and a maximum permeability of 1×10^{-7} cm/sec, as measured by ASTM D5084. The density of the backfill placed in the trench shall be not less than 15 pounds per cubic foot greater than the unit weight of the slurry in the trench.

The blended backfill material shall be free of roots, organic soil lumps, trash, debris or other deleterious materials.

It is the intent of the specifications that the Contractor know the limits and capabilities of the backfill mixture, so that the suitability of the mixture may be determined before placement in the slurry trench.

2.7 Trench Cap Soils

The soils used for the temporary cover over the trench shall be approved clayey soils CH, CL (ASTM D2487) to provide a two (2)-foot thick cap.

3.0 EXECUTION

3.1 General

The Contractor shall construct a slurry wall in the location shown on the Drawings, to the depths shown on the profiles. The profile shown is based on the best subsurface information available, but it is recognized that subsurface conditions can vary between boreholes over the length of the proposed slurry wall. It is the intent of the specifications to key the slurry wall three (3) feet into the Clay/Till deposits that are encountered beneath the alluvial sediments over the length of the slurry wall. Logs for borings shown on the profile are included in the Predesign Field Activities Report for the 102nd Street Landfill Site.

In the event that the Contractor deems the available borings do not provide sufficient information, the Contractor may, at no additional cost to the Owner, conduct boring operations at the Site to obtain the required data.

The slurry wall construction may be carried out from a working platform constructed by the Contractor to provide proper grades for slurry wall construction, backfill mixing, and similar activities. The completed wall and any disturbed areas shall be brought to the final lines and grades shown on the Drawings.

The southern portion of the slurry wall will be constructed from the bulkhead wall constructed in the river. Mixing of backfill on the working platform will not be permitted in this area.

The slurry trench shall have a two (2)-foot thick cap placed over it to protect the slurry wall and to provide a firm surface permitting placement of the landfill cap layers above the trench. The slurry wall cap shall provide a firm surface which will not prevent or inhibit the proper compaction of the landfill cap layers.

EQUIPMENT DATA SHEET APL PUMP	ITEM NO.	P-201, P-202, P-203, P-204		
	NO. REQ'D.	Four (4)		
	REQ'N. NO.		COMM. NO.	
	P.O. NO.		PROJ. NO.	23594000
	PROJ.	OXYCHEM/OLIN REMEDIAL DESIGN		
SERVICE	LOCATION	NIAGARA FALLS, NY		
PROCESS DATA				
Service:	Pumping Aqueous Phase Liquid (i.e. Groundwater) from approx. 25 ft. Deep Wells to a Storage Tank.			
S.G. @ 60° F:	1	Rated Flow:	5.6 GPM	
PH Range:	6 to 8	TDH:	105 ft.	
Temp:	Ambient			
	Electrical Area Classification - Class 1 Div. 1 Group D			
<u>Mechanical Design</u>				
Type:	Submersible Multi-Stage Turbine Pump, 1 in. Outlet			
Manuf. & Model:	GRUNDFOS 5E8 (or Approved Equal) in a Packaged System			
Materials of Const.:	304 Stainless Steel			
Seals:	Teflon Seal Ring			
Motor:	1/3 HP/3450 RPM, 230V/1PH/60 Hz-Explosion Proof Enclosure			
Controls:	Explosion Proof Module with High & Low Limit Float Switches			
Est. Weight:	24 lbs.			
Miscellaneous:	System package shall include 1"-304 S.S. disch. piping, power lead, level probe, winch, and control module.			

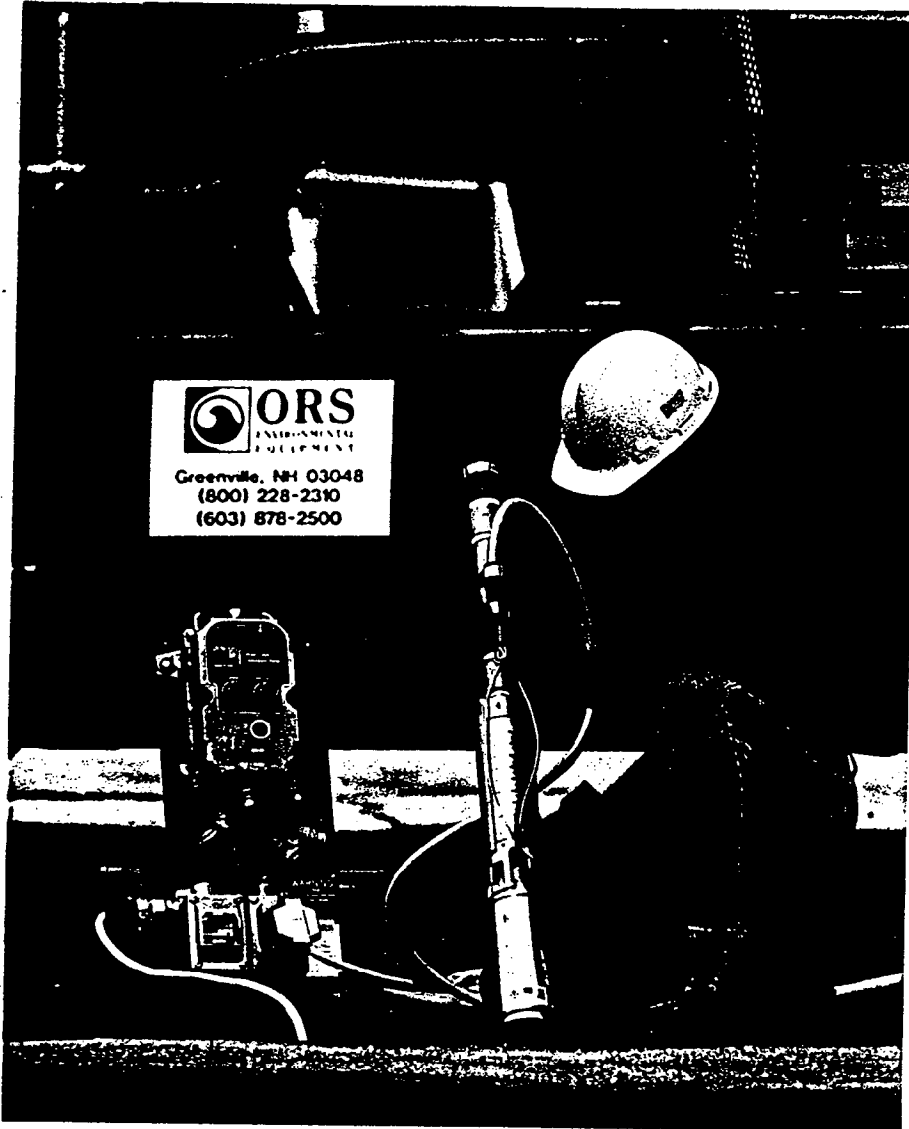
* Information to be furnished/verified by Vendor.

Design by B. Somers	Fluor Daniel	App.	Rev. No. B	By A. Bumb
Date 11/03/92	Client	App.	Date 9/8/95	App.

EQUIP. NOS. P-201, P-202, P-203, P-204

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Pumping Systems



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well water
table
depression
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ORS Environmental Equipment's Water Table Depression Pumps are designed for use in hazardous areas to assist in the recovery of contaminants from the groundwater. The system automatically creates a "cone of depression" on the water table and accelerates the flow of contaminating hydrocarbons toward the recovery well. The level sensor switches the pump on and off to maintain the water level in the well at a predetermined depth. The sensor also shuts off the pump if hydrocarbons come in contact with the intake.

Versatile

ORS Environmental Equipment's line of electric Water Table Depression Pumps are available in three models: submersible deep well pumps, submersible shallow well pumps and surface mounted shallow well pumps. Submersible deep well pumps are designed for wells with a 20' (6.1 m) or greater depth to liquid and are made of stainless steel to withstand corrosive conditions. Their small diameter, multi-stage design is ideal for use in wells as small as 4" (10.2 cm) in diameter and where high output pressure is required.

Submersible shallow well pumps are designed for wells less than 35' (10.7 m) in depth to liquid and are made of aluminum. These pumps use abrasion resistant impellers and are especially appropriate for applications in which water may contain silts and sands.

Surface mounted pumps are ideal for narrow gauge wells which do not exceed 20' (6.1 m) in depth to liquid. These cast iron centrifugal pumps have Viton[®] seals and are available in a number of flow ranges.

Fluid Extraction Systems

ORS Environmental Equipment

Water Table Depression Pump

Features and Specifications

THIS SHEET FOR
REF. ONLY - P-201, 202, 203, 204
WILL BE CUSTOM SYSTEMS
NOT REPRESENTED BY THE
MODEL NOS. BELOW.

Features

Automatic: Intrinsically safe, Level Sensor turns pump on and off automatically.

Variable Flow Rates: Modular equipment to handle virtually any flow rate or discharge head.

Practical: Quality materials and workmanship give long-term, trouble-free operation.

Reliable: Field-proven equipment.

Deep Wells (>20'): Submersible multi-stage turbine, stainless steel pump with Teflon[†] seals and bearings. Stainless steel motor with integral thrust bearing.

Shallow Wells (<35'): Submersible single-stage aluminum centrifugal pump with Viton seals, gaskets and suction head. Self-contained motor in pump body. Motor protected by oil lubricated mechanical seals.

Shallow Wells (<20'): Surface mounted, cast iron single-stage centrifugal pump with Viton seals and explosion proof motor.

Sensors: Intrinsically safe Level Sensor using AC current to prevent electrolysis and corrosion. Petroleum resistant. 1 1/8" (23.6mm) diameter by 12" (30.5cm) length.

Control Module: Explosion proof modular, solid state electronic, 12" x 27" (30.5cm x 68.6cm). Meets or exceeds NEC standards for Class 1, Division 1, Groups C&D areas with 12' (3.6m) power cord. Three position switch for manual, auto

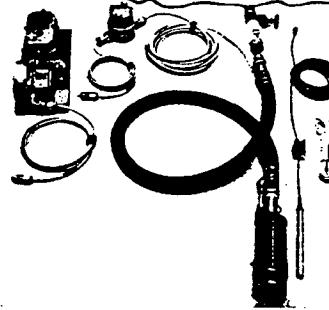
on and off control. Power plug UL approved.

Time Tested: Used for years in countless applications, safely and reliably.

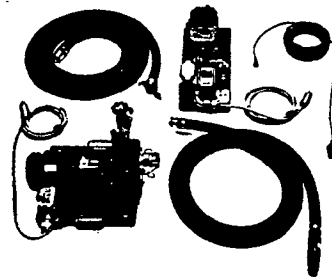
Versatility: The same controls can be used above or below ground; modular design is suitable for small or large diameter wells. Interchangeable parts throughout.

Custom Options: Flow meters; flow inducer pump stand for deep well pumps; 316 alloy stainless steel for salt water applications.

[†]Teflon is a trademark of Dupont



Pictured left are two shallow well water table depression pumps. The top is a submersible model and the bottom is a surface mounted model.



Specifications

Shallow Well Pump Systems

Models	1031001	1031002	1032001	1032002	1032021*
Motor					
Hp	3/4 (.56kW)	1 (.75 kW)	1 (.75 kW)	2 (1.5 kW)	1 1/2 (1.1 kW)
Voltage**	115 VAC	115	230	230	230
Amps	11	13	5.5	11	9
Sensor Cable	50' (15.2m)	50' (15.2m)	50' (15.2m)	50' (15.2m)	50' (15.2m)
Pump Diameter	6" (15.2cm)	6" (15.2cm)	6" (15.2cm)	7 1/2" (19cm)	3" (7.6cm)
Hose Length	50' (15.2m)	50' (15.2m)	50' (15.2m)	50' (15.2m)	25' (7.6m)
Power Cord	50' (15.2m)	50' (15.2m)	50' (15.2m)	50' (15.2m)	12' (3.6m)

* Surface mounted model used in small diameter shallow wells

** Available in 50/60 Hz.

† Downwell intake diameter

Deep Well Pump Systems

Models	1031017	1031004	1032054	1032009	1032057*
Motor					
Hp	1/3 (.25kW)	1/2 (.37 kW)	3/4 (.56 kW)	2 (1.5 kW)	3 (2.2 kW)
Voltage**	115	115	230	230	230
Amps	8	11	8	13	16
Sensor Cable	100' (30.5m)	100' (30.5m)	100' (30.5m)	100' (30.5m)	100' (30.5m)
Pump Diameter	3 3/4" (9.5cm)	3 3/4" (9.5cm)	3 3/4" (9.5cm)	3 3/4" (9.5cm)	5 3/4" (14.6cm)
Hose Length	70' (21.3m)	100' (30.5m)	100' (30.5m)	100' (30.5m)	150' (45.7m)
Power Cord	70' (21.3m)	100' (30.5m)	100' (30.5m)	100' (30.5m)	100' (30.5m)

* Supplied with power interrupter center module and level sensor

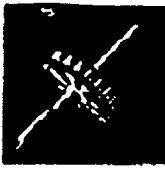
** Available in 50/60 Hz.



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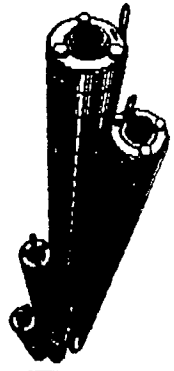
**Redi-Flo4
Environmental
Submersible Pumps**

5E

Submittal Data

3450 RPM

60 Hertz



JOB or CUSTOMER:

ENGINEER:

CONTRACTOR:

SUBMITTED BY: DATE:

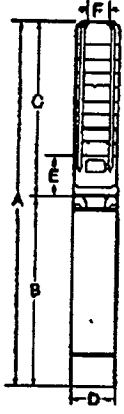
APPROVED BY: DATE:

ORDER NO.: DATE:

SPECIFICATION REF.:

QUANTITY	TAG NO.	MODEL NO.	GPM	FEET	VOLT	PHASE	COMMENT

Dimensions



Technical Data

FLOW RANGE: 1.2 to 7 US GPM

MOTORS: Grundfos MS402E Environmental Submersible Motor (Standard)
 Maximum Operating Temperature: 104°F (40°C)
 Maximum Operating Pressure: 220 PSI
 Maximum Number of Starts Per Hour: 100
 Minimum Recommended Flow Past Motor: 0.25 ft/sec
 (NOTE: Franklin Pollution Recovery motor is optional.)

DISCHARGE SIZE: 1" NPT

PUMP END CONSTRUCTION MATERIALS: Stainless Steel and Teflon®

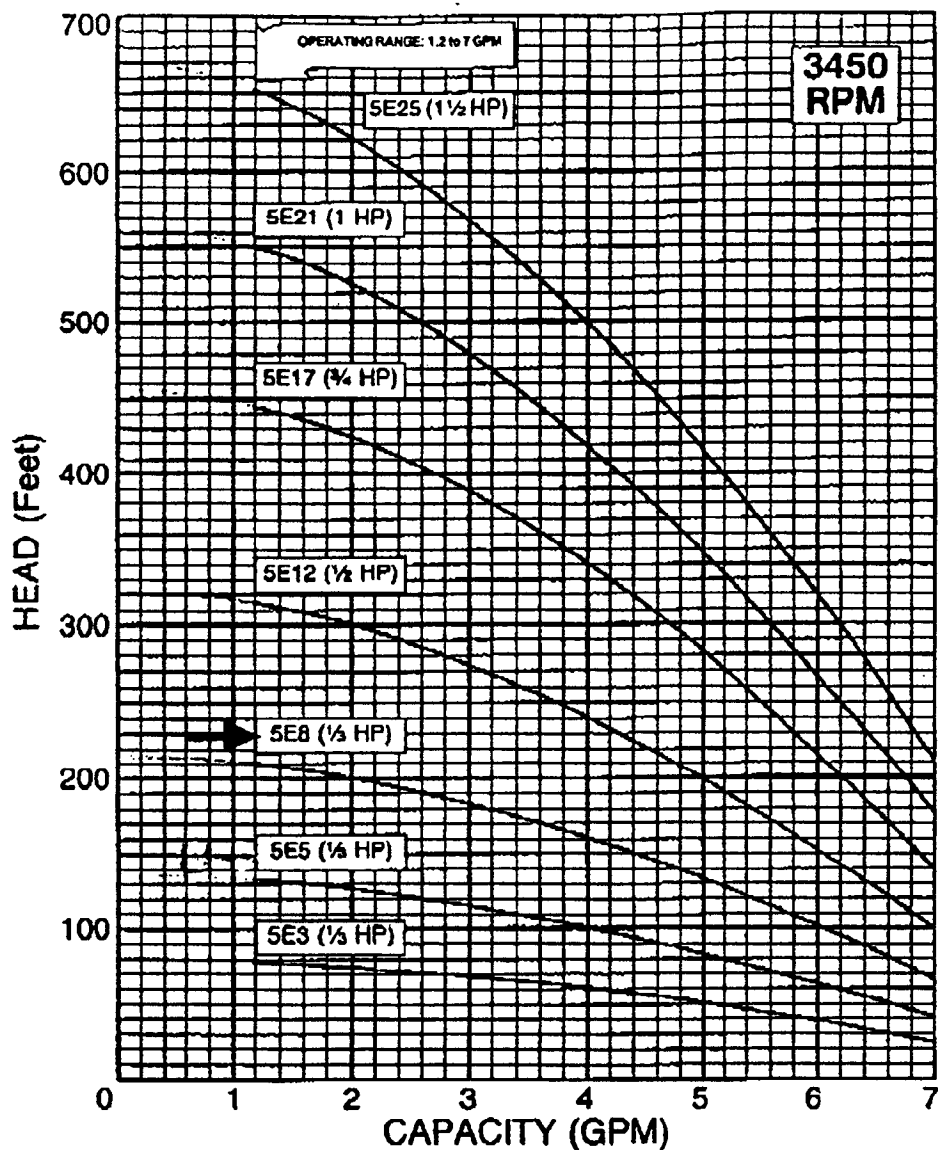
INSTALLATION: Unit to be installed vertically for submerged operation.

Electrical Data, Dimensions, and Weights ①

PUMP TYPE	MOTOR				DIMENSIONS (In Inches)							NET WEIGHT (LBS.)②	SHIP. WEIGHT (LBS.)②
	HP	SF	PH	VOLTS	OVERALL LENGTH A	MOTOR LENGTH B①	PUMP END LENGTH C	MAX. DIA. D	INLET E	DISCH. PIPE SIZE (NPT) F			
5E3	1/8	1.75	1	230	18 1/16	10	8 1/16	3 1/32	3 1/4	1	23	25	
5E5	1/8	1.75	1	230	20 5/16	10	10 1/16	3 1/32	3 1/4	1	24	26	
5E8	1/4	1.75	1	230	22 1/4	10	12 1/4	3 1/32	3 1/4	1	26	28	
5E12	1/2	1.60	1	230	26 1/16	10 1/16	16	3 1/32	3 1/4	1	28	29	
5E17	3/4	1.50	1	230	31 7/16	11 1/16	20 1/16	3 1/32	3 1/4	1	31	32	
5E21	1	1.40	1	230	35 1/16	12	23 7/16	3 1/32	3 1/4	1	33	35	
5E25	1 1/2	1.30	1	230	40 5/16	13 1/16	26 3/4	3 1/32	3 1/4	1	35	37	

① Data for Grundfos MS402E motors. ② Does not include motor leads.

Performance Curves



Materials of Construction

REDI-FLO4 PUMP END	
Check Valve Housing	304 Stainless Steel
Check Valve	304 Stainless Steel
Check Valve Seat	304 Stainless Steel & Teflon®
Diffuser Chamber	304 Stainless Steel
Impeller Seal Ring	Teflon®
Impeller	304 Stainless Steel
Suction Interconnector	304 Stainless Steel
Inlet Screen	304 Stainless Steel
Pump Shaft	304 Stainless Steel
Coupling	329/420/431 Stainless Steel
Straps	304 Stainless Steel
Cable Guard	304 Stainless Steel
Priming Inducer	304 Stainless Steel
Intermediate Bearings	Teflon®

GRUNDFOS ENVIRONMENTAL MOTOR	
Nema Top	304 Stainless Steel
Studs & Fasteners	304 Stainless Steel
Nuts	316 Stainless Steel
Sand Slinger	Viton®
Shaft Extension	431 Stainless Steel
Diaphragm	Viton®
Stator Housing	304 Stainless Steel
Fill Plug Screw	304 Stainless Steel
Fill Plug Washer	Teflon®

GRUNDFOS ENVIRONMENTAL MOTOR LEADS	
Connector Sleeve	304 Stainless Steel
Connector Potting	Scotch Cast #4° Epoxy w/Viton® Cap
Connector Plug	Viton®
Lead Insulation	Teflon®

NOTE: Specifications are subject to change without notice.

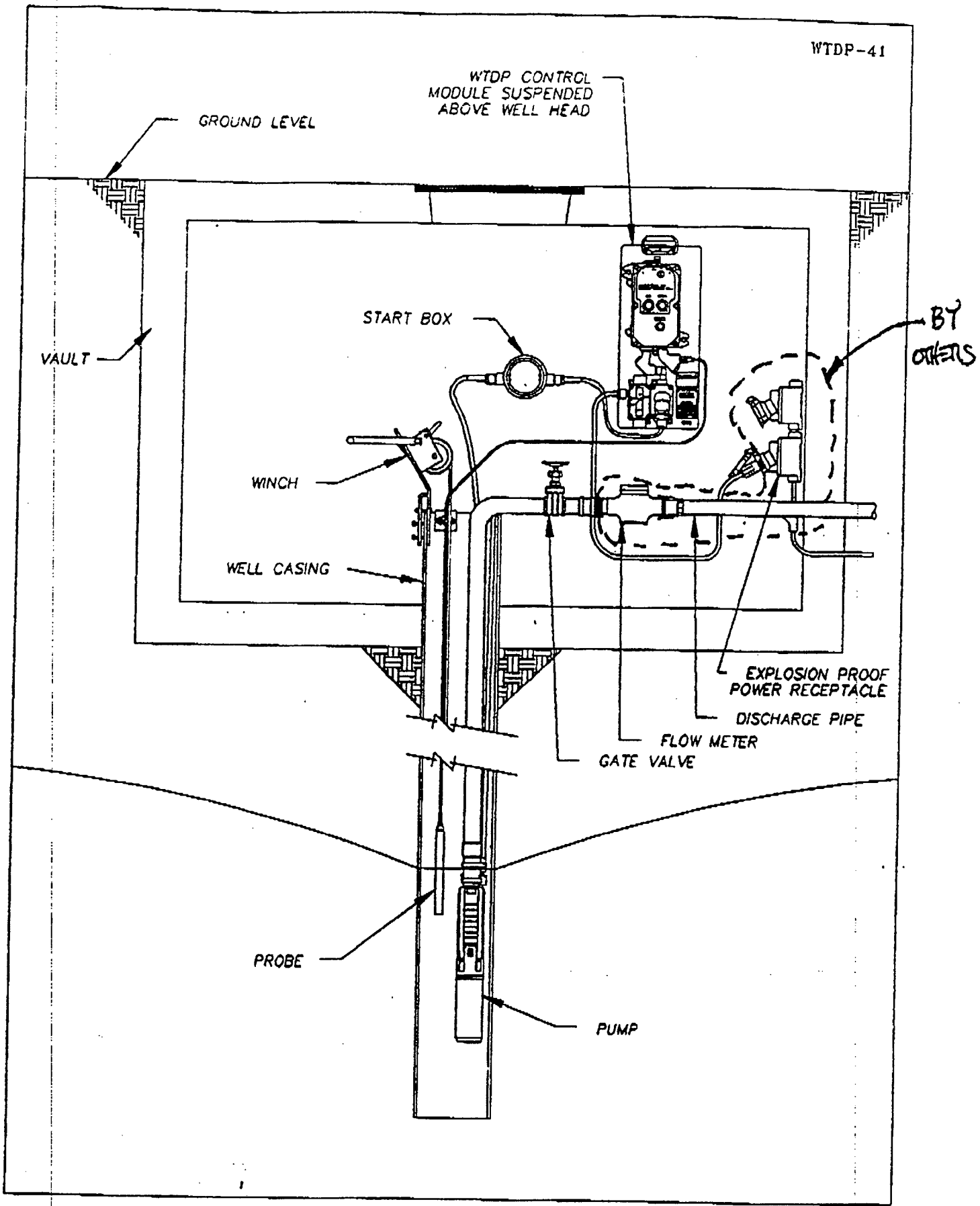


FIGURE 6. Water Table Depression Pump Deployed in Vault.

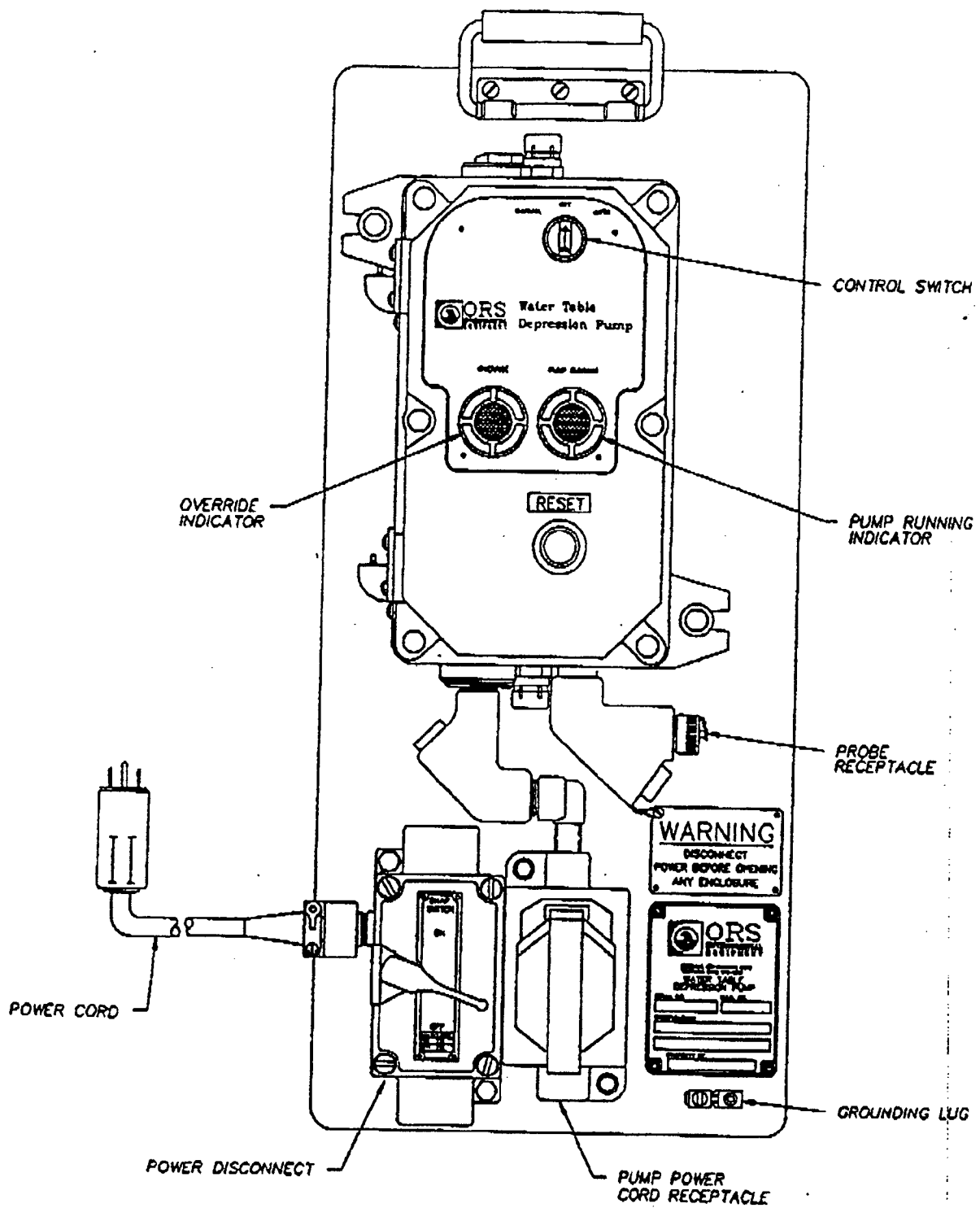


FIGURE 3. The Water Table Depression Pump Control Module.

6.4 PROBE

The density probe utilizes a float (water) and two reed switches as high and low sensors. Both styles utilize a low level override float as redundancy back-up. This float will float only in water and drops in hydrocarbon or air. When the override float drops, while the probe is in a "Run" mode, the system will be overridden and the Water Table Depression Pump will be shut down.

6.4.1 MATERIALS OF CONSTRUCTION (Probe)

Case coating	Nylon 11
Case body	304 Stainless steel
Probe shaft	304 Stainless steel
Fasteners	304 Stainless steel
Top, housing & bottom	Nylon 6/6
Stop collar	Stainless steel with nylon bushing
Connector	Anodized aluminum
Cable & jacket	Ether based urethane
Strain relief	Nylon 6/6 with Neoprene gland
Float	Polyurethane foam, Teflon® shaft

APL COLLECTION TRENCH

A. Qualifications

The Contractor shall be a specialist in the construction of groundwater collection trenches by the B-P Drain Method.

1. The Contractor shall submit evidence and references from at least three similar projects [constructed over the last ten years]. Project descriptions shall include depth, width, and length of the trench as well as a description of the permanent materials placed in the trench for groundwater extraction. A brief history of each project shall include the type of slurry used, soil conditions and any difficulties encountered in construction and drain development. Submit with the bid.
2. The Bio-Polymer Slurry Specialist shall be knowledgeable and experienced in drainage trench construction using Bio-Polymer slurry. This experience shall include, but not necessarily be limited to: 1) the use and control of Bio-Polymer slurry in trench construction; 2) methods required to properly mix and degrade the Bio-Polymer slurry; 3) trench excavating and backfilling procedures; and 4) knowledge of construction equipment and materials testing as required for slurry trench construction. The specialist shall control the mixing, composition, placement, cleaning and maintenance of the Bio-Polymer slurry and backfill. The specialist shall supervise and ensure that the trench is continuous and freely-draining. The credentials of the trench specialist shall be submitted at least one week prior to starting trench construction.

B. Work Plan

The Contractor shall submit a preconstruction work plan for approval by the Owner's Representative at least 30 days prior to the start of work under this section. The work plan shall include the following items.

1. **Schedule:** A schedule in sufficient detail to identify the major segments of the work. Starting and ending dates for all major work items shall be clearly identified.
2. **Bio-Polymer Slurry Trench Construction Method:** A detailed description of the methods of construction which shall include the excavation methods, slurry mixing and handling, material handling and placement, backfill placement, cleanout riser pipe placement, geotextile placement, etc.
3. **Equipment:** A list of major equipment by type and capacity which shall include excavator, slurry mixer, material handler, pipe layer support, and transport equipment.

C. Quality Control Plan

The quality control plan shall be submitted along with the work plan.

1. The plan shall include a list of test methods and minimum standards with which to gauge the quality of the work during construction including slurry viscosity, depth measurements, control of well/sump verticality, control of pipe grades, control of filter fabric overlap etc.

APL COLLECTION TRENCH

2. The plan shall address the physical properties and manufacturer's stated properties for all permanent materials including manufacturer's certifications of quality, mill certificates, gradation test data, etc.
3. The plan shall state when all quality control data will be submitted to the Owner and the correction procedures to be employed in the case of substandard results.

2.0 PRODUCTS

2.1 Materials

A. Biodegradable Bio-Polymer

Biodegradable Bio-Polymer shall naturally degrade or be "broken" to a nontoxic water solution once backfilling of trench is complete. Degraded Bio-Polymer shall not materially reduce trench wall transmissivity. The Contractor shall submit the physical and chemical characteristics and properties of the Bio-Polymer with the quality control plan. Substances prohibited by local, state or federal law shall not be contained in the Bio-Polymer. The biodegradable Bio-Polymer shall not form a filter cake on the trench walls which might decrease the transmissivity of the drainage trench/alluvium interface. Unused Bio-Polymer slurry shall convert to water containing a minute residual of nontoxic material once the drainage trench is completed.

B. Water

The water used in preparing the Bio-Polymer slurry shall be fresh water. The water shall be free of excessive amounts of oil, acid, alkali, organic matter and other deleterious substances which could adversely affect the properties of the Bio-Polymer. Potential water sources shall be tested by the Contractor prior to beginning trench excavation to assure that water of suitable characteristics for slurry preparation shall be used. Water used in preparing the Bio-Polymer slurry shall have the following minimum properties:

1. Ph between 6 and 8
2. total dissolved solids less than 750 mg/l
3. total hardness less than 250 mg/l

It is the responsibility of the Contractor to insure that the slurry resulting from mixing water and Bio-Polymer shall meet the standards of this specification.

C. Slurry

The slurry for supporting the trench shall consist of a stable suspension of biodegradable Bio-Polymer in water. It is the responsibility of the Contractor to insure that the slurry meets the necessary properties and monitor the slurry and the trench during excavation. The viscosity, pH and filtrate loss of the slurry will additionally be monitored by the Contractor to determine when breakdown of the slurry begins. The

APL COLLECTION TRENCH

gel strength of the slurry shall be maintained at a high level so that hydrostatic pressure is transferred from the slurry to the trench walls.

D. Additives

Admixtures of softening agents, preservatives, dispersants, or retarders may be added to the slurry to permit efficient use of and proper workability of the slurry. The Bio-Polymer slurry may be modified as required for successful trench excavation. Any additives used must be biodegradable and broken down prior to completion of the trench cap. Chemical and physical properties and characteristics of any proposed additives shall be submitted with the quality control plan.

E. Backfill

Durable, clean, washed, and graded gravel shall be used to backfill the trench. The aggregate shall be Size 1 or 1ST per NYDOT Sec. 703-02.

F. Geotextile Filter Fabric

A woven, polypropylene geotextile shall be furnished and installed to separate the backfill from native soils. Bias weave material such as [Exxon GTF 400E] or approved equal shall be used. This material shall have the following minimum properties:

<u>Fabric Property</u>	<u>Minimum Property</u>
Polymer Composition	Polypropylene
Roll Width	20 ft.
Tensile Strength	300 (Warp) x 200 (Fill)
Apparent Opening Size	No. 70 Standard Sieve

G. Perforated Collection Pipe

A six inch diameter perforated collection pipe shall be furnished and installed in accordance with Specification 02725.

H. Cleanout Risers

Vertical cleanout risers shall be furnished and installed to accept the maintenance jetting equipment and permit the free flow of APL into the Collection Pipe. The riser shall be constructed of six inch diameter SDR 11 HDPE pipe.

2.2 Equipment

The Contractor shall furnish necessary plant and equipment for construction of the facilities shown on the contract documents. The equipment shall be of type and capacity to complete the work in an efficient manner, and shall be maintained in operable condition at all times.

APL COLLECTION TRENCH

A. Trench Excavation

Equipment for excavating the slurry trench shall be approved earthmoving equipment such as a backhoe and/or clamshell capable of performing the indicated work on the drawings and/or as specified herein. The equipment shall develop a live load surcharge that will produce no significant contribution to the instability of the trench. The equipment shall be capable of excavating to the required trench depth from the working platform. It shall be capable of excavating the required minimum width of the trench in a single pass of the excavating equipment.

B. Slurry Mixing Plant

The Contractor shall provide a slurry mixing plant containing the necessary equipment for preparing the Bio-Polymer slurry including a high-shear colloidal mixer capable of producing a stable suspension of Bio-Polymer in water. Pumps, valves, hoses, storage supply lines and other equipment shall be provided as required to adequately supply Bio-Polymer slurry to the trench. The slurry mixing plant shall be equipped with a high-speed/high-shear colloidal mixer. The slurry mixing plant shall be subject to approval by the Owner's Representative.

C. Backfill

The backfill shall be installed in the trench, through the slurry, by equipment which minimizes segregation of the gravel and the creation of voids. Initial backfill placement shall be tremie. Subsequent backfill may be placed by filling continuously from the beginning of the trench in the direction of the excavation. All backfill placed around cleanout risers and collection pipes shall be placed by tremie. Rodding and/or jetting equipment shall be available, if needed, to correct any defects in the backfill placement.

D. Collection Pipe Laying

The collection pipe shall be installed in the trench through the Bio-Polymer slurry by equipment operating from the working platform. The equipment shall develop a live load surcharge that will produce no significant contribution to the instability of the trench. The pipe laying equipment shall be inspected and calibrated to ensure that measurements of grade made on the surface transfer without error to the invert. The pipe shall be bedded with backfill placed by a tremie pipe. Line and grade of the drainage pipe shall be controlled by survey or laser-guided equipment. The pipe laying equipment shall be subject to approval by the Owner's Representative.

3.0 EXECUTION

3.1 Excavation

Trench excavation shall be maintained in an open condition by the biodegradable slurry method. Excavation shall be conducted in a manner which provides for a continuous minimum width trench to the required depth along the centerline of excavation. The Contractor shall excavate the trench immediately to the minimum depth shown on the drawings at the point where excavation is started. The Owner's Representative may direct

APL COLLECTION TRENCH

the point where excavation is started. The Owner's Representative may direct the Contractor to deepen the trench based on examination of spoils and shall approve the depth of the trench immediately after excavation. The trench shall be constructed without undue interruption until complete.

Trench spoils will be placed, mixed, and compacted under the final cap in accordance with Specification 02200.

3.2 Mixing and Placing Slurry

- A. The Bio-Polymer slurry shall be prepared by mixing water and biodegradable polymer. No slurry shall be made within the trench. The Bio-Polymer slurry shall be prepared in the mixing plant and hydrated in a tank with circulation until the resulting slurry appears homogeneous and meets quality control standards. Additives may be added to the slurry at the mixing plant. The slurry shall be constantly agitated until introduced into the trench. Slurry shall be supplied to the trench through pipelines which shall be extended as necessary to supply the excavation.
- B. After the initial 3 ft of soil has been excavated and stockpiled, slurry shall then be introduced into the trench at the time excavation begins. The level of the slurry in open trenches shall be maintained at a level sufficient to maintain trench stability and no more than 3 ft below the ground surface or less than 3 ft above the groundwater table until the placement of filter fabric, drainage pipe, and backfill material is complete. The Contractor shall have sufficient personnel, equipment, slurry storage equipment and stored slurry materials ready to raise the slurry level in the excavated trench during construction. The Contractor shall have personnel on call to raise the slurry level at any time, weekends, and/or holidays included. Dilution of slurry by surface water shall be prevented. The quality of the slurry shall be maintained at all times, including periods of work stoppage.

3.3 Trench Stability

The Contractor shall be responsible for maintaining the stability of the excavated trench for its full length and depth and shall be responsible for maintaining slurry densities and levels within specified limits. The Contractor shall control surcharges from excavation and backfilling equipment, waste, berm construction, backfill stockpiles, and any other loading situations that may affect trench stability. It is the Contractor's responsibility to ensure that any stockpiles do not affect the open trench stability and that open trench stability is maintained at all times. In the event of failure of the trench walls prior to completion of backfilling, the Contractor shall at his expense re-excavate the trench and remove all material displaced into the trench and take corrective action to prevent further deterioration as directed by the engineer.

3.4 Geotextile

The geotextile shall be installed in panels as wide as practical in order to minimize overlapping joints. Minimum panel width shall be 20 ft and the overlap of each successive panel shall be not less than 4 ft. Each panel shall provide a continuous cover for both sides and the bottom of the trench. Geotextile panels shall be installed immediately prior to placement of backfill material and shall be installed in such a manner as to prevent tears,

APL COLLECTION TRENCH

folds or uncovered areas. After completion of the backfilling operation, excess geotextile shall be cut away and removed.

3.5 Pipe Laying

The drainage pipe shall be laid in a continuous line starting at the lowest invert elevations at each of the wetwells and proceeding upgrade to the cleanouts. The pipe shall be bedded with at least 6 inches of gravel and covered with a minimum of 3 ft of additional gravel. The pipe shall be backfilled immediately after pipe laying and bedding is complete. The pipe shall be centered between the trench walls. The pipe may be weighted to assist in placement through the slurry so long as no bends or kinks are introduced and the grade is maintained. The pipe shall terminate with a perforated end cap and will not be physically connected to the wet well riser pipe to be installed later.

3.6 Backfilling

Backfilling of the trench shall commence as soon as practical and be continuous to minimize the area of trench supported only by slurry. The areas for the storage of backfill material shall be approved by the Owner and restored upon completion of the work.

The Contractor shall backfill continuously from the beginning of the trench in the direction of the excavation to the end of the trench. The backfill shall be placed into the trench in a manner that avoids trapping pockets of slurry and segregation of the gravel. Free dropping of backfill through the slurry will not be permitted. Initial backfill shall be placed by tremie or similar, approved means until the backfill rises above the surface of the slurry. Subsequent backfill shall proceed by backfill to the point where it rises above the slurry and allowing it to slide down the slope of previously placed backfill. This method shall continue from the beginning of the trench to the end following in the direction of the excavation. Ensure connection between the trench backfill and the wet well filter pack to be installed later.

3.7 Drain Development and Activation

After completion of backfilling, the slurry shall be degraded to water and residual material. Slurry modifiers shall be added as necessary to destroy the viscosity and filtrate properties of the slurry. The broken slurry shall be oxygenated and pH adjusted to promote slurry degradation and drain activation. Water shall be flushed through the trench backfill material in order to remove residual material and to insure satisfactory hydraulic conductivity through the trench media.

3.8 Slurry Disposal

Slurry shall be mixed in with general site fill and placed under the cap.

3.9 Treatment of APL Collection Trench

After the trench is developed, the geotextile shall be trimmed and overlapped to cover the backfill. An additional strip of geotextile shall be placed over the backfill to separate the backfill from subsequent soil layers.

PRECAST CONCRETE

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes requirements for the fabrication and erection of precast concrete including:

1. Precast concrete manholes, inline cleanouts, APL wet well vaults, pullboxes, and cribwall members as shown on drawings.
2. Furnishing manhole steps, frames, lids and grates and other hardware as shown on drawings.
3. Design of the cribwall retaining structure and corresponding precast prestressed components.
4. Erection of complete precast system.
5. Grouting and caulking of precast components as required.

B. Related Specifications

The following specifications prescribe items of related work:

02200	Earthwork
02725	Underground Piping Systems
03300	Cast-In-Place Concrete
65000	General Requirements - Electrical

Coordinate work prescribed by this specification with work prescribed by the above listed specifications.

1.2 References

The publications listed below form part of this specification to the extent referenced in this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. If there is a discrepancy between the references and the specifications, the specifications shall govern.

A. ACI (American Concrete Institute)

1. ACI 211.1-91 Standard Practice for Selecting Properties for Normal, Heavyweight, and Mass Concrete
2. ACI 301-89 Specification for Structural Concrete for Buildings
3. ACI 315-92 Details and Detailing of Concrete Reinforcement
4. ACI 318/318R-92 Building Code Requirements for Reinforced Concrete

APL COLLECTION TRENCH

3.10 Clean Up

Prior to demobilization, the working platform shall be regraded to promote drainage and all Contractor equipment, materials, and personnel shall be removed from the site.

3.11 Quality Control

The Contractor shall be responsible to ensure that all work is performed to the standards established herein, subject to review and inspection by the Owner. All quality control records, routine tests, observations, and measurements shall be available for inspection by the Owner's Representative. The Contractor shall bear the cost of all specified tests.

A. Materials

The Contractor shall submit data, tests, manufacturer's certificates, etc., to document the compliance of all materials to these specifications.

1. **Bio-Polymer** - The Contractor shall submit Material Safety Data Sheets for the Bio-Polymer materials and additives. Test data shall be submitted to document the physical and chemical properties of the Bio-Polymer slurry and degraded slurry.
2. **Water** - The water shall be tested in accordance with API RP 13B as established in Section 2.1.B.
3. **Gravel** - The supplier shall provide test results documenting the gradation of the gravel prior to construction. The Contractor shall perform one additional test for each 500 tons of backfill placed into the trench.
4. **Geotextile** - The manufacturer shall supply data sheets.
5. **Drainage Pipe** - The manufacturer shall supply a certificate indicating that the pipe complies with the specifications.

B. Bio-Polymer Slurry

1. The slurry used in trenching shall be tested each shift in accordance with API RP 13B to ensure the ability of the slurry to stabilize the trench. The following tests shall be performed at the indicated minimum frequencies:

Viscosity	4 per shift
Density	4 per shift
pH	4 per shift
Filtrate Loss	1 per shift

Samples of the slurry shall be obtained from both the trench and mixing plant for testing. Equipment and personnel for performing these tests shall be supplied by the Contractor.

2. The degraded slurry and water in the trench shall be tested by the Contractor to demonstrate that the slurry has been broken. The Contractor shall test and

APL COLLECTION TRENCH

monitor the viscosity and pH of the slurry to verify degradation. In addition, the Contractor shall pump and flush the trench and wet wells until the pore volume of the trench has been circulated at least three times.

3. Conform to the minimum standards described in the Contractor's approved Quality Control Plan.

C. Excavation

The Contractor shall make measurements of the trench depth at least every 20 linear ft. All depth measurements shall be made from the working platform to the bottom of the trench. The Contractor shall generate and maintain on site an as-built profile of the trench depth.

D. Collection Pipe Placement

The Contractor shall verify the elevation to which the collection pipe is placed. The Contractor may either survey the invert elevation each 20 linear ft. or maintain the specified grade with laser-guided equipment and document same.

E. System Performance

The Contractor shall verify the continuity of the system by pumping from a centrally located well/sump and observing an immediate drawdown in other well/sumps in the system.

Additional temporary observation wells may be added by the Contractor, as needed, for this test at no additional cost to the Owner. This test shall be performed in the presence of the Owner.

F. Records

Records shall be maintained by the Contractor for all testing, measurements, observations, and inspections. Quality Control Reports shall be submitted to the Owner's Representative each day on a form acceptable to the Owner. These reports shall list all test results, measurements, and observations made of the work for that day.

G. Quality Assurance

The Owner reserves the right to perform additional tests, using his own forces, on the slurry and backfill. The Owner's testing will in no way relieve the Contractor of the responsibility to perform tests as necessary to meet this specification.

END OF SPECIFICATION

DIVISION 3 - CONCRETE

03300	Cast-In-Place Concrete
03400	Precast Concrete

CAST-IN-PLACE CONCRETE

1.0 GENERAL

1.1 Summary

This specification prescribes requirements for cast-in-place concrete construction.

A. Scope of Specification

1. Construction of plain and reinforced concrete work.
2. Sampling, testing, and inspecting concrete and concrete construction.
3. Placing anchor bolts and embedments for structural items.
4. Detailing, providing fabrication, and placing steel bar reinforcing, including reinforcing supports and accessories.

B. Concrete Work

1. Concrete Apron to Buffalo Avenue (Drawing 594000-10S-01)
 2. Replacement Pavement on Buffalo Avenue (Drawing 594000-30K-13)
 3. Base Slabs for Precast Catch Basins and Precast Manholes (Drawing 594000-30K-13)
 4. Base Slabs for APL Force Main In-Line Cleanout Manholes (Drawing 594000-30K-08)
 5. Concrete Headwall (Drawing 594000-30K-13)
 6. Pipe Collars at Connection to Existing Manhole (Drawing 594000-30K-13)
 7. Storm Drain Manholes SDMH 1,3,4, & 5 (Drawing 594000-30K-14)
 8. Storm Drain Manhole Cover Slabs @ SDMH 1,2,3,4,& 5 (Drawing 594000-30K-14)
 9. Buoyancy Counterweight Slabs for SDMH 2 (Drawing 594000-30K-14)
 10. APL Loadout Facility: Sump, Slab, Containment Walls, Truck Pad, Curb, Pump Pad, Pipe Support Pedestals, and Tank Pedestals (Drawings 594000-15Q-01 and 594000-15Q-02)
 11. NAPL Recovery Well Pads (Drawing 594000-30K-06)
 12. Monitoring Well and Piezometer Pads (Drawing 594000-30K-06)
 13. Guard Posts for Monitoring Wells and Piezometers (Drawing 594000-30K-08)
 14. Fence Post and Gate Footings (Drawing 594000-10S-01)
-

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 03300
Page 2 of 14
2-5-96/Rev. No. 1

CAST-IN-PLACE CONCRETE

15. Plug Both Ends of Existing 42" Storm Drain (Drawings 594000-30K-04C and 594000-30K-05C)
16. Fill Existing 42" Storm Drain with Lean Concrete (Drawings 594000-30K-04C and 594000-30K-05C)

1.2 References

The publications listed below form part of this specification to the extent referenced in this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. In the event there is a discrepancy between the references and this specification, then this specification shall govern.

A. ACI (American Concrete Institute)

1. ACI 211.1-91 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
2. ACI 301-89 Specification of Structural Concrete for Buildings
3. ACI 302.1R-89 Guide for Concrete Floor and Slab Construction
4. ACI 304R-89 Guide for Measuring, Mixing, Transporting, and Placing Concrete
5. ACI 305R-91 Hot Weather Concreting
6. ACI 306R-88 Cold Weather Concreting
7. ACI 308-92 Standard Practice for Curing Concrete
8. ACI 315-80 Details and Detailing of Concrete Reinforcement
9. ACI 347R-88 Guide to Formwork for Concrete
10. ACI 504R-90 Guide to Sealing Joints in Concrete Structures

B. AISC (American Institute for Steel Construction)

1. Code of Standard Practice, Adopted 01Sep86

C. ASTM (American Society for Testing and Materials)

The standards of the American Society for Testing and Materials are listed under Section 1.4 of ACI 301 and are declared to be a part of these specifications, the same as if fully set forth herein. In addition, the following form a part of this specification to the extent referenced:

1. ASTM A36 Standard Specification for Structural Steel
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Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 03300
Page 3 of 14
2-5-96/Rev. No. 1

CAST-IN-PLACE CONCRETE

- | | | |
|-----|-----------|------------------------------------------------------------------------------------------------------------------------------------|
| 2. | ASTM A185 | Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement |
| 3. | ASTM A615 | Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| 4. | ASTM C31 | Standard Practice for Making and Curing Concrete Test Specimens in the Field |
| 5. | ASTM C33 | Standard Specification for Concrete Aggregates |
| 6. | ASTM C39 | Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens |
| 7. | ASTM C94 | Standard Specification for Ready-Mixed Concrete |
| 8. | ASTM C143 | Standard Test Method for Slump of Hydraulic Cement Concrete |
| 9. | ASTM C150 | Standard Specification for Portland Cement |
| 10. | ASTM C171 | Standard Specification for Sheet Materials for Curing Concrete |
| 11. | ASTM C172 | Standard Method for Sampling Fresh Concrete |
| 12. | ASTM C173 | Standard Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method |
| 13. | ASTM C260 | Standard Specification for Air-Entraining Admixtures for Concrete |
| 14. | ASTM C309 | Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete |
| 15. | ASTM C494 | Standard Specification for Chemical Admixtures for Concrete |
| 16. | ASTM C618 | Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete |
| 17. | ASTM E329 | Standard Practice for Use in the Evaluation of Testing and Inspection Agencies as Used in Construction |

D. NRMCA (National Ready Mixed Concrete Association)

1. Checklist for Ready Mixed Concrete Production Facilities, Fifth Edition, March, 1992

E. OSHA (Occupational Safety and Health Act)

CAST-IN-PLACE CONCRETE

1.3 Submittals

- A.** The Contractor shall submit 1 copy of the following documentation to the Engineer for review and approval 14 days prior to placing any concrete, or as required by Project requirements:
- **Mix Designs**

Mix designs shall be proportioned in accordance with Chapter 3 of ACI 301. Submit mix designs for each combination of ingredients on each class of concrete for review.
 - **Compressive strength results.**
 - **Material suppliers, sources, properties, and certifications.**
 - **A copy of the current National Ready Mixed Concrete Association Certificate of Conformance for Concrete Production Facilities for Supplier's plants, if concrete is provided by a ready mixed concrete supplier.**
- B.** Prior to the production of concrete, the Contractor shall submit to the Engineer for record only, 1 copy of Manufacturer's specifications with application and installation instructions for proprietary materials and items including bonding agents, form release agents, water stops, joint systems, liquid curing compounds, and prepackaged repair materials.
- C.** Prior to the production of concrete, the contractor shall submit a complete description of proposed curing methods.
- D.** A delivery ticket for each batch, conforming to Section 16 of ASTM C94 shall be given to the Owner's Testing Agent at the point of delivery.
- E.** The Independent Testing Agent shall submit compression test results to the Engineer on a weekly basis. Breaks of 500 psi below the specified design strength at 28 days shall be submitted on the same day. Reports shall contain the project identification name and number, date of concrete placement, name of contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete in structure, design compressive strength at 28 days, compressive break strength, and type of break.
- F.** Prior to placing reinforcing steel, the contractor shall submit the following for review by the engineer:
- **Bar lists for fabrication of reinforcing steel.**
 - **Field placing drawings.**
 - **Certified mill test reports for each bar size for each heat of reinforcing steel delivered.**

CAST-IN-PLACE CONCRETE

1.5 Delivery

A. Concrete

1. Deliver ready mixed concrete in truck mixer, meeting the requirements of ASTM C94.
2. Water reducing and air entraining admixtures are to be added at the batch plant, while accelerators and retarders may be added at the batch plant or jobsite. Refer to ACI 304, Section 4.5, for requirements for charging of ingredients into the mixer.

B. Reinforcing Steel

1. Reinforcing steel shall be prepared for shipment in such a manner that quality and cleanliness shall be maintained during shipment. Materials shall be adequately protected against damage during shipment.
2. Shipments shall be by structure to the maximum extent possible.
3. Store reinforcement above ground and protect from dirt, oil, and grease.

2.0 PRODUCTS

2.1 General

Any product not listed under the following Materials section may be submitted to the engineer for review and approval. A product that is not listed is not to be used without written approval of the engineer.

2.2 Materials

A. Concrete Materials

1. Cement: ASTM C150, Type I, or as shown and indicated on drawings; use only 1 brand for all cement.
2. Fly ash: ASTM C618, Class F.
3. Fine and coarse aggregates: ASTM C33 for normal weight concrete.
4. Water: Mixing water for concrete shall meet the requirements of ASTM C94.

B. Admixtures

1. Air entrainment: ASTM C260, liquid air-entraining admixture, equivalent to Micro Air by the Masterbuilders Co., or Air Mix by the Euclid Chemical Co., or approved equal.

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 03300

Page 6 of 14
2-5-96/Rev. No. 1

CAST-IN-PLACE CONCRETE

2. Water reducing: ASTM C494, Type A, Equivalent to Pozzalith 200N by the Masterbuilders Co., or Eucon WR-75 by the Euclid Chemical Co., or approved equal.
3. Noncorrosive, nonchloride accelerator, if so specified: The admixture shall conform to ASTM C494, Type C or E, and not contain more chloride ions than are present in municipal drinking water. The admixture manufacturer must have long term noncorrosive test data of at least a year's duration, from an independent testing laboratory, using an acceptable accelerated corrosion test method such as that using electrical potential measures, equivalent to Pozzutec 20 by Masterbuilders, or Accelguard 80 by the Euclid Chemical Co., or approved equal.
4. Admixtures containing calcium chloride, thiocyanates, or any admixture shall not contribute more than 5 ppm (0.005 percent) by weight, of chloride ions to the total concrete constituents.

C. Concrete Accessories

1. Bonding compounds: Nonrewettable; the compound shall be a polyvinyl acetate type such as Euco Weld by the Euclid Chemical Company. Obtain Engineer's approval prior to use.
2. Epoxy adhesive: The compound shall be a 2-component, 100 percent solids, 100 percent reactive compound suitable for use on dry or damp surfaces, Euco Epoxy Number 452MV or Number 620 by the Euclid Chemical Company or Sikadure Hi-Mod by the Sika Chemical Company.
3. Repair topping: Self-leveling, polymer modified high strength topping, Thin Top SL by the Euclid Chemical Company, or approved equal.
4. Patching mortar shall be a free-flowing polymer-modified cementitious coating equivalent to Euco Thin Coat by the Euclid Chemical Company.

D. Curling Compounds and Accessories

1. Liquid membrane curing compounds conforming to ASTM C309 shall be equal to Euco Diamond Hard Liquid Densifier and Sealer by the Euclid Chemical Co. or approved equal.
2. Polyethylene film: ASTM C171, 4 mil thick, clear, white opaque color, or black.
3. Absorptive mats: ASTM C171, cotton fabric or burlap-polyethylene, minimum 8 ounce per square yard, bonded to prevent separation during handling and placing.

E. Waterstops

Waterstops shall be dumbbell or centerbulb type and shall be made from extruded PVC (polyvinyl chloride) for storm drain manholes, or HDPE (high density polyethylene) for other work. Waterstops shall have a minimum width of 6 inches, unless noted otherwise.

CAST-IN-PLACE CONCRETE

F. Reinforcing Steel

1. Fabrication

- a. Reinforcing bars: ASTM A615, Grade 60, deformed billet-steel bars, plain finish.
- b. Welded wire fabric: ASTM A185, cold-drawn plain steel; in flat sheets, plain finish.
- c. Material shall be new and in accordance with the ASTM specification or other recognized standards specified. Materials not manufactured in the United States shall be submitted for approval. The owner reserves the right to reject the use of such materials.
- d. Bar bends and fabrication tolerances shall be in accordance with ACI 315.
- e. Reinforcing steel shall be bent cold. Rebending of hooks shall not be permitted. Bars may be straightened provided the bend is more than or equal to 2 times the recommended minimum diameter of bends.
- f. Bar supports shall be according to Chapter 5 of ACI 301.
- g. Tie wire shall be black annealed wire, 16 gage minimum.

2. Placing Drawings and Bending Schedules

- a. Placing drawings and bending schedules showing the number, grade, size, length, mark, location, and bending diagrams for reinforcing steel shall be prepared in accordance with ACI 315.
- b. Lap splices shall be as indicated on the design drawings.
- c. Each structure or foundation shall have a different identity number. Drawings shall indicate the related PO number and drawing number.

3. Identification and Tagging

- a. Tag reinforcing in accordance with this specification.
- b. Tag each bundle of bars, straight or bent, showing drawing number, structure, mark number, bar quantity, and size.
- c. Tag stock length straight bars showing number of bars, size, and length.

G. Products for Concrete Formwork

Design and installation of formwork, tolerances, preparation of form surfaces, removal of forms, and reshoring is to be in strict accordance with Chapter 4, ACI 301.

CAST-IN-PLACE CONCRETE

H. Anchor Bolts

Anchor bolts shall be galvanized steel in accordance with ASTM 436, or Hilti "HVA" Adhesive Stainless Steel Anchors as manufactured by the Hilti Corporation, or approved equal.

2.3 Design Criteria

A. Concrete Strength

Concrete for surface slabs, the headwall, and at the APL Loadout Facility is to have a minimum 28-day compressive strength of 4000 psi. Other concrete is to have a minimum 28 day compressive strength of 3000 psi, or as noted on the drawing.

B. Slump

Structural concrete shall have a maximum slump of 4 inches.

C. Water-Cement Ratio

Maximum 0.40.

D. Formwork

Design and construction shall comply with Chapter 4 of ACI 301 and the building code of the local jurisdiction.

2.4 Concrete and Lean Concrete Mixes

A. Concrete Proportioning

1. Proportion concrete mixes in accordance with ACI 301, on the basis of either previous field experience or trial mixes; do not proportion concrete mixes based on empirical data. Mixing and transportation of concrete shall be in accordance with Chapter 4 of ACI 304.2R.
2. Include proposed chemical admixtures in mix design in same proportions and batching sequence as shall be used in production concrete.
3. Concrete shall contain a coarse aggregate with a maximum aggregate size of 1.5 inches. Refer to ACI 301, Section 3.6 for additional requirements.
4. The minimum content of entrained air shall be 4% and the maximum content shall be 8%.
5. Fly ash may be used as a cementitious material, with the fly ash replacing a maximum of 20 percent of the cement (by weight). The fly ash shall be used in calculating the water-cement ratio and shall come from the same source.

CAST-IN-PLACE CONCRETE

B. Lean Concrete Proportioning

1. Lean concrete will consist of a mixture of cement, sand, and water (no aggregate) to produce a flowing mixture that will be used to fill the existing 42" storm drain.
2. Use a minimum 5 bag mix (470 lbs. cement : 2700 lbs. sand) with enough water to allow the mixture to flow freely.

3.0 EXECUTION

3.1 Preparation

A. Anchor Bolts and Embedments

1. Steel, ironwork, pipe sleeves, inserts, wood blocking, nailer strips, isolation joint material, construction joint dowels, and other fixtures as shown, specified, or required to be built into concrete shall be placed accurately and secured against displacement during concreting. Sufficient time between erection of forms and placing concrete shall be given to the various trades to permit proper installation of their work. The installation of anchors, inserts, and sleeves for electrical, mechanical, or plumbing work shall be subject to the inspection and approval of the supervisor of the particular trade or trades involved before concrete is placed.
2. The installation of and tolerances for anchor bolts and embedded items shall comply with Paragraph 7.5 of the AISC Code of Standard Practice. Anchor bolts shall be located within 1/8 of an inch of design position.
3. Locate plate inserts within plus or minus 1/4 of an inch horizontally or vertically.
4. Protect bolt threads against damage and concrete; cap or plug sleeves to keep out water, concrete, and debris.
5. Tack welding of anchor bolts, reinforcing steel, and embedments is not permitted.

B. Placing Concrete

Preparation before placement and conveying of concrete shall be in accordance with Chapter 8, Section 8.1 and 8.2 respectively of ACI 301.

3.2 Installation

A. Concrete Production

Production of concrete shall comply with Chapter 7 of ACI 301. Water may be added to the mix at the point of delivery in accordance with Section 11.7 of ASTM C94 when permitted by the owner's testing agent but in no case shall the total amount of water added at the jobsite batch plant exceed the quantity specified for the design mix.

CAST-IN-PLACE CONCRETE

B. Placing Concrete

1. Placement of concrete shall be in accordance with Chapter 8 of ACI 301. The temperature of plastic concrete, as placed, shall not exceed 90 degrees F. During cold weather, as placed, temperature shall not be less than 50 degrees F. Hot and cold weather concreting shall be in accordance with ACI 305 and ACI 306.
2. Ensure that discharge of ready mixed concrete is completed within 1.5 hours after batching. The 1.5 hours may be extended if the concrete is of such slump after 1.5 hours (or 300 revolutions) that it can be satisfactorily placed and consolidated without the addition of water.
3. Maintain records of concrete placement; record date, location, quantity, air temperature, field test results, and test samples taken; maintain concrete delivery tickets with record for ready mixed concrete.
4. After concrete placement and form removal, clean exposed reinforcing steel and embedded items of concrete splatter, dirt, and other foreign matter.
5. Concrete that has achieved initial set or has been contaminated by foreign matter shall not be deposited in the structure. Retempered concrete shall not be used.

C. Slabs on Grade

1. Construct slabs in accordance with Chapter 11 of ACI 301.
2. Place concrete in single pour.
3. Floor slab tolerance shall conform to Chapter 7, Section 7.15 of ACI 302.1R.

D. Slab Finishes

Concrete slab surfaces shall have a light broom finish in accordance with ACI 302.1R.

E. Finishing Formed Surfaces

Exposed, formed concrete surfaces shall be finished in accordance with Chapter 10 of ACI 301, unless otherwise noted on the design drawings.

F. Formwork

1. The design, installation, and removal of formwork shall be in accordance with ACI 347 except as modified herein. Wall and soil supported member forms may be removed after 48 hours provided the concrete is sufficiently hard not to be damaged by form removal, and provided curing operations start immediately. Self-supporting member forms may be removed after 7 days provided the concrete strength is 80 percent of the 28-day strength. No superimposed load shall be applied before the 28-day strength has been verified by field cured cylinders. Formwork tolerances shall meet ACI 301 Table 4.3.1.

CAST-IN-PLACE CONCRETE

2. Unless otherwise shown on the concrete drawings, exposed edges shall have a 1-inch chamfer. Unexposed corners may be either square or chamfered.
3. Obtain approval before framing openings in structural members if openings are not indicated on the drawings.
4. Do not apply form release agent wherever concrete surfaces shall receive special finishes or wherever applied coverings are affected by agent; soak inside surfaces of untreated forms with clean water; keep surfaces coated before placing concrete.
5. Coordinate work of other specifications in forming and placing openings, slots, reglets, recesses, chases, sleeves, bolts, anchors, and other inserts.

G. Reinforcement

1. The grade, type, and details of reinforcing steel shall be in accordance with the design drawings. Placement of reinforcement shall be in accordance with Section 5.7 of ACI 301 unless otherwise approved by the engineer.
2. Place, support, and fasten reinforcing before placing concrete; do not insert dowels into fresh concrete; do not float welded wire fabric down into fresh concrete. Support slab reinforcement at the required depth and secure prior to placing concrete; do not pull welded wire fabric up into fresh concrete as it is placed.
3. Secure at least 25 percent of bar intersections (including wall dowels) with wire in 2-way mats.
4. Splice reinforcing bars only as shown on the design drawings. Necessary splices not shown on the drawings shall be lapped sufficiently, as approved by the engineer, to develop the strength of the bars by bond for bars through size Number 11. Mechanical splices shall be made only as shown and noted on the drawings. Welded splices are not allowed.
5. Minimum concrete cover shall 2 inches, unless otherwise noted.

H. Joints and Embedded Items

1. Joints and embedments shall be in accordance with Chapter 6 of ACI 301 unless otherwise approved by the engineer.
 2. Construction joints shall be located as shown on the concrete drawings. Any variation from location shown shall be approved by the Owner's representative. Should the concrete operation require the placement of an intermediate construction joint, the concrete shall be struck off square with the structure, water stops added if the normal joint has a waterstop, the location completely recorded and reported to the engineer in writing. Adjacent pour shall not be made until a disposition has been received from the engineer.
 3. There should be no construction, isolation, and control joints in slabs on grade.
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CAST-IN-PLACE CONCRETE

4. The surface of construction joints shall be thoroughly cleaned and defective or contaminated concrete, surface film, and laitance removed. Prewet the remaining concrete followed by a brush application of a neat cement paste. Obtain Engineer's approval before using bonding agents. Coating of vertical construction joints is not required.
5. Locate construction joints in framed slabs according to the design drawings. Obtain approval from the engineer before placing any construction joints in locations other than that shown on the design drawings.
6. Provide and install waterstops in joints as detailed on drawings. Join waterstop sections according to the manufacturer's recommendations. Anchor securely to prevent movement during concrete placement. Provide at all joints subject to either groundwater or process fluids.
7. Continue reinforcing through construction joints.

I. Repair of Surface Defects

1. Unless otherwise specified or permitted by the Engineer, tie holes, honeycombs, and other concrete surface defects shall be repaired in accordance with Chapter 9 of ACI 301 and alternate methods in 9.2.2.4 ACI 301, as soon as practicable after form removal at such times and in such manner as shall not delay, interfere with, or impair the proper curing of the fresh concrete. The engineer shall be notified before proceeding with repair if the defect is greater than 5 inches deep and larger than 200 square inches in surface area, or if the depth is over 1/3 the thickness of the member and greater than 6 inches in any other direction.
2. Prepackaged concrete and patching compounds may be used after Engineering approval is obtained. As an alternate, a patching mortar similar to the concrete mix minus the coarse aggregate can be used. Do not use more than 1 part cement to 2-1/2 parts sand by damp, loose volume.
3. Remediation of Out-Of-Tolerance Slabs
 - a. Grind down high points.
 - b. Raise low points by using the specified underlayment compound or repair topping if the areas are exposed.

J. Curing and Protection

1. Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures and shall be maintained with minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete. Curing shall conform to the requirements in Chapter 12, ACI 301.
2. Concrete Surfaces in Contact with Forms

The time during which concrete surfaces are in contact with wood or metal forms may be considered as curing time. Wood forms shall be maintained in a moist

CAST-IN-PLACE CONCRETE

condition until removal. After form removal, the concrete shall be cured until the end of the curing period by one of the methods of concrete surfaces not in contact with forms. Moist wood forms in contact with concrete shall not be considered as curing for hydraulic structures. Curing time shall commence as soon as the wall forms have been loosened and sprinkling has begun. Wall forms shall be loosened between 24 and 48 hours after concrete placement and sprinkling begins. Wood forms shall be kept moist until the forms are loosened and the curing procedure begins.

3. Concrete Surfaces Not in Contact with Forms

Concrete surfaces not in contact with forms can utilize any of the methods indicated in ACI 301, Section 12.2.1 for preservation of moisture, except do not use ponding, sprayed water, or wet sand on exposed concrete slabs.

K. Lean Concrete

1. After sealing each end of existing 42" storm drain with concrete, as described on Drawings 594000-30K-04C and 594000-30K-05C, fill storm drain with lean concrete.
2. Provide access holes at minimum 100 feet intervals along pipe length.
3. Verify the volume of concrete injected versus the volume of the annular space. Fill a minimum of 95% of annular space. If pipe will not accept calculated quantities, visual observations of concrete coming through downgrade access holes will provide confirmation of filling.

3.3 Field Quality Control

- A. Acceptance of concrete shall be based upon results for slump, air content, temperature, and strength taken at the site. Testing frequency shall be as follows:

CONCRETE FIELD TESTING
(not applicable for lean concrete)

<u>TEST</u>	<u>STANDARD</u>	<u>FREQUENCY</u>	<u>ACCEPTANCE CRITERIA</u>
Slump	ASTM C143	per truck	< 4"
Air content	ASTM C173	per truck	Between 4% and 8%
Strength	ASTM C39	Minimum of one test per day's concreting	as defined in 2.3 A.

- B. Each strength test shall consist of six cylinders, two tested at 7 days, two tested at 28 days, and two kept in reserve. The average strength of two cylinders from the same sample, tested at 28 days, shall be considered the strength of the concrete sample.
- C. The finished structure shall be evaluated for acceptability in accordance with Chapter 18 of ACI 301. The contractor shall pay costs incurred for additional testing, analyses,

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 03300
Page 14 of 14
2-5-96/Rev. No. 1

CAST-IN-PLACE CONCRETE

and any corrective work required when the structure is found to be deficient in strength or other specified characteristics.

- D. During construction, the Independent Testing Agency shall inspect, sample, and test concrete materials and production of concrete as required by the engineer. Failure to detect any defective work or material shall not prevent in any way later rejection when such defect is discovered, nor shall it obligate the engineer for final acceptance. The testing and inspection agency shall meet the requirements of ASTM E329.
- E. Complete records of testing shall be kept by the Inspection and Testing Agency

4.0 ATTACHMENTS

Not applicable.

END OF SPECIFICATION

GENERAL REQUIREMENTS - EQUIPMENT

- O.** Outline and detail drawings shall, as a minimum, show the following information:
1. Overall dimensions and differential elevations, as required.
 2. Nozzle or inlet sizes, rating, facings, locations, and flow directions.
 3. Support mounting dimensions and location of anchor bolt holes.
 4. Weight of components and total assembled weight and operating weight.
 5. Size (space envelope) and weight of each separate component and subassembly to be furnished by Supplier.
 6. PO or Requisition Number (whichever is applicable), Equipment Item Number, and Item Name.
 7. Materials of construction.
 8. Leveling instructions, handling instructions, and tolerances.
 9. Location of lifting lugs and rigging points.
- P.** U-1 Forms and nameplate facsimile shall be furnished for any ASME code stamped equipment.

1.4 Quality Assurance

- A.** Supplier shall develop and apply Quality Assurance and Quality Control Procedures and make them available to Buyer upon request.
- B.** Supplier shall appoint a designated person with overall responsibility for quality and performance of the work and as Buyer's point of contact.
- C.** Buyer reserves the right to approve Seller's suppliers and the extent of subcontract work. After Buyer's approval, changes shall only be made with Buyer's written authorization.
- D.** Supplier shall be responsible for supervision and coordination of subsuppliers.

2.0 PRODUCTS

2.1 Materials

Asbestos or asbestos filled materials shall not be used as a material of construction for gaskets, packing, seals, or for any other item or component thereof.

GENERAL REQUIREMENTS - EQUIPMENT

2.2 Inspection & Tests

A. Inspection

1. Supplier shall furnish Buyer copies of Supplier's inspection and quality control plan.
2. Materials and workmanship shall be subject to inspection by Buyer in the shop and in the field.
3. Buyer's Inspector will check, as a minimum, the following:
 - Equipment components' metallurgy
 - Dimensions
 - Connection sizes and locations
 - Quality of workmanship against certified drawings
 - Data
 - PO documents
4. Buyer or a representative reserves the right to visit or be in residence at Supplier's shop(s) to ensure that established schedules are being met and to ensure that quality control is being maintained at an acceptable level. Prior notice for these visits will be given.

B. Testing

1. Instruments and controls shall be checked for continuity and operation at the factory.
2. Following field assembly, all control and safety devices shall be tested for compliance with this specification and with local codes and regulations.
3. Supplier shall advise Buyer in writing at least 2 weeks in advance of any shop testing planned. Such notice shall describe the exact nature of the test(s) to be performed.
4. Buyer shall have the option of witnessing any shop testing unless specifically waived in writing by Buyer. Supplier shall provide the Buyer with certified copies of all tests performed.
5. Failure on the part of Buyer to witness any test shall neither delay such test nor delay the orderly fulfillment of the specifications. Supplier shall not be released from any obligations under the specifications by virtue of Buyer's attendance at, or failure to attend, any such tests, or by virtue of lack of notification of rejection of the results of any such tests.

GENERAL REQUIREMENTS - EQUIPMENT

6. After any inspection or test, Buyer may reject the equipment or any component thereof for any defect or nonconformance to the specifications. Notice of rejections shall be conveyed in writing and shall state the respects in which the equipment is defective or not in conformance to the specifications. Supplier shall promptly correct the defects and ensure that the equipment complies with the specifications. Thereafter, if Buyer so requires, the test shall be repeated, at Supplier's cost, as many times as required to meet the performance guarantee.
7. Supplier shall not ship any equipment or any parts thereof, from his premises until Buyer has either given written release of results of the tests conducted at such premises, or ordered shipment without such release.
8. Buyer may elect to conduct field tests at own expense to verify performance guarantees under actual working conditions. The field test procedures shall be mutually agreed upon between Buyer and Supplier. Supplier may elect to have representation at own expense during these tests. Where the tests reveal deficiencies in the equipment or deviations from the guaranteed performance, Supplier shall be completely responsible for any modifications, repairs, and adjustments required to meet the equipment performance guarantees.
9. Should additional field testing be required to verify performance guarantees, the cost for all field performance testing, including the first field test, shall be at the Supplier's expense.

2.3 Identification & Tagging

A. Nameplates

1. A corrosion resistant metal nameplate shall be permanently attached to the equipment (not baseplate) and contain the following information using specified units:
 - PO Number
 - Equipment Item Number
 - Supplier's Name
 - Serial Number
 - Rated Capacity
 - Size and Type
 - Year Built

GENERAL REQUIREMENTS - EQUIPMENT

B. Marking

Connections furnished on the purchased equipment shall be impression stamped or permanently tagged to agree with Supplier's connection table or general arrangement drawing.

C. Tagging

1. Each item shall be identified with its PO Number and Item Number. Tags shall be corrosion resistant metal (not aluminum) and impression stamped with the following information:
 - PO No.
 - PO Item No.
 - Equipment Item No.
2. Tags shall be attached to each component with stainless steel wire. This tagging is in addition to the equipment nameplate. Equipment shipped in fully enclosed containers shall also include the above information marked on the outside of the container.
3. Miscellaneous parts shall be tagged or marked with the equipment item number for which they are intended.
4. Equipment containing insulating oils, antifreeze solutions, or other fluids shall be prominently tagged at openings to indicate the nature of the contents, and shipping and storage precautions.

2.4 Preparation For Shipment

- A. Assembly and preparation for shipment shall be in accordance with Supplier's standards and as noted herein. Supplier shall be solely responsible for the adequacy of the preparation for shipment provisions with respect to materials and application, and to provide equipment at the destination in ex-works condition when handled by commercial carriers.
- B. Shipment preparation procedures shall be submitted to Buyer for concurrence.
- C. Such procedures shall be mutually agreed upon before shipment.
- D. Equipment shall be completely free from water before shipment preparation.
- E. Stainless steel surfaces shall not be painted.
- F. Carbon steel exposed surfaces shall be shop primed and finish painted.

GENERAL REQUIREMENTS - EQUIPMENT

- G.** Unless specified otherwise, surface preparation and painting shall be as follows:
1. Surfaces to be painted shall be cleaned in accordance with SSPC-SP6.
 2. Surface preparation shall be followed by application of 1 coat of inorganic zinc rich primer to a dry film thickness of 3 to 5 mils.
 3. The primed surfaces shall be finish painted with 1 coat of polyamide epoxy to a dry film thickness of 3 to 5 mils.
- H.** Surface preparation, priming and finish painting of the following items shall be in accordance with Supplier's standard painting specification:
- Blowers
 - Control Boxes
 - Filters
 - Instruments
 - Motors
 - Pumps
 - Valves
- I.** VPI crystals in the bags shall be installed in large cavities to absorb moisture, preferably attached to flange covers.
- J.** Adequate protection shall be provided against mechanical damage and atmospheric corrosion in transit, and for mutually acceptable period of outdoor storage at jobsite before installation.
- K.** Bracing, supports, and rigging connections shall be provided to prevent damage during transit, lifting, or unloading.
- L.** Temporary bracing shall be painted yellow to indicate that it is to be removed after installation.

3.0 EXECUTION

Not applicable.

END OF SPECIFICATION

7. OTHER INFORMATION

WATER TREATMENT FACILITY SAMPLING AND ANALYSIS

• WATER TREATMENT SYSTEM

Sampling requirements for permit compliance at Outfall 001 are provided in Table 3. Flow will be indicated, recorded and totalized continuously at the effluent. Grab samples for permit compliance will also be taken from the effluent line for the required analysis.

Operational testing will be performed to verify influent load and treatment system performance. These tests include the following:

Location	Frequency	Type	Selected Parameters
Holding Tank	Weekly	Grab	Benzene Chlorobenzene Sum of Dichlorobenzenes Sum of Trichlorobenzenes Sum of Tetrachlorobenzenes 2,5-Dichloroaniline 4-Chlorophenol Sum of Chlorobenzoic Acids
Lead Carbon Column Effluent	Weekly	Grab	Benzene Chlorobenzene Sum of Dichlorobenzenes Sum of Trichlorobenzenes Sum of Tetrachlorobenzenes 2,5-Dichloroaniline 4-Chlorophenol Sum of Chlorobenzoic Acids

The list of selected parameters is used since these compounds have expected influent concentrations greater than 200 ppb, require greater than 90% removal efficiency and will be representative of the removal of other compounds in the water. If the lead column effluent has an effluent concentration greater than 10 parts per billion for any one of the chemicals listed above then the carbon in the lead column will be replaced.

• SEDIMENTATION POND

The sedimentation pond will be checked for turbidity prior to discharge to the river through Outfall 002. Turbidity sampling will also be performed hourly during discharge. An operator will be at the site during pumping. Samples will be taken from a sample connection on the pump discharge pipe and tested with a portable

turbidimeter. Test results will be recorded in a log specifying at a minimum the following information: date, time, location, test result and the name of person running the test. A portable flow meter will be used to continuously indicate, record and totalize the flow. If turbidity is 17 NTUs or greater the operator will stop the pump. As an alternative the clear pond may be pumped to the water treatment facility.

- **EMBAYMENT SURFACE WATER**

The embayment surface water will be checked for turbidity prior to discharge to the river through Outfall 003. Turbidity sampling will also be performed hourly during discharge. An operator will be at the site during pumping. Samples will be taken hourly from a sample connection on the pump discharge pipe and tested with a portable turbidimeter. Test results will be recorded in a log specifying at a minimum the following information: date, time, location, test result and the name of person running the test. A portable flow meter will be used to continuously indicate, record and totalize the flow. If turbidity is 17 NTUs or greater the operator will stop the pump.

GENERAL REQUIREMENTS - EQUIPMENT

1.0 GENERAL

1.1 Summary

A. Scope of Specification

1. This specification prescribes the general requirements for equipment.
2. Compliance with this specification does not relieve supplier of the responsibility of furnishing properly designed equipment, mechanically and electrically suited to meet operating conditions.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, Work included in this specification shall conform to the applicable provisions of these publications.

A. SSPC (Steel Structures Painting Council)

1. SSPC - SP6 Near White Metal Blast Cleaning

B. OSHA (Occupational Safety And Health Act)

1.3 Submittals

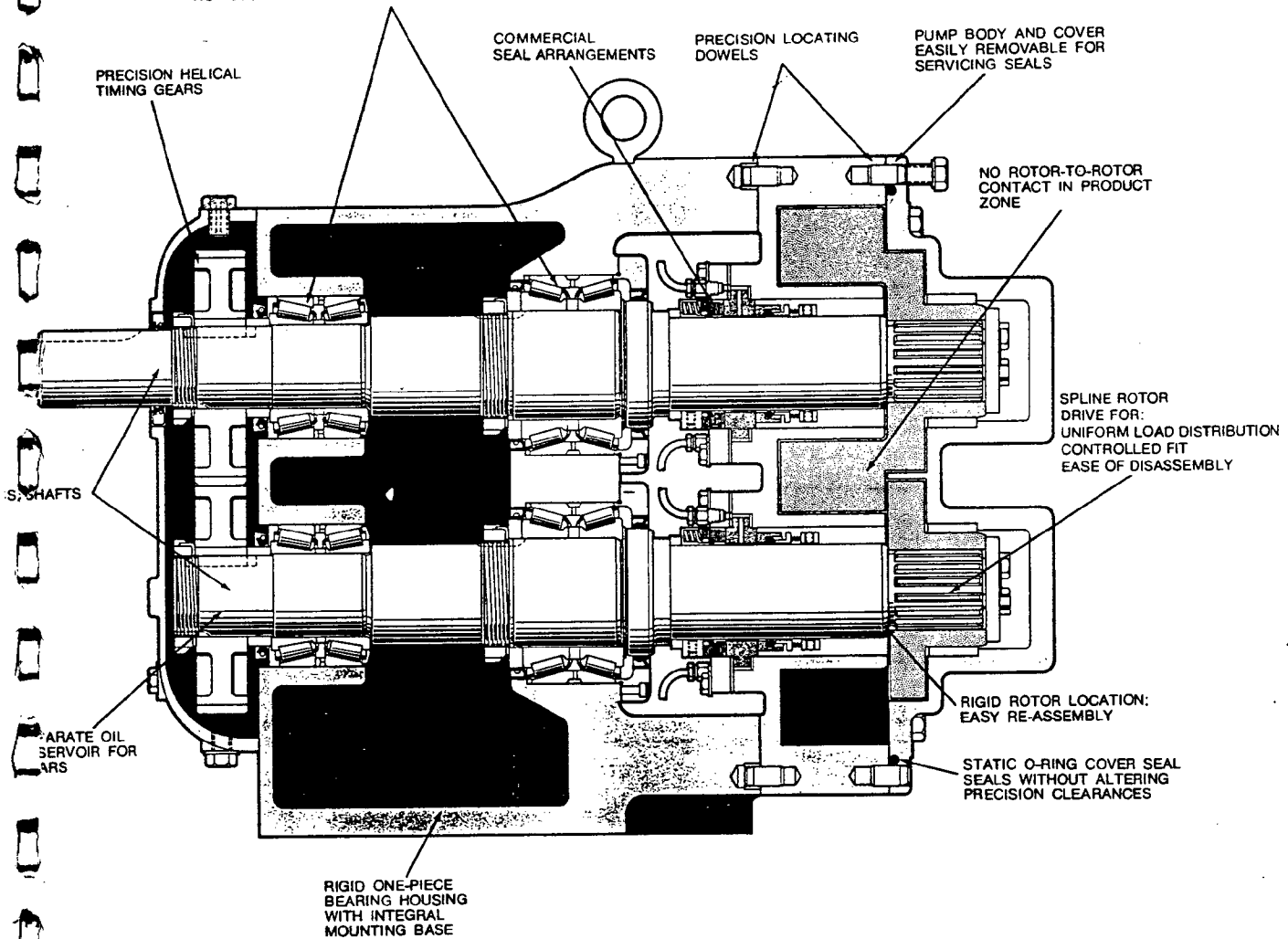
- A.** Supplier shall submit the type and quantity of drawings and documentation for Buyer's authorization or information as listed in the Request for Quotation.
- B.** Mutual agreement on scheduled submittal of drawings and engineering data shall be an integral part of any formal PO (Purchase Order).
- C.** Any comments made by Buyer on any drawing submittal shall not relieve Supplier or subsuppliers of any responsibility in meeting the requirements of the specifications. Such comments shall not be construed as permission to deviate from requirements of the order unless specific and mutual agreement is reached and confirmed in writing.
- D.** The basic intent of any Buyer comment is to note drawing content as it relates to the applicable specifications and to provide for the informational needs required for a fully integrated installation design.
- E.** Any reproducible transparency submittal shall be of microfilm quality to allow for subsequent production of legible copies.

GENERAL REQUIREMENTS - EQUIPMENT

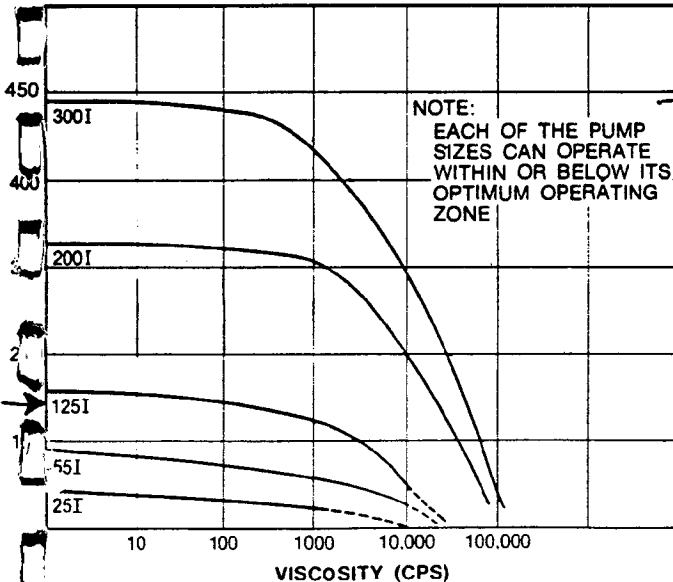
- F.** Supplier shall be required to add to the drawings all reasonable notes and data requested by Buyer including equipment item numbers, connection points and locations, instrumentation, and other data as required by Buyer for an integrated front end design.
 - G.** Supplier shall complete and submit as built data sheets.
 - H.** Each drawing shall be provided with a title block in the bottom right-hand corner incorporating the following information:
 - 1. Official trade name of the company.
 - 2. Supplier's drawing number.
 - 3. Drawing title giving the description of contents whereby the drawing can be identified.
 - 4. A symbol or letter indicating the latest issue or revision.
 - 5. Purchase order number and item tag numbers.
 - I.** Revisions to drawing shall be identified with symbols adjacent to the alterations, a brief description in tabular form of each revision shall be given, and if applicable, the authority and date of the revision shall be listed. The term "Latest Revision" shall not be used.
 - J.** Supplier shall submit a recommended spare parts list for startup and 1 year operation. This submittal shall include recommended spare parts, illustrative sectional drawings, part numbers and materials. Part numbers shall identify each part for interchangeability purposes. Commercially available purchased items such as antifriction bearings shall be identified by the original manufacturer's numbers.
 - K.** A complete parts list (nonpriced) shall be contained in Supplier's final instruction and operation manuals. This list shall not be typical but apply specifically to the equipment purchased.
 - L.** For other and more specific spare part requirements (if required), refer to the RFQ (Request for Quotation) and formal PO.
 - M.** Lubrication requirements shall be submitted with final engineering data/manuals.
 - N.** Drawings, calculations, and engineering data submitted to purchaser shall be in the English language. Dual dimensions may be used by manufacturers normally using the metric system of units provided that the English system is also shown.
-

"I" MODELS SPECIFICATIONS & DATA

MODEL - 200 & 300 TIMKEN® BEARINGS
 MODELS - 25, 55, 125 BALL BEARINGS —
 NO ADJUSTMENT NEEDED — PRESET ASSEMBLIES



NORMAL APPLICATION RANGES



Model	Displacement Per Revolution	Nominal Speed	Pressure ΔP	Nominal Capacity To	Typical HP Range	Inlet/Outlet	Nominal Temperature Range
25I	.06 gal	to 600	to 200	36 gpm	1-5	1/2"	40°F
55I	.15 gal	rpm	psi	90 gpm	2-7½	2"	to 300°
125I	.25 gal			150 gpm	3-15	2½"	
200I	.44 gal			260 gpm	5-25	4"	
300I	.75 gal			450 gpm	10-50	6"	

*Higher speeds and temperatures when approved by factory

CONSTRUCTION FEATURES

STD. PUMP BODY & COVER — 316 stainless steel

STD. ROTORS — "Waukesha 88" Alloy

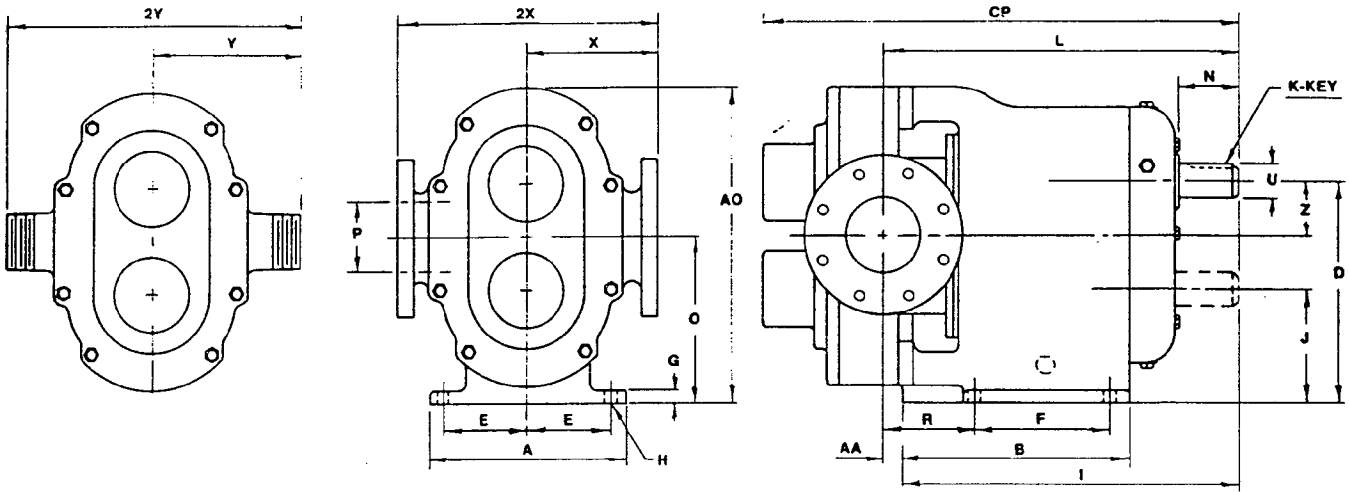
BEARINGS — Models 25, 55, & 125: Front roller & rear ball.
 Models 200 & 300: Front & rear double-row Timken roller bearings, each shaft.

SEALS — Single, double mechanical; packing gland; or many other options available.

TIMING GEARS — Precision helical

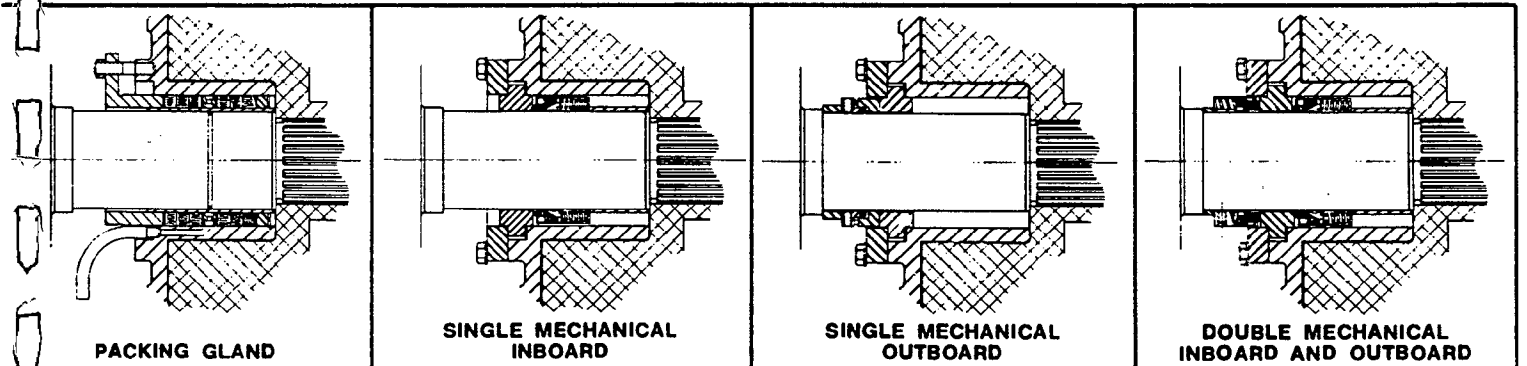
VISCOSITY RANGE — Less than 1 cps to over 1,000,000 cps.

DIMENSIONS



PUMP SIZE	A	AA	AO	B	CP	D	E	F	G	H	I	J	K	L	N	O	P	R	U	X	Y	2X	2Y	Z	WT. LBS.
25 I	6.25	3.6	10	4.8	16.3	6.88	2.31	2.56	.5	.44	9	3.56	.25	12.6	2.3	5.22	NPT 1.5 MALE	4.84	1	—	4.68	—	8.38	1.66	90
55 I	8	2.9	13.8	6.5	18.3	9.56	3.5	4.13	.63	.56	11.4	5.06	.25	14.3	2.6	7.31	NPT MALE	4.28	1.25	—	5.81	—	11.63	2.25	170
125 I	8	3.6	13.8	6.5	19.2	9.56	3.5	4.13	.63	.56	11.4	5.06	.25	15	2.6	7.31	NPT 2.5 MALE	4.97	1.25	—	5.81	—	11.63	2.25	190
200 I	11	1	17.8	12.8	26.3	12.39	4.75	7.5	.75	.66	18.6	6.38	.5	19.6	3	9.88	FLANGE AC TYPE	5.25	2	7.38	—	14.75	—	8.5	470
300 I	12	.6	20	13.8	30.1	13.88	5.25	8	.75	.66	21.9	6.88	.625	21.6	3.9	10.38	FLANGE 8 TYPE	5.38	2.375	8	—	16	—	9.5	815

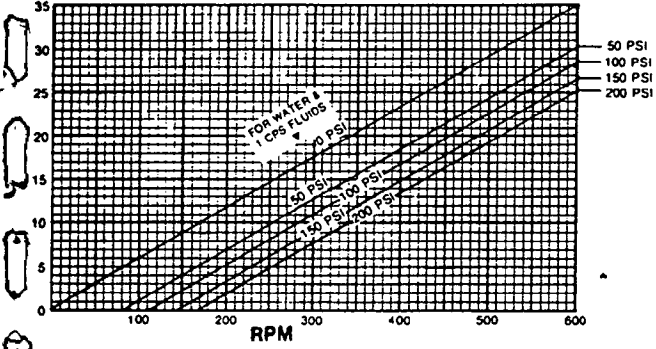
WITH A WIDE CHOICE OF SEALS FOR EVERY PUMPING APPLICATION



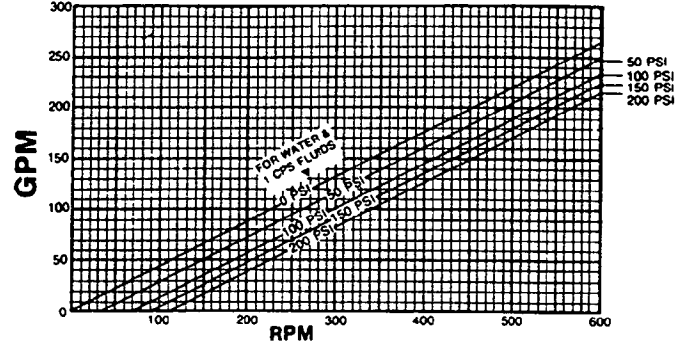
MOST COMMERCIAL SEAL ARRANGEMENTS MAY BE SPECIFIED
SEAL SEATS IN COBALT ALLOY — CERAMIC — TUNGSTEN CARBIDE

NORMAL APPLICATION RANGES FOR WAUKESHA "I" & "DI" PUMPS

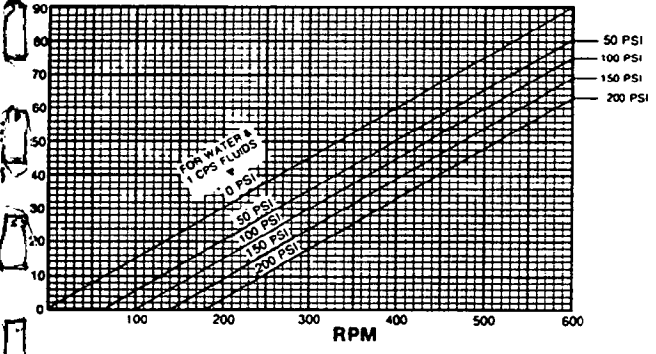
INDUSTRIAL PUMPS
SIZE 25



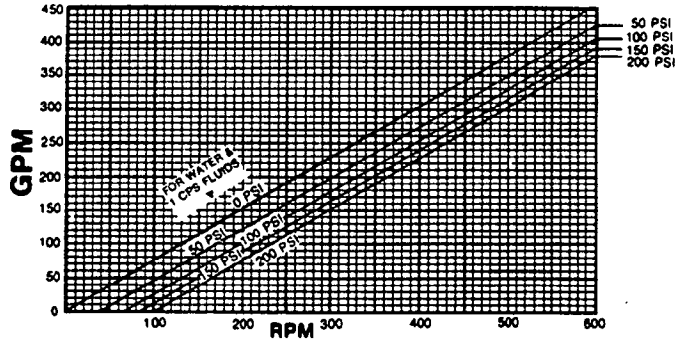
INDUSTRIAL PUMPS
SIZE 200



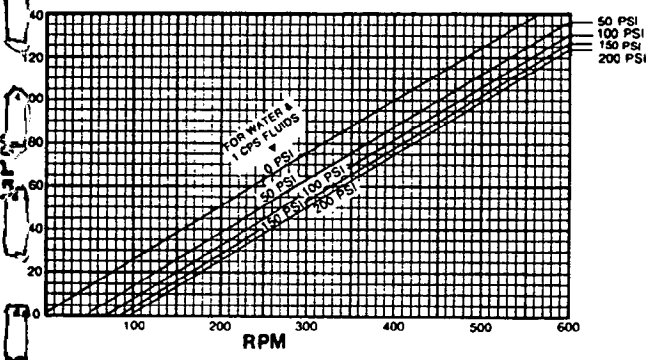
INDUSTRIAL PUMPS
SIZE 55



INDUSTRIAL PUMPS
SIZE 300



INDUSTRIAL PUMPS
SIZE 125



above are water performance curves only and more complete curves are available upon request.

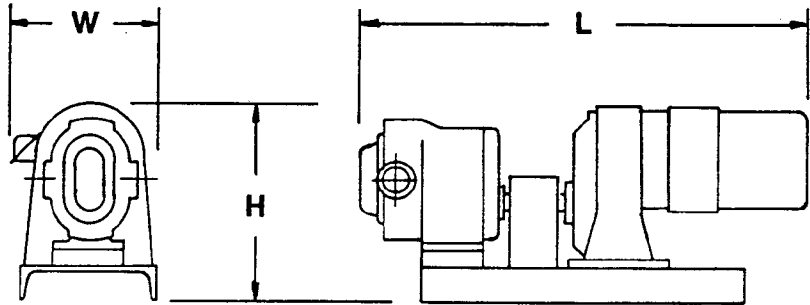
DRIVE SPECIFICATIONS

When a specific type of pump drive and/or control is required for a particular application, this information should be noted so that determination can be made as to the size, type, speed and rotation of the pump, size of

baseplate, etc. Drive units available with Waukesha Industrial Pumps include gearhead, V-belt and variable speed; other options include oil & hydraulic drives.

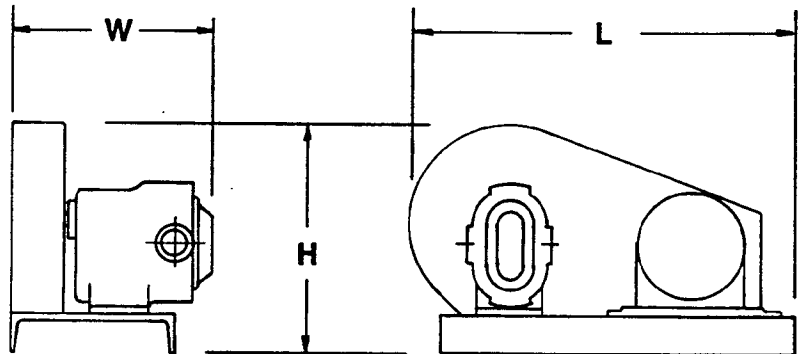
GEARHEAD UNIT

SIZE	L	W	H	LBS*
25	41	12	16	325
55	52	20	21	800
125	55	21	23	850
200	60	24	27	1400
300	65	30	24	1700



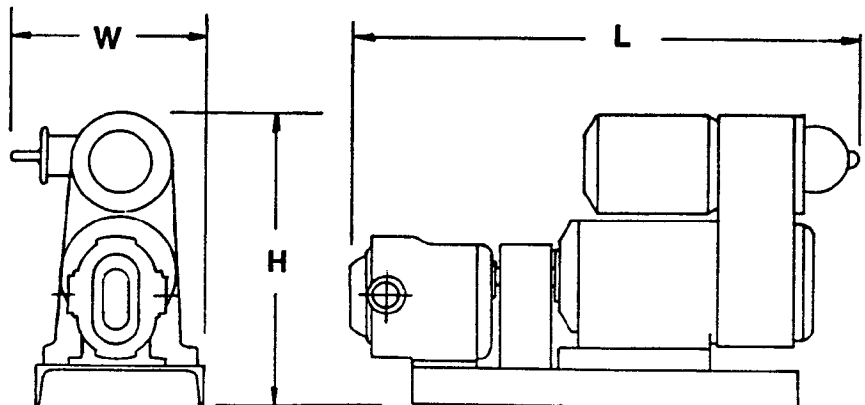
BELT DRIVE UNIT

SIZE	L	W	H	LBS*
25	40	21	26	320
55	50	26	32	550
125	50	26	32	600
200	60	28	35	1000
300	64	32	35	1500



VARIDRIVE UNIT

SIZE	L	W	H	LBS*
25	45	24	29	550
55	57	28	42	1000
125	63	30	42	1650
200	75	30	46	2200
300	90	32	50	3100



*Estimated shipping weight of complete unit.

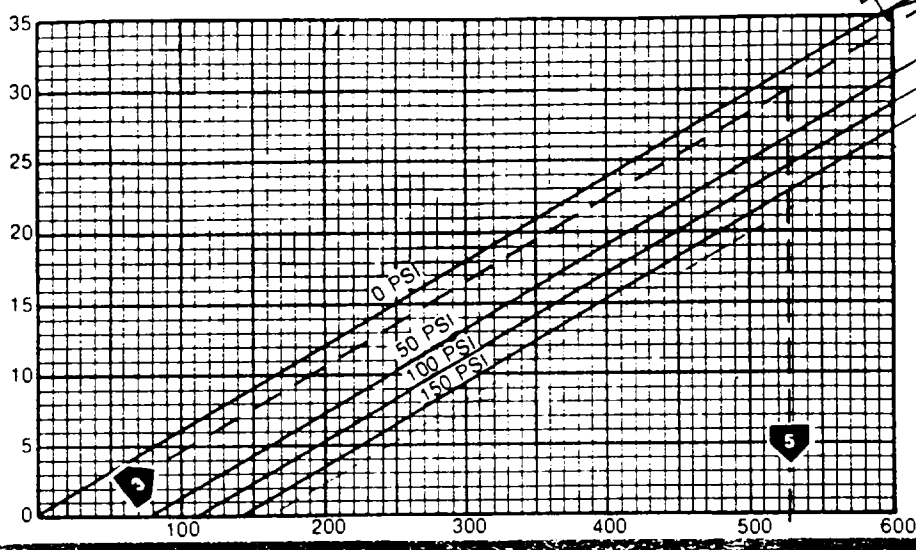
ALL VISCOSITIES - CPS

200 100 50 30 10 5 3 1

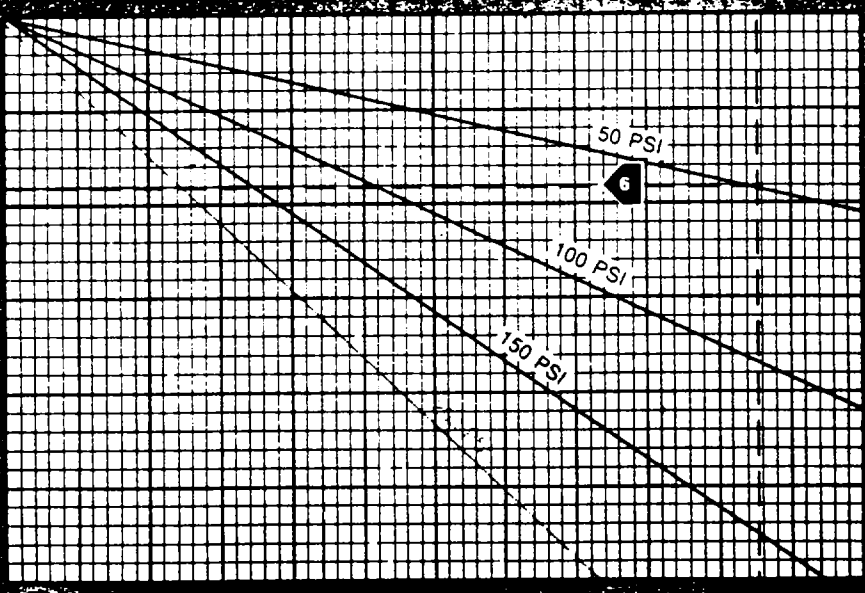
50 PSI
100 PSI
150 PSI

SANITARY PUMPS SIZE 25-

GPM

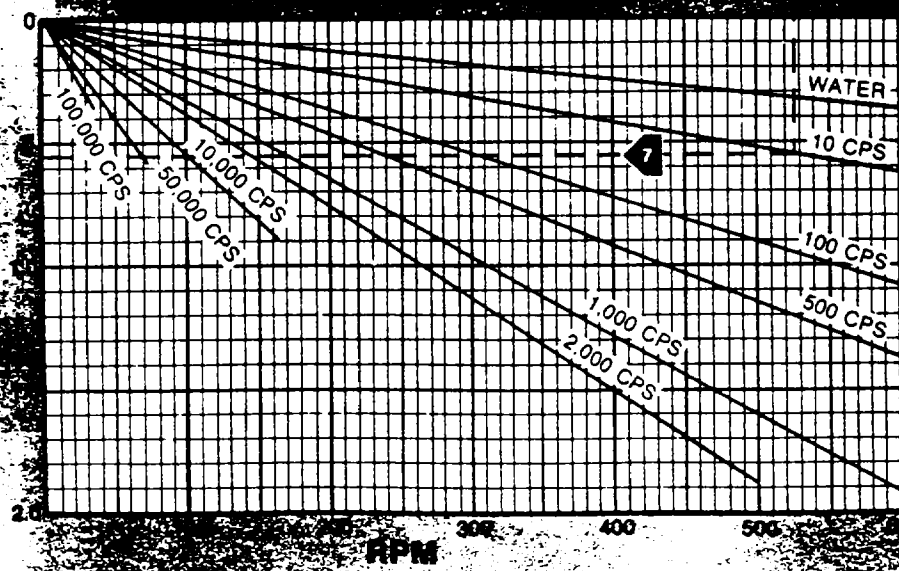


WHP



$HP = VHP + WHP$

VHP



EQUIPMENT DATA SHEET	ITEM NO.	P-312		
	NO. REQ'D.	One (1)		
	REQ'N. NO.		COMM. NO.	
	P.O. NO.		PROJ. NO.	23594000
	PROJ.	OXYCHEM/OLIN REMEDIAL DESIGN		
SERVICE	LOCATION	NIAGARA FALLS, NY		
PROCESS DATA				
Service:	Infrequent Pumping Chlorinated Hydrocarbons (Non-Aqueous Phase Liquid) from a Mobile Tank to a Storage Tank			
S.G.:	1.1	Rated Flow:	5 GPM	
		TDH:	20 ft.	
Temp:	Ambient	Viscosity:	20 Centistokes (Max)	
	This service has the potential for mild abrasion.			
<u>Mechanical Design</u>				
Type:	Drum Pump, Progressive Cavity			
Manuf. & Model:	Lutz B-70 High Viscosity			
Materials of Const.:	316 SS, Teflon Stator			
Tube Diameter:	2 in.			
Tube Depth:	40 in.			
Discharge Nozzle:	1 1/4 in. Hose			
Motor:	620KW (1 HP) Lutz B-40, 115v/1 Phase/60 Hz, Explosion Proof			
Est. Weight:	16 lbs.			
* Aqueous Phase Leachate				

* Information to be furnished/verified by Vendor.

Design by B. Somers	Fluor Daniel	App.	Rev. No. B	By A. Bumb
Date 11/03/92	Client	App.	Date 9/8/95	App.

Lutz HIGH VISCOSITY B-70

B-70 High Viscosity Pump

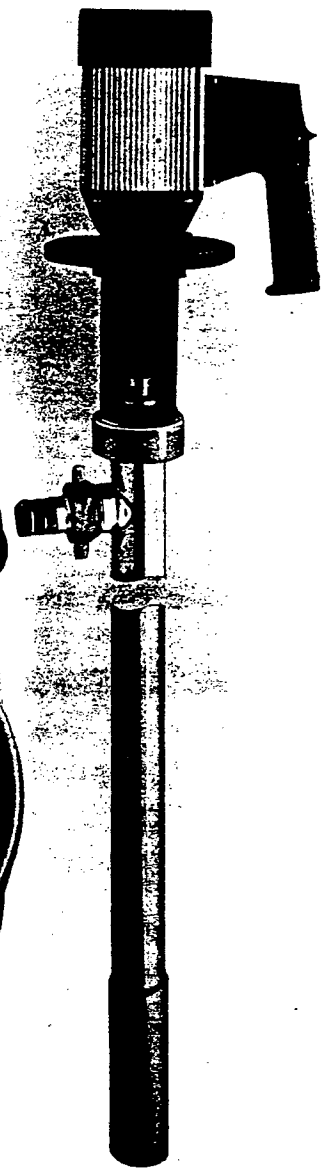
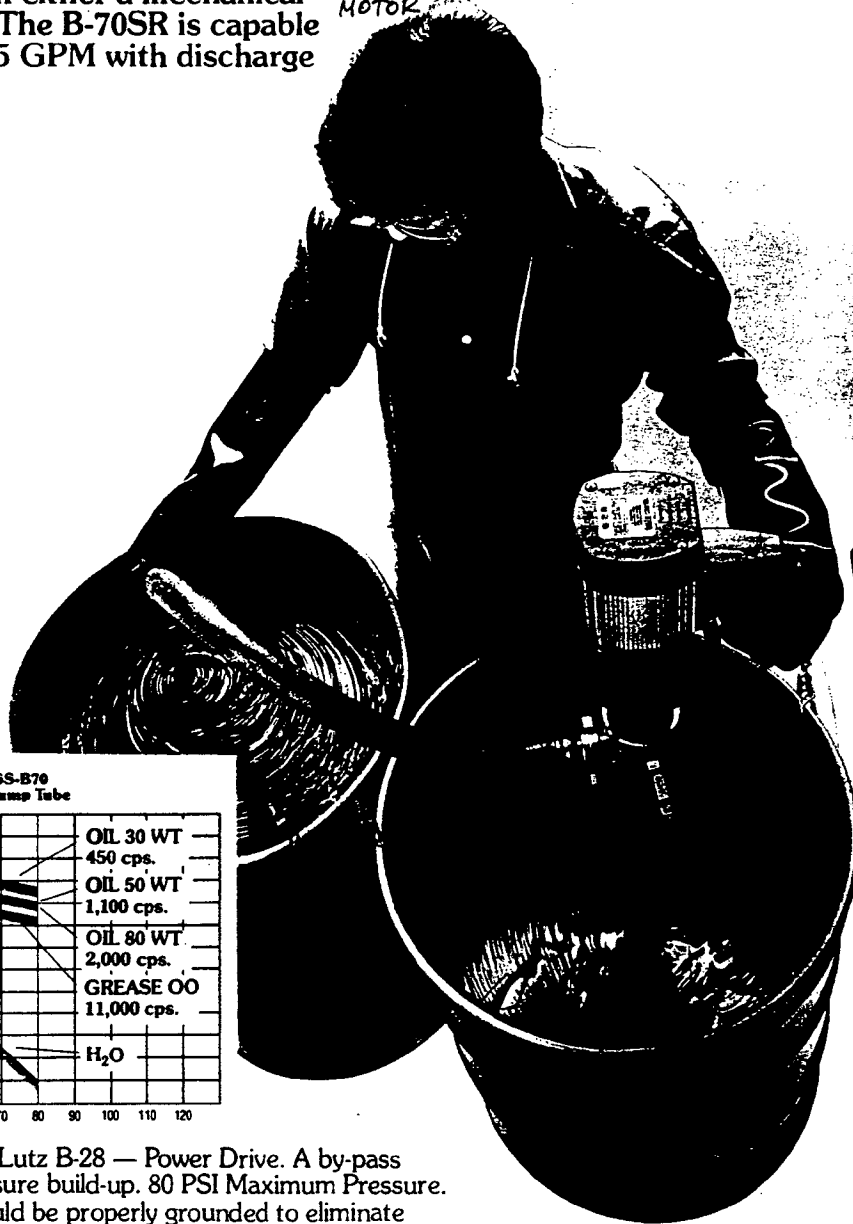
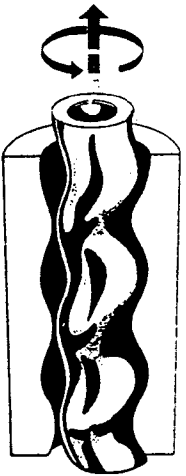
Designed specifically for the transfer of highly viscous materials (up to 60,000 cps*). The B-70SR is a progressive cavity-positive displacement pump. The built in gear reduction system reduces the actual pump speed to approximately 600 RPM. The B-70SR is constructed of 316SS with Teflon® Stator. Buna-N stators are also available. The B-70SR is available with either a mechanical seal or stuffing box. The B-70SR is capable of flow rates up to 5.5 GPM with discharge pressures to 80 PSI.

*(When using 4-AL motor.)

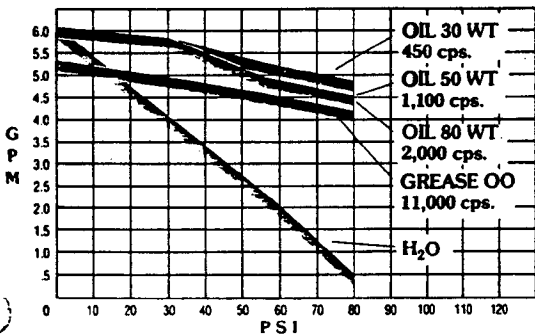
Some common applications include the transfer of oils, grease, inks, soap, shampoo, etc. Specifications - immersion depth 39", tube diameter 2", hose connection - 1/4". Weight of Pump Tube only: 16 lbs.

THE B-70 PUMP IS INTERCHANGEABLE WITH LUTZ MOTORS 4AL, B-28, B55T, and

→ B-40 UL.
MOTOR



B-28 Motor with SS-B70 SR High Viscosity Pump Tube



Based on materials at 70°F. Lutz B-28 — Power Drive. A by-pass must be used to avoid pressure build-up. 80 PSI Maximum Pressure. Pumps and Containers should be properly grounded to eliminate the possibility of electrostatic discharge.

Lutz[®] MULTIPURPOSE MECHANICAL SEAL DRUM PUMPS

Interchangeable with all Lutz[®] Motors and Tubes

B-40 Motor

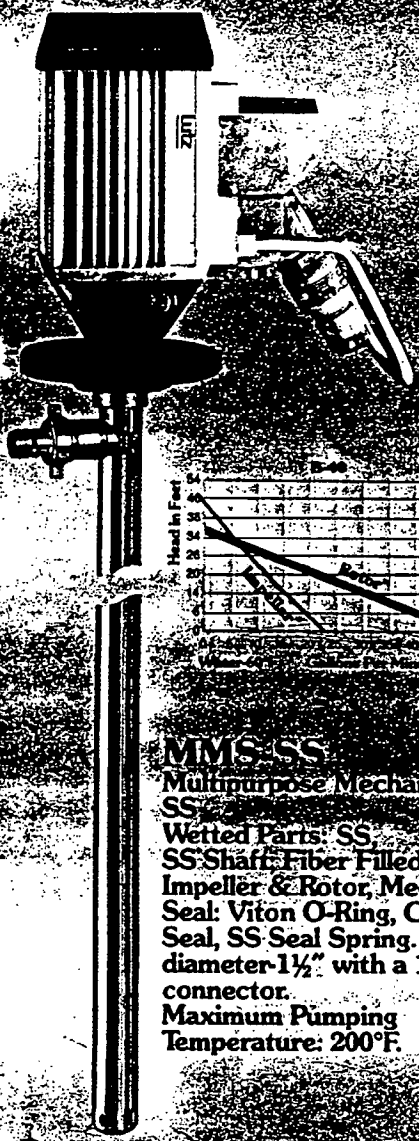
115v/60/1/620 Watts. U.L. Listed-Class I, Groups C&D Class II, Group G. Explosion Proof. Thermal overload protected, automatic reset. 16-ft. cord, 3-wire with ground wire. Explosion proof plug not included. WF-173116. Max. Viscosity—750 cps. Max. Specific Gravity—1.8

4AL Motor

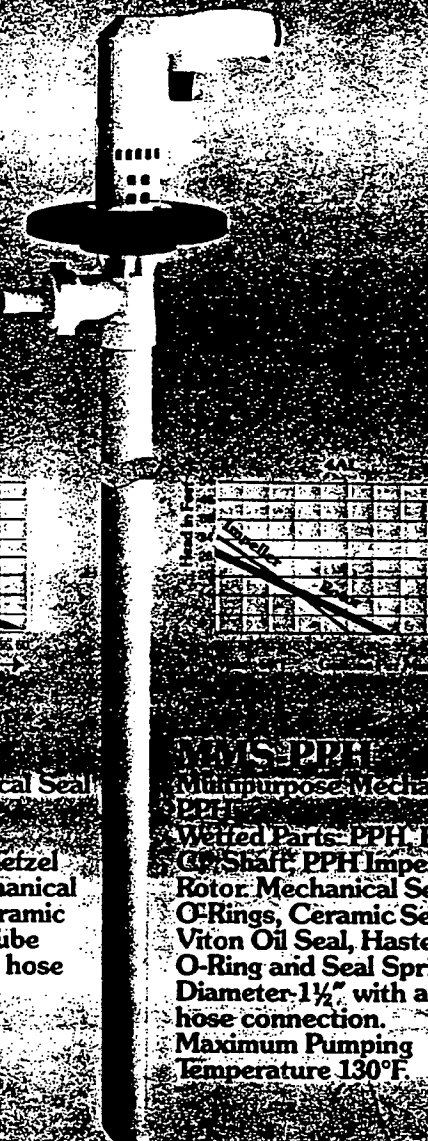
7500 RPM @ 90 PSI. 17 CFM Pneumatic. 3/8" air-line connection. Flame proof muffer and filter. Automatic oiler and moisture trap recommended. Suitable for hazardous duty. WF-4115. Max. Viscosity—320 cps. Max. Specific Gravity—1.4

4-GT Motor

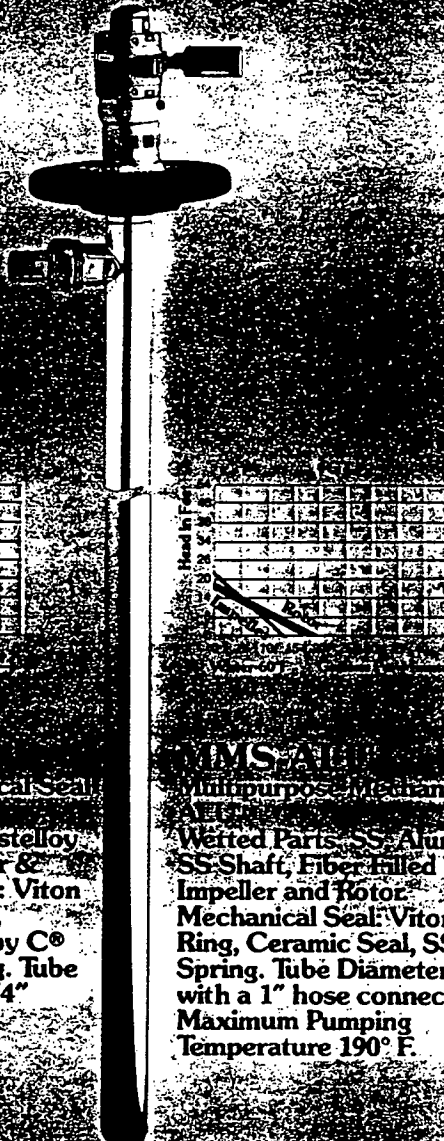
7500 RPM @ 87 PSI, 14 CFM Pneumatic. 1/8" air-line connection. Automatic oiler and moisture trap recommended. Suitable for hazardous duty. WF-4116. Max. Viscosity—150 cps. Max. Specific Gravity—1.4



MMS-SS
Multipurpose Mechanical Seal
SS
Wetted Parts: SS, SS Shaft, Fiber Filled Tefzel Impeller & Rotor, Mechanical Seal: Viton O-Ring, Ceramic Seal, SS Seal Spring. Tube diameter-1 1/2" with a 1" hose connector.
Maximum Pumping Temperature: 200°F.



MMS-PPH
Multipurpose Mechanical Seal
PPH
Wetted Parts: PPH, Hastelloy C® Shaft, PPH Impeller & Rotor, Mechanical Seal: Viton O-Rings, Ceramic Seal, Viton Oil Seal, Hastelloy C® O-Ring and Seal Spring. Tube Diameter-1 1/2" with a 3/4" hose connection.
Maximum Pumping Temperature 130°F.



MMS-ALU
Multipurpose Mechanical Seal
ALU
Wetted Parts: SS, Aluminum, SS Shaft, Fiber filled Tefzel Impeller and Rotor, Mechanical Seal: Viton-O-Ring, Ceramic Seal, SS Seal Spring. Tube Diameter-1 1/2" with a 1" hose connection.
Maximum Pumping Temperature 190°F.

All Pump tubes have several tapered ridges on the hose connection to prevent slippage and leakage during operation. Threaded connection on all tubes. For safety, a banding style clamp is recommended for use on the hose connections. Pumps and containers should be properly grounded to eliminate the possibility of electrostatic discharge. Pump tubes are available in 27" for carboys, 39" for 55-gallon drums, and 47" for vats.

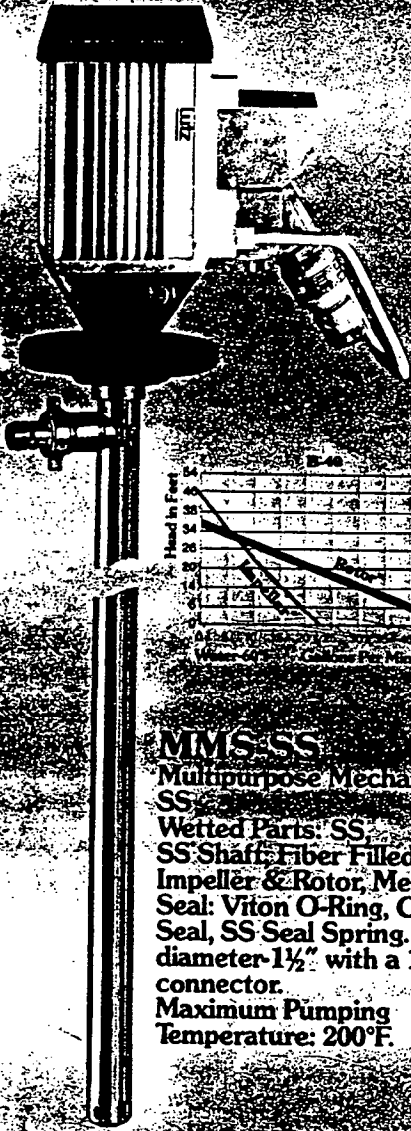
Lutz® MULTIPURPOSE MECHANICAL SEAL DRUM PUMPS

Interchangeable with all Lutz® Motors and Tubes

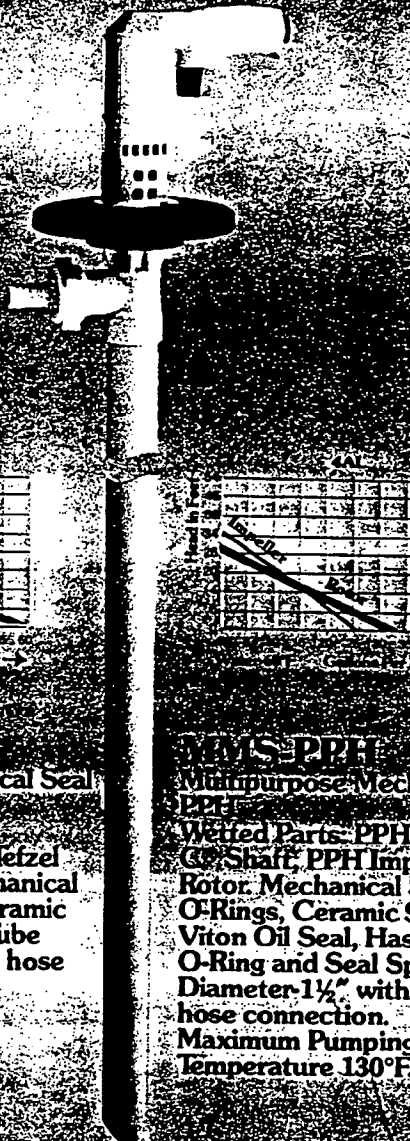
B-40 Motor
 115v/60/1/620 Watts, U.L. Listed-Class I, Groups C&D Class II, Group G-Explosion Proof Thermal overload protected, automatic reset, 16-ft. cord, 3-wire with ground wire. Explosion proof plug not included. Wt. 17.8 lbs.
 Max. Viscosity—750 cps
 Max. Specific Gravity—1.8

4AL Motor
 7500 RPM @ 90 PSI, 17 CFM Pneumatic, 3/8" air-line connection. Flame proof, muffler and filter. Automatic oiler and moisture trap recommended. Suitable for hazardous duty.
 Wt. 49 lbs.
 Max. Viscosity—320 cps
 Max. Specific Gravity—1.4

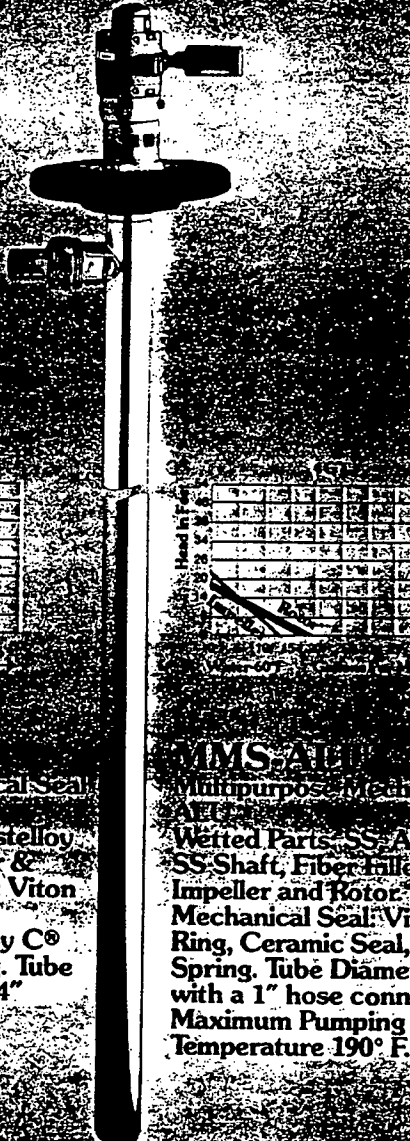
4-GT Motor
 7500 RPM @ 87 PSI, 14 CFM Pneumatic, 1/8" air-line connection. Automatic oiler and moisture trap recommended. Suitable for hazardous duty. Wt. 11 lb.
 Max. Viscosity—150 cps
 Max. Specific Gravity—1.4



MMS-SS
 Multipurpose Mechanical Seal
 SS
 Wetted Parts: SS, SS Shaft, Fiber Filled Tefzel Impeller & Rotor, Mechanical Seal: Viton O-Ring, Ceramic Seal, SS Seal Spring. Tube diameter 1 1/2" with a 1" hose connector.
 Maximum Pumping Temperature: 200°F.



MMS-PPH
 Multipurpose Mechanical Seal
 PPH
 Wetted Parts: PPH, Hastelloy C® Shaft, PPH Impeller & Rotor, Mechanical Seal: Viton O-Rings, Ceramic Seal, Viton Oil Seal, Hastelloy C® O-Ring and Seal Spring. Tube Diameter 1 1/2" with a 3/4" hose connection.
 Maximum Pumping Temperature 130°F.



MMS-ALU
 Multipurpose Mechanical Seal
 ALU
 Wetted Parts: SS, Aluminum, SS Shaft, Fiber filled Tefzel Impeller and Rotor, Mechanical Seal: Viton O-Ring, Ceramic Seal, SS Seal Spring. Tube Diameter 1 1/2" with a 1" hose connection.
 Maximum Pumping Temperature 190° F.

All Pump Tubes have several tapered ridges on the hose connection to prevent slippage and leakage during operation. Threaded connection on all tubes. For safety, a banding style clamp is recommended for use on the hose connection. Pumps and containers should be properly grounded to eliminate the possibility of electrostatic discharge. Pump tubes are available in 27" for carboys, 39" for 55-gallon drums, and 47" for vats.

WATER TREATMENT SYSTEM

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the minimum requirements to be met in the design, fabrication, supply and installation of the Water Treatment System (WTS). The WTS shall be designed to remove suspended solids and contaminants from the construction waters generated during the remediation of the 102nd Street Landfill Site in Niagara Falls, New York. The system shall be operate for a period up to 2 years during remedial activities. No water will be treated during the winter months, therefore no heat tracing or insulation shall be required on the piping or equipment.

The WTS shall be prefabricated, skid or trailer mounted complete with piping, wiring and controls.

B. Related Specifications

Coordinate work prescribed by this specification with work prescribed in Specification 15179 - Holding Tank

1.2 Submittals

The WTS vendor shall submit the following documents.

A. Submit Shop Drawings Indicating:

1. All engineering data on the equipment supplied.
2. Overall dimensions and site preparation requirements
3. Nozzle or inlet sizes, ratings, facings, locations and flow direction
4. Weight of components and total assembled weight
5. Materials of construction
6. Parts lists
7. Motor characteristics

B. Operating Instructions:

1. Installation instructions
2. Operating instructions
3. Winterizing instructions
4. Parts and materials identification list
5. Lubrication instructions

1.3 Performance

The WTS shall be designed to handle a maximum flow rate of 70 gpm at the maximum inlet concentrations shown in Table 1-1 and meet the effluent requirements shown in Table 1-2. The system shall be a temporary installation for use during the remedial activities on the site. Total operating time shall be approximately 6 months per season. During the winter months

WATER TREATMENT SYSTEM

the system shall be winterized and shutdown. The system shall provide a minimum of 8,000 lbs of Calgon Fitratorb 300, or equivalent, carbon to limit the frequency of removal.

The carbon system shall be capable of operating on a continuous basis with any necessary periods of shutdown for checks or preventative maintenance clearly defined by the vendor. Backwashing the sand filter shall be accomplished by shutting down the feed pump, manually switching valves and starting the backwash pump.

A temporary 250,000 gallon holding tank, which is described in Specification 15179, will be used along with the WTS to handle the on-site generated water. This tank shall be used to remove the majority of sediment prior to pumping to the sand filter and to equalize the constituent loading prior to the treatment system. Using this tank effectively can reduce the peak water flow rates and the influent concentrations.

1.4 Contractor's Responsibilities

The Contractor shall be responsible for implementing the Water Management and Treatment activities described in Attachment 1. The Contractor shall provide sampling and analytical testing as necessary to show conformance with the discharge criteria.

2.0 PRODUCTS

2.1 General Description:

A shop fabricated, skid or trailer mounted WTS shall be provided for treatment of construction water during the remediation of the site. The system shall consist of a transfer pump, a pressure sand filter with backwash capability, a 3000 gallon filtered water backwash tank, activated carbon columns, and an effluent metering tank. The WTS shall include all piping, electrical and instrumentation for a fully functional system. Sample connections shall be provided on the system as shown on the process flow diagram in Figure 1.

The treatment system shall be designed for continuous duty at a maximum flow rate of 70 gpm. The carbon system shall have a maximum surface loading rate of 3 gpm per square foot of bed area and a total bed depth of greater than 10 feet.

The Filter Feed transfer pump shall be rated at 70 gpm and shall pump water from the Holding Tank (to be supplied separately) to the sand filter. The sand filter shall have a maximum surface loading rate of 4 gpm per square foot. The filtered water shall enter a 3,000 gallon opened top Filtered Water Tank. The filter shall continue to operate until the differential pressure reaches 15 psig. A pressure gage shall be provided on the inlet to the filter so the operator knows when to backwash. Backwashing shall be manually achieved by closing and opening the appropriate valves and then starting the backwash pump. Backwashing shall continue for at least 10 minutes at 200 to 250 gpm with the backwash water going back to the Holding Tank.

The carbon column feed pump shall pump the filtered water through the carbon columns and into a 1000 gallon clearwell. The transfer pump will be controlled on level in the filtered water tank with on/off set points at the appropriate level to provide adequate water for the next backwash cycle. Piping and valves shall be provided on the carbon system to allow

WATER TREATMENT SYSTEM

changing the lead/lag positions of the columns when the carbon in one column becomes exhausted. The system design shall allow the exhausted carbon to be removed, new carbon added, and the column put back in service in the lag position or provide for replacement of carbon units (vessel/container and carbon).

A 1,000 gallon clearwell tank shall be provided for flow measurement and as the effluent sampling point. A weir shall be provided in the clearwell for determining flow rate. A level/flow meter shall also be provided on the upstream side of the weir for indicating and recording flow rate. A pump shall be provided to transfer the contents of the clearwell to the river. The pump shall be controlled by a level switch in the outlet side of the clearwell.

The system shall include sufficient instrumentation, such as, pressure gages and level indicators, to adequately operate and maintain the equipment. Field electrical connections shall be made at only to the main switch panel on the skid.

Sampling connections shall be provided on the discharge of the filter feed pump and in between the lead and lag carbon columns.

3.0 EXECUTION

3.1 Installation

The WTS shall be delivered to the site for installation by the on-site contractor. The location of the WTS is shown on Drawing 594000-10Q-01.

3.2 Operating Procedures

The WTS will operate on a continuous basis as much as possible. During the winter when construction activity has halted, the WTS will be winterized. The transfer system for all sources of influent to the WTS will use engineering controls to limit pumping sediment to the holding tank. This includes the use of silt fences, pump screens and other methods to minimize the transport of sediment. The WTS will operate 24 hours/day even though construction activity may be shorter in order to work off the water in the holding tank and prepare for the next day's construction activity. System operation, including tank levels, flow rates, pressure drops and system mechanical integrity, will be checked at least every four hours during operation. More frequent inspections will be required during high flow conditions or when treating high turbidity water. Sediment levels will be checked daily in the holding tank and removed when the sediment level interferes with operation or creates a risk to the holding tank. In the event the holding tank becomes full of water, construction dewatering activities must stop until sufficient volume is again available. Conversely, if daily collected water volumes are expected to be relatively low or if the concentration of site chemicals is relatively high (as indicated by portable VOC meter at the trench) then it would be beneficial to inventory water in the holding tank for equalization.

The sand filter will be backwashed manually based on pressure drop. The source of backwash water will be the filtered water tank. Dirty backwash water will be discharged back to the holding tank. The filtered water tank will be sized for a 15 minute backwash or 3,000 gallons.

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 11231
Page 4 of 9
2-5-96/Rev. No. 1

WATER TREATMENT SYSTEM

Water from the filtered water tank will be pumped to the carbon system which consists of two (2) carbon columns in series. Once breakthrough is detected in the lead column the operator will take it out of service. The spent carbon will be slurried out and new carbon will be added. This column will then by the lag (polishing) column and the other will become the lead column. Effluent from the carbon system will be discharged to the Niagara River.

The effluent line will be metered to indicate, records and totalize the flow rate. Grab samples permit monitoring will be taken from this effluent.

3.3 Removal

Contractor will decontaminate system and remove from site at end of project. Spent carbon and sand media may be reclaimed or disposed under the cap in accordance with Specification 02200 - Earthwork.

4.0 ATTACHMENTS

Attachment 1: Water Management During Remedial Activities at the 102nd Street Landfill Remediation Project.

NOTE: Discrepancies between Attachment 1 and the specifications are governed by the specification.

END OF SPECIFICATION

WATER TREATMENT SYSTEM

Parameter	WTS Influent⁽¹⁾ Concentration (ppb)
Flow	70 gpm
Solids, Total Suspended	2,000
Benzene	5,099
Toluene	138
Chlorobenzene	2,460
2-Monochlorotoluene	19
4-Monochlorotoluene	15
1,2-Dichlorobenzene	144
1,4-Dichlorobenzene	417
1,2,3-Trichlorobenzene	263
1,2,4-Trichlorobenzene	903
1,2,3,4-Tetrachlorobenzene	890
1,2,4,5-Tetrachlorobenzene	157
Hexachlorobenzene	10
alpha Hexachlorocyclohexane	107
beta Hexachlorocyclohexane	21
gamma Hexachlorocyclohexane	46
delta Hexachlorocyclohexane	115
2,5-Dichloroaniline	1,133
3,4-Dichloroaniline	10
Phenolics, Total	16

WATER TREATMENT SYSTEM

TABLE 1-1 WTS INFLUENT PARAMETERS 102ND STREET LANDFILL	
Parameter	WTS Influent⁽¹⁾ Concentration (ppb)
2-Chlorophenol	34
4-Chlorophenol	304
2,4-Dichlorophenol	199
2,5-Dichlorophenol	156
2,4,5-Trichlorophenol	50
2,4,6-Trichlorophenol	11
2-Chlorobenzoic Acid	100
3-Chlorobenzoic Acid	100
4-Chlorobenzoic Acid	237
Chloroform	5
Tetrachloroethylene	45
1,2-Trans-Dichloroethylene	146
Trichloroethylene	91
2,4-Dimethylphenol	20
Pentachlorophenol	15
1,3-Dichlorobenzene	96
Di-N-Butyl Phthalate	20
Aniline	7
Carbon Disulfide	10
Arsenic	89
Antimony, Total	12
Cadmium, Total	13

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 11231
Page 7 of 9
2-5-96/Rev. No. 1

WATER TREATMENT SYSTEM

TABLE 1-1 WTS INFLUENT PARAMETERS 102ND STREET LANDFILL	
Parameter	WTS Influent⁽¹⁾ Concentration (ppb)
Chromium, Total	7
Copper, Total	11
Lead, Total	14
Mercury	10
Nickel, Total	32
Thallium, Total	18
Zinc, Total	75

Client Name: OxyChem/Olin
 Project Name: Remedial Action
 102nd Street Landfill Site

Project Specification 11231
 Page 8 of 9
 2-5-96/Rev. No. 1

WATER TREATMENT SYSTEM

TABLE 1-2 EFFLUENT LIMITATIONS		
Effluent Parameter	Discharge Limitations	Units
	Daily Max.	
<u>Outfall 001 - Treatment Plant Effluent:</u>		
Flow	Monitor	gpd
Solids, Total Suspended	42	lbs/d
Benzene	0.01	lbs/d
Toluene	0.01	lbs/d
Chlorobenzene	0.01	lbs/d
Monochlorotoluenes	0.01	lbs/d
Sum of Dichlorobenzenes	0.03	lbs/d
Sum of Trichlorobenzenes	0.01	lbs/d
Sum of Tetrachlorobenzenes	0.01	lbs/d
Hexachlorobenzene	0.01	lbs/d
Sum of Hexachlorocyclohexanes	0.01	lbs/d
2,5-Dichloroaniline	0.02	lbs/d
3,4-Dichloroaniline	0.01	lbs/d
Phenolics, Total	0.01	lbs/d
2,4-Dichlorophenol	0.01	lbs/d
Chloroform	0.01	lbs/d
Tetrachloroethylene	0.01	lbs/d
1,2-(trans)-Dichloroethylene	0.01	lbs/d
Trichloroethylene	0.01	lbs/d
Pentachlorophenol	0.01	lbs/d

WATER TREATMENT SYSTEM

**TABLE 1-2
 EFFLUENT LIMITATIONS**

Effluent Parameter	Discharge Limitations	Units
	Daily Max.	
Aniline	0.01	lbs/d
Di-(N-Butyl) Phthalate	0.01	lbs/d
2-Chlorophenol	0.01	lbs/d
4-Chlorophenol	0.01	lbs/d
2,5-Dichlorophenol	0.01	lbs/d
2,4,5-Trichlorophenol	0.01	lbs/d
2,4,6-Trichlorophenol	0.01	lbs/d
2,4-Dimethylphenol	0.01	lbs/d
Arsenic, Total	0.1	lbs/d
Antimony, Total	0.03	lbs/d
Cadmium, Total	0.03	lbs/d
Chromium, Total	0.02	lbs/d
Copper, Total	0.03	lbs/d
Lead, Total	0.04	lbs/d
Mercury, Total	0.01	lbs/d
Nickel, Total	0.1	lbs/d
Thallium, Total	0.05	lbs/d
Zinc, Total	0.19	lbs/d
Sum of Chlorobenzoic Acids	0.34	lbs/d

**WATER MANAGEMENT DURING REMEDIAL
ACTIVITIES**

AT THE

**102ND STREET LANDFILL REMEDIATION
PROJECT**

August 25, 1995

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1. INTRODUCTION	1
2. DESIGN BASIS	2
3. CONSTRUCTION SEQUENCE	8
4. WATER TREATMENT SYSTEM DESCRIPTION	8
5. OPERATING PROCEDURES	8
6. EFFLUENT CHARACTERISTICS	11
7. OTHER INFORMATION	13

1. INTRODUCTION

Remediation of the 102nd Street Landfill Site (Site) requires the removal of embayment sediments and the construction of groundwater collection systems. Water draining from the sediments, APL trench dewatering and some surface water will be treated prior to discharge. An on-site treatment system will be constructed to treat these waters and will include a holding tank, sand filters and a carbon filtration system.

Rainfall surface runoff from the majority of the Site will not come in contact with Site chemicals and only suspended sediment removal is required. This runoff will flow to a sedimentation pond and through a filter curtain into a clear pond. Erosion control measures will be provided on the Site during construction which will reduce the amount of flow and sediment to the sedimentation pond. The contents of the sedimentation pond will be periodically pumped to the Niagara River.

All treatment facilities will be used for temporary service since construction is scheduled to be completed in approximately two years. Minimal work will be performed during the winter months and the treatment facility will be shutdown during these periods. Total operating time of the water treatment plant will be approximately 12 months.

2. DESIGN BASIS

• FLOW

Construction water collected during the remedial activities at the 102nd Street Landfill will be managed by a sedimentation pond and by a water treatment system (WTS). Construction water will consist of the following:

<u>System</u>	<u>Source</u>
Water Treatment System	<ul style="list-style-type: none">• Rainwater surface runoff which has come in contact with site chemicals• APL collection trench construction water• Slurry wall construction water• Water between "mud" line and top of sediments in the embayment• Free-draining water contained within embayment sediments• Seepage under the cofferdam• Groundwater flow into the embayment
Sedimentation Pond	<ul style="list-style-type: none">• General rainwater surface runoff

Water decanted from above the "mud" line in the shallow embayment will be discharged directly to the Niagara River. Construction water management is discussed below:

1) Water Treatment System (Outfall 001)

- Rainwater Surface Runoff from Bermed Area

Surface runoff which has potential to come in contact with Site chemicals will be isolated by berms, collected separately and pumped to the holding tank of the water treatment system. This area is estimated at four (4) acres. Based on a two (2)-inch rainfall (1 yr. - 24 hr) and $C = 0.5$ this will contribute a volume of approximately 110,000 gallons. Once clean fill is placed over these areas this runoff will collect in the sedimentation pond.

In the unlikely event the sedimentation pond overflows, the water will drain into the embayment and be handled with the embayment water.

- APL Trench

The groundwater flow into the APL trench is estimated at 100 gpd lineal foot of trench. Assuming 200 lineal feet of trench is dewatered during construction the flow rate will be 20,000 gpd.

- **Slurry Wall**

The slurry wall dewatering requirements are similar to the APL trench; however, the amount of trench exposed will be 50 feet. Flow from this activity is estimated at 5,000 gpd.

- **Shallow Embayment, Free Draining Water (Sediment)**

Once decanting the surface water in the embayment is complete then dewatering trenches may be constructed to drain the interstitial water in the sediment. Based on a total excavated area of 6.1 acres, an excavation depth of two (2) feet, 36 percent voids filled with water and 67 percent free drainage, the volume of water will be approximately 1 MM gallons. This volume will be pumped over a four (4)-week period at the rate of 30 gpm to the holding tank. A major storm event of two (2)-inches over the entire nine (9)-acre embayment, inside the cofferdam, would result in an additional 0.5 MM gallons that may require treatment.

- **Shallow Embayment, Groundwater and Cofferdam Seepage**

Dewatering will continue during the construction of the bulkhead. Flow will be based on seepage under the cofferdam and upward flow of groundwater or groundwater flow from the site. The combined total is conservatively estimated to be 20,000 gpd with a pumping rate of 30 gpm.

- **NAPL Recovery Well**

Installation of NAPL recovery wells will not generate significant volumes of water. Any water will be taken to OxyChem Niagara Plant for treatment in the U Area carbon adsorption system and discharged under permit to the NFWWTP

2) **Sedimentation Pond (Outfall 002)**

General surface runoff from the Site will be collected in the sedimentation pond during most of the construction activities. At the end of the remediation activities, the sedimentation pond will be incorporated/graded into cap fill and runoff will consist of sheet flow to the Niagara River. The proposed sedimentation pond has a capacity of approximately 500,000 gallons. This is adequate to retain the runoff from an area of 25 acres (approximate area of the Site inside the slurry wall) for a 10 year - 24 hour duration rainfall of 3.5 inches. The actual area contributing to the sedimentation pond will be a function of construction activities. The work will be phased to minimize the disturbed area. Areas brought to finished subgrade will be routed through separate, individual filter traps and will not contribute to the sedimentation pond.

3) **Shallow Embayment, Decanting (Outfall 003)**

The water in the embayment, within the cofferdam, will initially be decanted and discharged directly to the Niagara River. If the turbidity exceeds 17 NTUs the flow will be diverted to the holding tank or pumping will cease. The volume of water in the embayment is approximately 3 MM gallons. Approximately 2.2 MM gallons will be

discharged directly to the Niagara River at a rate of approximately 200 gpm. Certain areas in the embayment may be isolated and separate decanting performed with discharge to the WTS holding tank. This volume will be approximately 220,000 gallons with a discharge rate of approximately 20 gpm. Engineering controls will be used to manage the water volumes.

Table 1 summarizes the volumes and flow rates to the Water Treatment System (Outfall 001). The design flow rate of the WTS is based on continuous treatment of collected water on an extended basis. Embayment water between the mud line and the sediment will be pumped at a rate of 70 gpm (20 gpm from contained areas and 50 gpm from general areas). The WTS will therefore be designed to process 70 gpm.

TABLE 1 SUMMARY OF FLOW TO WATER TREATMENT SYSTEM				
Description	Estimated Rate	Estimated Duration	Rainfall Runoff per Major Event	Estimated Total Volume
Rainwater Surface Runoff from bermed area		5 weeks	110,000 gal (for 2-inch rain)	0.25MM gal
APL Trench (Onshore)	20,000 gpd	4 weeks		0.25MM gal
Slurry Wall	5,000 gpd	4 weeks		0.1MM gal
Shallow Embayment Water				
Contained Areas	220,000 gal/20 gpm	2 weeks		0.20MM gal
General (Muddy)	800,000 gal/50 gpm	2 weeks		0.80MM gal
Embayment Sediment Free Draining Water	1,000,000 gal/30 gpm	4 weeks		1.0MM gal
Rainwater into Embayment		12 weeks	500,000 gal (for 2-inch rain)	2.0MM gal
Groundwater and Cofferdam Seepage	20,000 gpd	12 weeks		1.7MM gal
Sedimentation Pond to Holding Tank		26 weeks		0.3MM gal
TOTAL				6.6MM gal

(1) Based on 40" rainfall/year x 0.1 years = 4" rainfall x 4 acre x 0.5

(2) Based on 40" rainfall/year x 0.25 years = 10" rainfall x 9 acres

• CHEMICAL LOADING TO WATER TREATMENT PLANT (OUTFALL 001)

An evaluation of existing groundwater sampling data was performed to determine the loading to the water treatment system. Table 2 lists the WTS influent parameters. The data used to estimate influent concentrations was obtained from monitoring wells listed in Table 3.

TABLE 2 WTS INFLUENT PARAMETERS 102ND STREET LANDFILL	
Parameter	WTS Influent ⁽¹⁾ Concentration (ppb)
Flow	70 gpm
Solids, Total Suspended	2,000
Benzene	5,099
Toluene	138
Chlorobenzene	2,460
2-Monochlorotoluene	19
4-Monochlorotoluene	15
1,2-Dichlorobenzene	144
1,4-Dichlorobenzene	417
1,2,3-Trichlorobenzene	263
1,2,4-Trichlorobenzene	903
1,2,3,4-Tetrachlorobenzene	890
1,2,4,5-Tetrachlorobenzene	157
Hexachlorobenzene	10
alpha Hexachlorocyclohexane	107
beta Hexachlorocyclohexane	21
gamma Hexachlorocyclohexane	46
delta Hexachlorocyclohexane	115
2,5-Dichloroaniline	1,133
3,4-Dichloroaniline	10
Phenolics, Total	16
2-Chlorophenol	34
4-Chlorophenol	304
2,4-Dichlorophenol	199
2,5-Dichlorophenol	156
2,4,5-Trichlorophenol	50

**TABLE 2
WTS INFLUENT PARAMETERS
102ND STREET LANDFILL**

Parameter	WTS Influent ⁽¹⁾ Concentration (ppb)
2,4,6-Trichlorophenol	11
2-Chlorobenzoic Acid	100
3-Chlorobenzoic Acid	100
4-Chlorobenzoic Acid	237
Chloroform	5 ⁽²⁾
Tetrachloroethylene	45 ⁽²⁾
1,2-Trans-Dichloroethylene	146 ⁽²⁾
Trichloroethylene	91 ⁽²⁾
2,4-Dimethylphenol	20 ⁽²⁾
Pentachlorophenol	15 ⁽²⁾
1,3-Dichlorobenzene	96 ⁽²⁾
Di-N-Butyl Phthalate	20 ⁽²⁾
Aniline	7 ⁽²⁾
Carbon Disulfide	— 10 ⁽²⁾
Arsenic	89
Antimony, Total	12 ⁽²⁾
Cadmium, Total	13 ⁽²⁾
Chromium, Total	7 ⁽²⁾
Copper, Total	11 ⁽²⁾
Lead, Total	14 ⁽²⁾
Mercury	10
Nickel, Total	32 ⁽²⁾
Thallium, Total	18 ⁽²⁾
Zinc, Total	75 ⁽²⁾

⁽¹⁾ Average of selected wells from RI sample data

⁽²⁾ Representative Concentration from Comprehensive Waste Well Analysis, Table 5.4

Source of data:

Remedial Investigation Final Report, Volume 1, July 1990.

TABLE 3
GROUNDWATER ANALYTICAL DATA USED
TO ESTIMATE INFLUENT CONCENTRATIONS

MONITORING WELL NO.	TABLE NO. ⁽¹⁾
OW33	10.16
OW35	10.16
OW36	10.16
OW37	10.16
OW38	5.2, Part 1
CW-18	5.1, Part 1
CW-35	5.1, Part 1
MW-1	5.1, Part 1
MW-2	5.1, Part 1
MW-13	5.6
MW-14	5.6
MW-15	5.6
MW-16	5.6
OW49	10.16
OW34	10.16
OW51	10.16
MW-18	10.16
MW-22	10.16
MW-3	10.17
OW47	10.17
OW40	10.17
MW-19	10.17
MW-17	10.17
OW43	10.17
OW30	10.17
OW25	10.17

⁽¹⁾ Indicated table is from Remedial Investigation, Final Report, Volume 1, July 1990.

3. CONSTRUCTION SEQUENCE

Construction schedule for activities are shown on a quarterly basis in the table below

REMEDIAL CONSTRUCTION ACTIVITIES SCHEDULE	
ACTIVITY	SCHEDULE
Remedial site work begins	April '96-June '96
Install sediment/clear pond	April '96-June '96
Install temporary water treatment plant	April '96-June '96
Decommission/Decon	July '97-Sept. '97

4. WATER TREATMENT SYSTEM DESCRIPTION

A flow diagram of the water treatment system is shown in Figure 1. The water treatment system (WTS) consists of a 250,000 gallon decant tank (holding tank), a sand filter and a carbon adsorption system. The holding tank is sized to provide surge volume and equalization for continuous and intermittent (stormwater) flows. The tank will be open top construction with an interior polyethylene liner. Three valved withdrawal points will be provided on the tank at 2, 4 and 6 feet above the bottom of the tank. A bottom drain will also be provided. The inlet to the tank will be located opposite the outlet.

Water from the holding tank will be pumped to the mixed media pressure filter. The filter diameter will be five (5) feet to provide a surface loading rate at average flow of two (2) gpm/square foot. The filter will be backwashed periodically from a filtered water tank. Backwashing will be at a rate of 10 to 15 gpm/square foot.

The carbon system will consist of two five (5)-foot diameter columns in series. No backwashing will be provided for the carbon system. Clean water from the effluent will be discharged to a clear well and then be pumped to the Niagara River.

5. OPERATING PROCEDURES

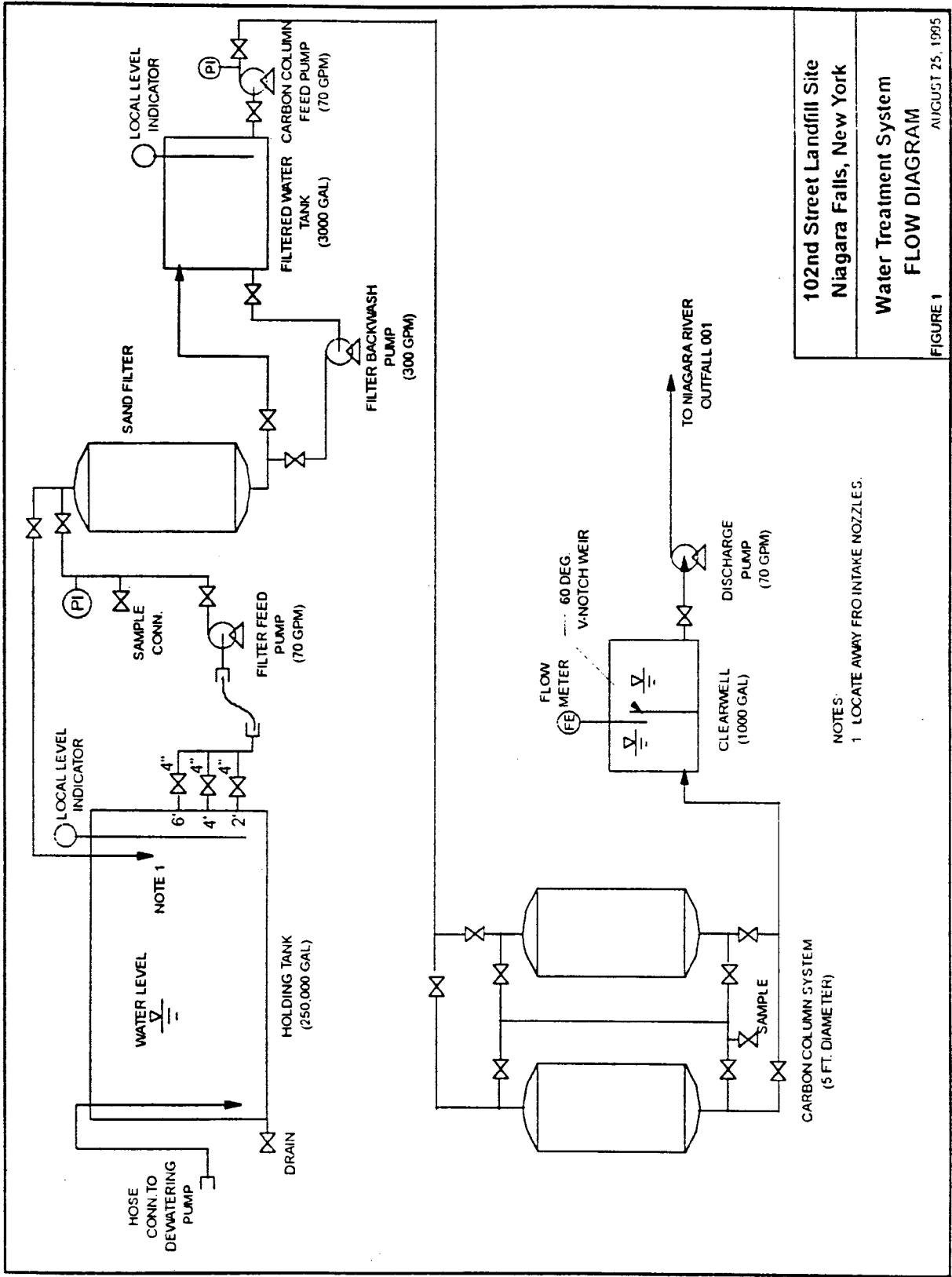
The WTS will operate on a continuous basis as much as possible. During the winter when construction activity has halted the WTS will be winterized. The transfer system for all sources of influent to the WTS will use engineering controls to limit pumping sediment to the holding tank. This includes the use of silt fences, pump screens and other methods to minimize the transport of sediment. The WTS will operate 24 hours/day even though construction activity may be shorter in order to work off the water in the holding tank and prepare for the next day's construction activity. System operation, including tank levels, flow rates, pressure drops and system mechanical integrity, will be checked at least every four hours during operation. More frequent

inspections will be required during high flow conditions or when treating high turbidity water. Sediment levels will be checked daily in the holding tank and removed when the sediment level interferes with operation or creates a risk to the hold tank. In the event the holding tank becomes full of water, construction dewatering activities must stop until sufficient volume is again available. Conversely, if daily collected water volumes are expected to be relatively low or if the concentration of site chemicals is relatively high (as indicated by portable VOC meter at the trench) then it would be beneficial to inventory water in the holding tank for equalization.

The sand filter will be backwashed automatically based on pressure drop. The source of backwash water will be the filtered water tank. Dirty backwash water will be discharged back to the holding tank. The filtered water tank will be sized for a 15 minute backwash or 3,000 gallons.

Water from the filtered water tank will be pumped to the carbon system which consists of two (2) carbon columns in series. Once breakthrough is detected in the lead column the operator will take it out of service. The spent carbon will be slurried out and new carbon will be added. This column will then be the lag (polishing) column and the other will become the lead column. Effluent from the carbon system will be discharged to the Niagara River.

The effluent line will be metered to indicate, record and totalize the flow rate. Grab samples for permit monitoring will be taken from this effluent.



102nd Street Landfill Site
Niagara Falls, New York

Water Treatment System
FLOW DIAGRAM

FIGURE 1 AUGUST 25, 1995

NOTES:
1 LOCATE AWAY FROM INTAKE NOZZLES.

6. EFFLUENT CHARACTERISTICS

EFFLUENT LIMITS

The Effluent Limits and Monitoring Requirements (DHWR No. 9-32-022) for the three outfalls of construction water to the Niagara River were issued on January 5, 1995 from the EPA and the New York State Department of Environmental Conservation (DEC). Table 3 presents these requirements. These limits are effective during the period beginning June 1, 1994 until January 1, 1997. An extension will have to be applied for if construction water discharges extend beyond this date.

**TABLE 3
EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS**

Outfall Number & Effluent Parameter	Discharge Limitations		Units	Minimum Monitoring Requirements	
	Daily Avg.	Daily Max.		Measurement Frequency	Sample Type
<u>Outfall 001 - Treatment Plant Effluent:</u>					
Flow	Monitor	Monitor	gpd	Continuous	Meter
Solids, Total Suspended	Monitor	42	lbs/d	Weekly	Grab
Benzene	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Toluene	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Chlorobenzene	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Monochlorotoluenes	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Sum of Dichlorobenzenes	Monitor	0.03	lbs/d	Weekly ⁽¹⁾	Grab
Sum of Trichlorobenzenes	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Sum of Tetrachlorobenzenes	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Hexachlorobenzene	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Sum of Hexachlorocyclohexanes	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
2,5-Dichloroaniline	Monitor	0.02	lbs/d	Weekly ⁽¹⁾	Grab
3,4-Dichloroaniline	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Phenolics, Total	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
2,4-Dichlorophenol	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Chloroform	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Tetrachloroethylene	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
1,2-(trans)-Dichloroethylene	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Trichloroethylene	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Pentachlorophenol	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Aniline	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab

**TABLE 3
EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS**

Outfall Number & Effluent Parameter	Discharge Limitations			Minimum Monitoring Requirements	
	Daily Avg.	Daily Max.	Units	Measurement Frequency	Sample Type
Di-(N-Butyl) Phthalate	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
2-Chlorophenol	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
4-Chlorophenol	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
2,5-Dichlorophenol	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
2,4,5-Trichlorophenol	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
2,4,6-Trichlorophenol	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
2,4-Dimethylphenol	Monitor	0.01	lbs/d	Weekly ⁽¹⁾	Grab
Arsenic, Total	Monitor	0.1	lbs/d	Weekly ⁽¹⁾	Grab
Antimony, Total	Monitor	0.03	lbs/d	Monthly	Grab
Cadmium, Total	Monitor	0.032	lbs/d	Monthly	Grab
Chromium, Total	Monitor	0.018	lbs/d	Monthly	Grab
Copper, Total	Monitor	0.028	lbs/d	Monthly	Grab
Lead, Total	Monitor	0.035	lbs/d	Monthly	Grab
Mercury, Total	Monitor	0.008	lbs/d	Weekly ⁽¹⁾	Grab
Nickel, Total	Monitor	0.096	lbs/d	Monthly	Grab
Thallium, Total	Monitor	0.045	lbs/d	Monthly	Grab
Zinc, Total	Monitor	0.19	lbs/d	Monthly	Grab
Sum of Chlorobenzoic Acids	Monitor	0.34	lbs/d	Weekly ⁽¹⁾	Grab
<u>Outfall 002 - Sedimentation Pond Discharge:</u>					
Flow	Monitor	Monitor	gpd	Continuous	Meter
Turbidity	Monitor	17	NTUs	Hourly	Grab
<u>Outfall 003 - Embayment Surface Water Discharge:</u>					
Flow	Monitor	Monitor	gpd	Continuous	Meter
Turbidity	Monitor	17	NTUs	Hourly	Grab

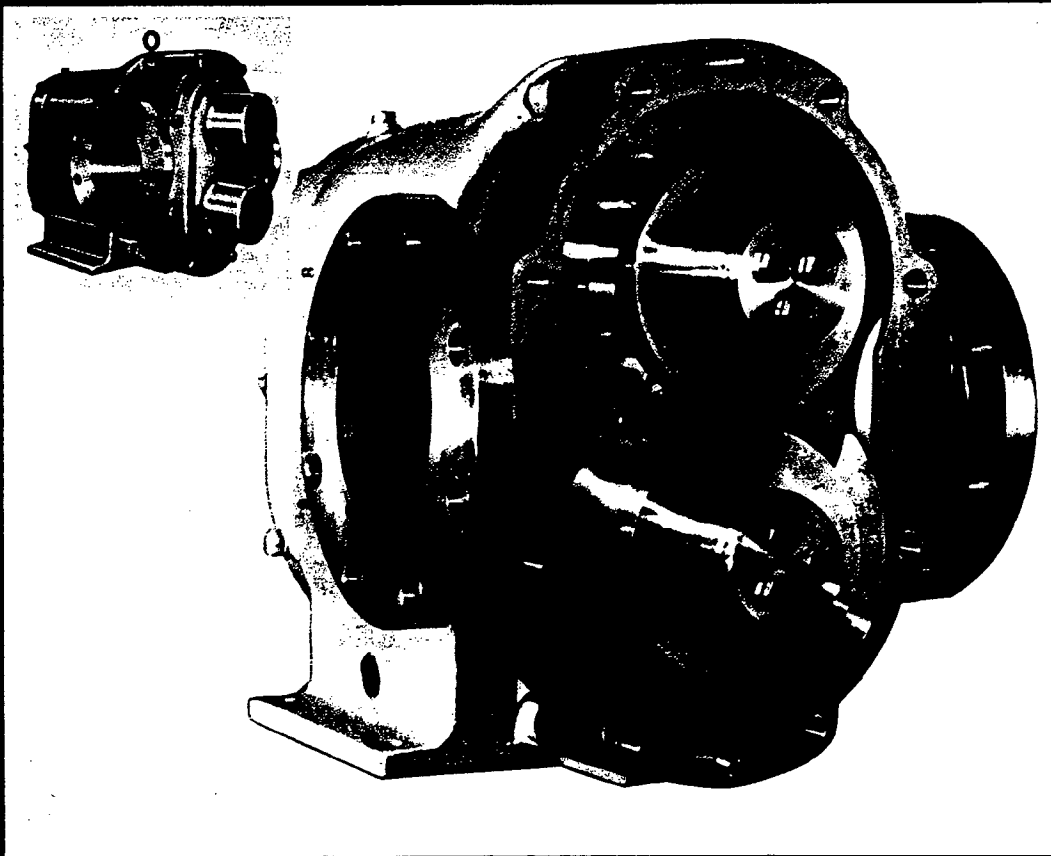
Note (1): The minimum measurement frequency for all the parameters (except flow) is monthly following a period of sixteen (16) consecutive sampling events showing no exceedances of the stated discharge limitations. If a discharge limitation for any parameter is exceeded the measurement frequency for all parameters will again be weekly, until a period of eight (8) consecutive sampling events shows no exceedances at which point monthly monitoring may resume.

EQUIP. No. P-311

WAUKESHA

Industrial *WIR*

ROTARY POSITIVE DISPLACEMENT



CORROSION-RESISTANT

• 316 Stainless Steel

WEAR-RESISTANT

• A395 Ductile Iron

EQUIPMENT DATA SHEET FUTURE NAPL TRANSFER PUMP	ITEM NO.	P-311	
	NO. REQ'D.	One (1)	
	REQ'N. NO.	COMM. NO.	
	P.O. NO.	PROJ. NO.	23594000
	PROJ.	OXYCHEM/OLIN REMEDIAL DESIGN	
SERVICE	LOCATION	NIAGARA FALLS, NY	

PROCESS DATA

Service: Pumping Chlorinated Hydrocarbons (Non-Aqueous Phase Liquid) from a Storage Tank to a Transfer Truck.

Rated Flow: 20 GPM

S.G. 1.1 to 1.6

TDH: 30 Ft.

Temp: Ambient

Viscosity 20 centistrokes (max)

PH: 6 to 8

This service has the potential for mild Abrasion.

Mechanical Design

Type: Lobe Pump - approx. 360 RPM

Manuf. & Model: Waukesha 25I

Materials of Const.: 316 SS Casing, Waukesha 88 Alloy Lobes & Shafts

Suction: 1 1/2 in., NPT

Discharge: 1 1/2 in., NPT

Seal: Mechanical Teflon/316 SS

Motor: 2 HP/1750 RPM/230 V.A.C./1 PH/60 Hz-TEFC

Est. Weight: 325 lbs.

* Information to be furnished/verified by Vendor.

Design by B. Somers	Fluor Daniel	App.	Rev. No. B	By A. Bumb
Date 11/03/92	Client	App.	Date 9/8/95	App.

SLURRY WALL

3.2 Lines and Grades

The slurry wall shall be constructed to the lines and grades shown on the Drawings. It is the intent of the specifications to key the slurry wall into the Clay/Till. In general, where the Clay/Till can be identified in the field during construction, the slurry wall shall be carried to the depth necessary to provide the desired key, irrespective of the elevations shown on the Drawings. Special care should be taken by the Contractor to limit this excavation of the Clay/Till to the three (3) feet required for the key. The Contractor shall not purposefully excavate greater than three (3) feet into the Clay/Till.

The Plan location of the slurry wall is given using site coordinates, and the Contractor shall use site coordinate system in controlling locations of his facilities as well as the slurry wall. In general, the Contractor shall exercise care to follow the line of the proposed slurry wall.

Following the grading of the site and preparation of the working platform, the Contractor shall lay out the proposed centerline of the slurry wall on the ground.

After the proposed centerline has been established, it shall be reviewed in detail in the field by the Owner and the Contractor, and the findings of that review shall be entered into the records of the project.

3.3 Excavation

A. Equipment

The equipment used for excavation of the trench shall be any type of earthmoving equipment suitable for efficiently performing the work indicated on the Drawings and as specified herein. The equipment employed must be capable of excavating a three (3)-foot minimum width trench in one pass through the key trench and the subsurface materials present to three (3) feet into the Clay/Till. If a dragline is used, the bucket shall be a perforated, heavy-duty model. The sides of the bucket shall have no protrusions for drag or hoist chains beyond the limits of the cutter teeth.

B. Procedures

The Contractor shall prepare the route of the slurry wall by grading the adjacent areas to direct storm runoff away from the line of the trench, and by grading the areas he proposes to use for mixing, storing, and handling slurry, and for the mixing and handling of backfill materials. Grading will be limited to six (6)-inches of soil within the limits of the landfill. No excavation will be permitted.

The site preparation work shall be not less than 100 feet in advance of trench excavation.

The Contractor shall construct berms as necessary to direct surface runoff from the slurry trench during excavation, backfilling, and closure operations. These surface water controls will be incorporated into the Site stormwater control plan. Surface runoff shall not be directed to the Niagara River and the contractor will take all necessary precautions to ensure that runoff, slurry, excavated materials and backfill do not enter the river. Following completion of construction, the berms outside the slurry wall shall be removed and the area shall be graded to the lines and grades shown on the Drawings.

SLURRY WALL

The Contractor shall construct working platforms for slurry wall construction as necessary to provide space at proper locations and gradients for bentonite slurry mixing, storage and placement, and for mixing, storage, and placing trench backfill. The working platform so constructed shall utilize embankment fill materials as specified under Section 02200 - Earthwork. Following completion of the slurry wall construction, the Contractor shall remove any excess embankment fill materials from the slurry wall working zone, and use the material to bring the landfill to the grades shown. The final placement and compaction of the embankment fill materials shall be in accordance with the applicable requirements of Section 02200 - Earthwork.

Excavation for the slurry trench shall be made by the method commonly referred to as the "Slurry Method" of slurry trench construction. Excavation of the slurry trench may be done with a backhoe, dragline, or clamshell or a combination of any other suitable excavation equipment the Contractor has available. Regardless of the method of construction, excavation of the slurry trench shall proceed in a manner which, when completed, provides a continuous three (3)-foot minimum width trench to the required depth at all points along the centerline of the excavation. The excavation shall be carried to a minimum depth of three (3) feet below the top of the lacustrine Clay/Till. The Contractor shall be responsible for demonstrating verticality and continuity of the trench. The slurry wall shall be constructed without extended interruption until complete. A minimum extension of five (5) feet beyond any corner in both directions throughout the entire depth of backfill shall be constructed at any slurry wall corner to obtain continuous trench backfill through the entire length of the slurry wall.

Excavated materials from the trench will be transported to, placed, and compacted within the landfill. Blending or stabilization of the excavated materials may be required to meet the requirements of Specification 02200 - Earthwork. No materials excavated from the trench will be used in the soil bentonite backfill.

The Contractor shall be responsible for maintaining the stability of the excavated trench at all times for its full depth and shall be responsible to control slurry levels, slurry densities, equipment surcharges, and any other loading situations so that the trench remains stable. During construction of the trench no material shall be stockpiled higher than three (3) feet, nor closer than 25 feet to the trench, and slopes shall not be steeper than 1-Vertical to 3-Horizontal. These minimum stockpile limits will not relieve the Contractor of responsibility to ensure that stockpile surcharges do not influence trench stability while operating equipment near the trench. It shall be the responsibility of the Contractor to regulate the slurry density to maintain the stability of the trench at all times.

No materials will be stockpiled along the southern portion of the slurry wall that is to be constructed from the top of the bulkhead. Mixing of backfill will not be done from the bulkhead, but will be remotely mixed then transported to the excavation for placement.

The toe of the slope of the trench excavations shall not precede the toe of the backfill slopes by more than 100 feet or less than 50 feet. The slurry wall shall be constructed without undue interruption until it is complete. Should the slurry wall construction be temporarily delayed, some re-excavation of the previously constructed slurry wall will be required, as determined by the Owner. This re-excavation shall consist of backfill and slurry removal 10 feet perpendicular to the slope of the backfill for the full depth of the slurry trench starting at the top of the slope.

SLURRY WALL

Any portion of the slurry wall removed and replaced due to delays in construction shall be constructed at no expense to the Owner.

C. Making Excavation Slurry

All slurry for use in the trench shall be mixed in a colloidal continuous mixer. No slurry is to be made in the trench. Mixing of water and bentonite shall continue until bentonite particles are fully hydrated and the resulting slurry appears homogeneous. The slurry plant shall include the necessary equipment such as a mixer capable of producing a colloidal suspension of bentonite in water, mechanically agitated storage tank(s) or pond, pumps, valves, hoses, supply lines, and small tools, all as may be required to adequately supply slurry to the trench.

The initial mixture properties of the slurry shall be not less than six (6) percent bentonite, by weight. The viscosity shall be a minimum of 40 seconds as measured by the Marsh funnel and the density shall be a minimum of 65 pounds per cubic foot. Slurry shall be tested at a minimum of once per 50 linear feet of trench.

D. Storing Slurry

Storage containment area(s) having a minimum capacity of 10,000 gallons shall be provided to store initially mixed slurry to allow hydration time and to serve as a reserve in cases where substantial loss from the trench, through underlying pervious zones or other reasons, may occur. The slurry shall be occasionally agitated or recirculated in the storage tanks or ponds.

E. Slurry Placement

Slurry shall be introduced into the trench before the excavation is five (5) feet deep. The level of the slurry in the open trench shall be maintained at a minimum of three (3) feet above the static water level as well as being maintained within one (1) foot of the top of the trench at all times. Dilution of slurry by surface waters shall be prevented.

F. Cleaning and Maintaining Slurry in Trench

The Contractor shall remove excess soil debris from the slurry in the trench, to restore its properties as necessary to meet the maximum density specified. The density of the slurry in the trench shall be less than 85 pcf. Slurry in the trench shall be tested at a minimum of once per 50 linear feet of trench. The equipment used for cleaning the slurry of excess soil debris, and the bottom of the trench of sediments, shall consist of clamshell, air lift pumps, mud shakers, settlement tanks, or other approved equipment and all the necessary pipes, hoses, and fittings needed for the cleaning operation. The Contractor shall submit to the Owner in writing for review and approval his proposed method and equipment to be used for cleaning the slurry of excess debris and for removal of sediments deposited at the base of the trench. This cleaning operation shall be performed immediately prior to placement of the soil bentonite backfill and at any other time as directed by the Owner.

SLURRY WALL

3.4 Backfilling of Trench

A. Backfill Soils

No materials excavated from the trench will be used as backfill soil. Backfill soils must meet the requirements of Sections 2.4 of this specification. Backfill soil shall be tested for grain size analyses and Atterburg limits, at a minimum of once per 100 linear feet of trench.

B. Mixing Soil-Bentonite Backfill

Imported backfill material will be transported to the mixing area and the soil shall be mixed with bentonite slurry to achieve a homogeneous mixture meeting the bentonite and content and hydraulic conductivity specified.

The backfill mixing shall be done using suitable earthmoving or grading equipment such as a bulldozer or similar equipment. Mixing of the backfill soil bentonite mixture shall continue until the backfill appears homogeneous, with no clods or clumps of soil. Additional dry bentonite may be added by spreading the powder over the soils being mixed. The addition of water is prohibited in the backfill mixing.

Backfill shall be tested for slump, with required slump of three (3) to six (6) inches. When the backfill is mixed and ready for placement, it shall be tested for density, slump, bentonite content, and permeability at a minimum of once per 50 linear feet of trench. The soil-bentonite backfill shall have no clumps or particles larger than one (1) inch in any dimension. The permeability of the backfill shall be tested by ASTM D5084 at a minimum of once per 150 cubic yards of backfill.

C. Placing Backfill

No backfill mix shall be placed in the trench until the length of the trench is 10 times the excavated depth. The soil-bentonite backfill mix shall initially be lowered to the bottom of the trench and deposited by means of a clamshell bucket or other approved method. The bucket shall be lowered to the bottom of the trench or to the top of previously placed backfill before opening. No free-dropping of backfill material directly into the trench, or any other method of construction which will produce or allow segregation of material, will be permitted. The approved method and procedure shall be followed until the backfill reaches the slurry surface and attains its natural angle of repose from the bottom of the trench to the surface of the slurry.

The remaining backfill shall be placed in such a manner that the natural angle of repose of the backfill will be maintained, and so that no pockets of slurry are present in the completed slurry wall. Backfill material shall be bladed into the trench by the use of a bulldozer or other approved equipment at the starting point, and then shall be allowed to slide down the slope of the previously placed backfill so that the backfill below the slurry surface will be pushed along the bottom of the trench. If necessary, the Owner will require the Contractor to rod the backfill below the slurry surface to eliminate any pockets of entrapped slurry.

The toe of the slope of the trench excavation shall not precede the toe of the backfill slope by less than 50 feet nor more than 100 feet. The terminal end of the trench shall

SLURRY WALL

be re-excavated as necessary to remove any entrapped slurry, silts, and sands that may exist. This material shall be replaced with new backfill materials.

No mixing or placing of the backfill shall be performed when the air temperature is below 20° F. Frozen soil-bentonite backfill shall be thawed, remixed thoroughly and retested prior to placement in the trench.

D. Working Platform

The Contractor will be permitted to use the existing landfill area for storage, staging, and mixing operations, by grading the common borrow backfill and fill as necessary to provide a stable and adequate working surface.

Upon completion of the slurry wall construction, the Contractor shall regrade any areas outside the slurry wall disturbed by his operations to achieve the lines and grades shown on the Drawings. All such temporary working areas shall be prepared and restored by the Contractor, at no cost to the Owner.

3.5 Trench Cap

After completion of the soil bentonite backfill, the Contractor shall grade the adjacent areas to the lines and grades shown on the Drawings. The slurry wall shall then be covered by a two (2)-foot thickness of clayey soil (CH, CL), as defined in the Unified Soil Classification System, and compacted. The soil shall be placed in eight (8) inch lifts, compacted using power driven compaction equipment. Following filling to the surface grade, and compaction of the final lift of fill, the slurry wall shall be proof rolled by compaction equipment to demonstrate that the slurry will sustain the compactive efforts to be applied to the landfill cap soils.

The compaction shall be commenced at the top of the lower lift of soil, and each lift shall be compacted to 90 percent of the maximum dry density prior to proof rolling. The maximum dry density of the soil shall be determined from a Standard Proctor Compaction Test (ASTM D698) on the soil used for the trench closure. Monitor compaction in accordance with ASTM D2922. Compaction shall be tested at a minimum of once per 50 linear feet of trench cap.

3.6 Cleanup

The Contractor shall dispose of off-site all paper, rubbish, trash, and disposable items expediently to prevent any accumulation that may result in a fire or safety hazard. Used PPE and other potentially contaminated material will be placed within the landfill, beneath the cap, in a location designated by the Owner, in accordance with Specification 02200 - Earthwork.

Excess slurry and backfill shall be transported to the designated area within the landfill and blended or stabilized to meet the requirements of Specification 02200 - Earthwork.

3.7 Equipment Decontamination

Prior to mobilization to the Site, the Contractor shall clean his excavation, mixing and backfilling equipment and support vehicles. The piece of equipment or vehicle shall be cleaned using a power washer or steam jenny to remove soil, mud, oil, grease or hydraulic fluid. The equipment will be inspected by the Owner when mobilized to determine that the equipment is adequately cleaned.

SLURRY WALL

The equipment and support vehicles shall be steam cleaned prior to leaving the Site. The Contractor shall utilize the temporary decontamination pad (Specification 01120: Decontamination) for equipment decontamination. The equipment shall be decontaminated using a powered steam system furnished by the Contractor. Decontamination water shall be pumped to the storage tank furnished by the Contractor. The Contractor shall be responsible for containerizing used protective clothing during decontamination procedures and disposing of these materials within the landfill in the area designated by the Owner.

3.8 Quality Control/Quality Assurance

The Contractor shall prepare and submit the following reports, records, and documentation.

A. Bentonite

Copies of the certification data sheets for each batch of bentonite material received.

B. Water

Copies of data sheets for each water source used which include: pH, total dissolved solids, hardness, oil, organics, acids, alkali, or other deleterious substances in parts per million, including salt concentrations.

C. Imported Backfill Soil

Copies of grain size, Atterberg Limit, and TAL/TCL testing as specified by ASTM D422, D1140, and D4318 and as specified in Records Required, for each source of imported backfill soil.

D. Slurry Mixture (For Excavation)

Copies of tests of density and Marsh viscosity as specified by API 13B, records of mixtures utilized, their proportions and placement locations, and as specified in Records Required.

E. Backfill Mixture

Copies of tests of density and Marsh viscosity as specified by API 13B, records of mixtures utilized, their proportions and placement locations, slump (ASTM C143), permeability (ASTM D5084) and as specified in Records Required.

F. Trench Conditions For Backfilling

The Contractor shall prepare and submit on a daily basis a profile of the trench bottom as well as the backfill slope, a description of the material encountered in the bottom (include retention of samples, properly identified and labeled) and as specified in Records Required. Sounding of the trench and backfill slope shall be undertaken prior to any excavation or backfilling operations each day.

G. Bentonite Content in Backfill

The Contractor shall record all quantities of materials used in the preparation of each batch of soil-bentonite backfill, and shall apply bentonite in the quantities necessary

SLURRY WALL

to produce the specified concentration in the backfill mixture. Copies of these records shall be filed with the Owner to demonstrate that the backfill slurry is in accordance with the Specifications and the Contractor's design mix.

H. Hydraulic Conductivity of Backfill

Copies of tests indicating the permeability of the backfill material before placement using ASTM D5084, pursuant to the instructions of the Owner.

I. Consistency of Backfill

Copies of all slump tests in accordance with ASTM C143.

J. Density of Trench Cap

Copies of all density measurements of cover material as tested in accordance with ASTM D698 at intervals of 50 feet along the trench.

K. Hydraulic Conductivity of Completed Slurry Trench

Upon completion of the slurry wall, the Contractor will obtain undisturbed samples of the slurry wall backfill using the procedures of ASTM D1587. Samples will be collected at intervals no greater than 500 feet along the alignment of the slurry wall. Sample depths will be selected by the Owner.

Hydraulic conductivity shall be determined by the testing, with tap water as the permeant, of samples in a flexible wall permeability device in a triaxial cell per ASTM D5084. The Owner will specify the parameters of the tests based on the source depth of the sample. All hydraulic conductivity samples shall be taken from an elevation below the groundwater level. In general, the confining pressures for the tests shall approximate the pressures in the soils at the sample depth.

Samples that do not achieve a maximum hydraulic conductivity of 1×10^{-7} cm/sec will require the Contractor to excavate and replace that portion of the slurry wall.

End of Specification

SLURRY WALL

TABLE 1
SUMMARY OF TESTING REQUIREMENTS

MATERIAL	TEST	METHOD	REQUIREMENTS
Slurry for Excavation	Density	API 13B	65 to 85 pcf
	Viscosity	API 13B	> 40 Marsh sec.
	Bentonite Content		> 6 percent, by weight
	Filtration	API 13B	< 20 cc in 30 min.
Slurry in Trench during backfilling	Density	API 13B	< 85 pcf
Soil for Backfill	Grain Size	ASTM D1140 ASTM D422	> 20 percent passing 200 sieve
	Laboratory Analytical	TAL/TCL	@ background for area
Backfill	Density	API 13B	Minimum: 80 pcf, 15 pcf greater than slurry in trench Maximum: 105 pcf
	Bentonite Content		> 3 percent
	Slump	ASTM C143	3 to 6 inches
	Permeability	ASTM D5084	1×10^{-7} cm/sec
Completed Slurry Trench	Permeability	ASTM D5084	1×10^{-7} cm/sec
Trench Cap	Optimum Density	ASTM D698	
	Compaction	ASTM D2922	> 90 percent Standard Proctor

APL COLLECTION TRENCH

7. ASTM F714 Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter

C. **State of New York, Department of Transportation, Standard Specifications for Construction and Materials (NYDOT)**

Section 703 - Aggregates

1.2 Definitions and Abbreviations

- A. **B-P - Bio-Polymer**
- B. **Owner's Representative** - The Owner's Representative is designated by the Owner to act on its behalf in the execution of these specifications.
- C. **Bio-Polymer Slurry Drainage Trench Technique** - A modification of the slurry trench method which uses a biodegradable material instead of bentonite to support narrow, vertical excavations. Abbreviated as B-P Drain.
- D. **Backfill** - A freely-draining gravel used as the final fill for the Groundwater Collection Trench.
- E. **Working Platform** - A relative level and stable surface of compacted fill and/or excavated earth from which the trench is constructed.
- F. **Degraded Slurry** - Bio-Polymer slurry which through natural or artificial means has degraded to water and a minute amount of a nontoxic residual.
- G. **Cleanout Risers** - Vertical HDPE pipe with a large diameter elbow suitable to allow the collection pipe to be jetted clean for maintenance.
- H. **APL Collection Trench** - The completed groundwater and APL trench constructed by the B-P Drain method.
- I. **Drain Activation** - The process by which the Bio-Polymer is degraded to permit the free flow of groundwater and APL into and through the collection trench.
- J. **Wet Well** - The system by which the APL and groundwater will be removed. Refer to Specification 02013.

1.3 Submittals

The Contractor shall make timely submittal of all information required to the Owner's Representative. The Owner may review and approve these submittals. Approval of any submittal does not relieve the Contractor of the duty to perform the work to the standards specified.

EQUIPMENT DATA SHEET NAPL PUMP	ITEM NO.	P-301 through P-310		
	NO. REQ'D.	Ten (10)		
	REQ'N. NO.		COMM. NO.	
	P.O. NO.		PROJ. NO.	23594000
	PROJ.	OXYCHEM/OLIN REMEDIAL DESIGN		
SERVICE	LOCATION	NIAGARA FALLS, NY		

PROCESS DATA

Service: Intermittent Pumping of Chlorinated Hydrocarbons (Non-Aqueous Phase Liquid) from approx. 35 ft. Deep Wells to a Portable Transfer Tank.

S.G. 1.1 to 1.6 **Rated Flow:** 0.2 GPM
Temp: Ambient **TDH:** 60 psi
PH: 6 to 8

Electrical Area Classification - Class 1 Div 1 Group D

This service has the potential for mild Abrasion.

Mechanical Design

Type: Submersible, Deep Well Low Flow, Gear Pump
Manuf. & Model: Tuthill B-9235 (or approved equal) in a packaged system.

Materials of Const.: 316 Stainless Steel
Gears: Nickel Alloy (0.250" wide)

Discharge: 3/8 OD x 1/4 ID Tube

Seal: Magnetic drive

Motor: 12 volt D.C. Motor (5 amp) in Explosion Proof Housing

Coupling: Magnetic

Est. Weight: 30 lbs.

Probe: Solonist oil/water Interface Meter, Model 121 or Approved Equal

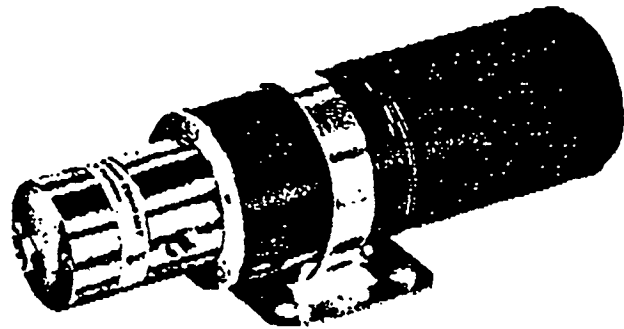
Miscellaneous: System package shall include 3/8" O.D. (1/4" I.D.) teflon tube discharge, power lead, transformer, conductivity probe, winch, and control module as described below.

Only one pump will operate at any one time in a very infrequent service. The vendor shall provide one transformer power source to convert 110v AC/ single phase/60 Hz power to D.C. current to power the pumps. Only one control module will be required to control the pumps. It will be portable; thus only one pump can operate at any one time.

* Information to be furnished/verified by Vendor.

Design by B. Somers	Fluor Daniel	App.	Rev. No. B	By A. Bumb
Date 11/03/92	Client	App.	Date 9/8/95	App.

DIRECT CURRENT 316 STAINLESS



Tuthill supplies ten direct current models to provide a range of capacities and pressures. In addition an AC-DC unit with a variable speed control is described on Page 16.

The DC units have the advantage of providing an additional method of flow control by varying the input voltage through the use of rheostats or other devices.

All these pumps are magnetically coupled as described on Page 2. Their operating principles are essentially identical.

In addition to motors and capacity, the pumps vary according to the gear materials used, the bearing materials, and the width of the pumping gears.

The type of gear material used and the specific configuration is indicated by the suffix used (-T, -C, -MC, or the lack of any suffix). The various gear materials, configurations, and options are discussed on Page 5.

Details of each configuration are shown in the cutaway views on Pages 6 through 11. The materials used are listed in detail on Page 4.

These DC models will handle fluids from -50° to 200° F. at flows to 49 GPH and at pressures to 100 PSI. They are safe for system pressures to 500 PSI. Pumps may be run dry for up to one minute without damage.

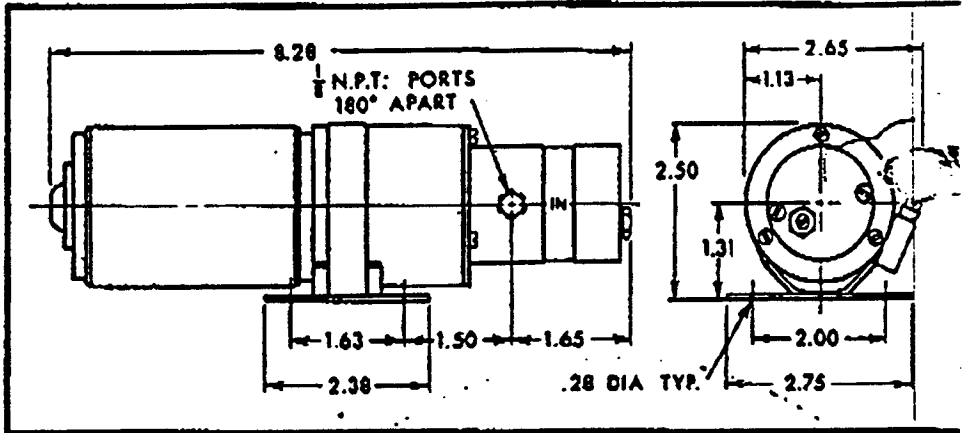
MODELS B9235, B9235-MC

Have pumping gears .250" wide to produce flow to 28 GPH and pressures to 100 PSI. See Performance Curve. Use DC motor good for continuous duty up to 5 amps at 12 VDC. Driving gears of nickel alloy (B9235) or combination of nickel alloy driving gear with carbon and Teflon filled Ryton driven gear (B9235-MC).

Compact...see dimensional drawings. Weight only 4 pounds.

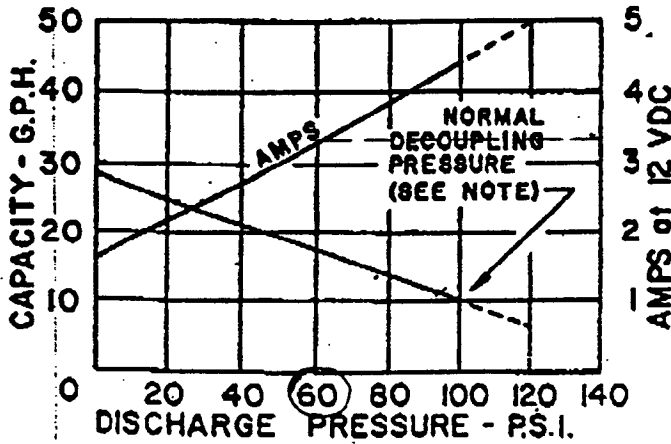
MODELS B9241, B9241-T, B9241-C

Identical in appearance with Models B9235 at left and use same motor. However have pumping gears .450" wide and can, therefore, provide capacity to 49 GPH and pressures to 70 PSI. See Performance Curve below. Supplied with nickel alloy gears (B9241), Teflon gears (B9241-T), or Teflon and carbon filled Ryton gears (B9241-C).

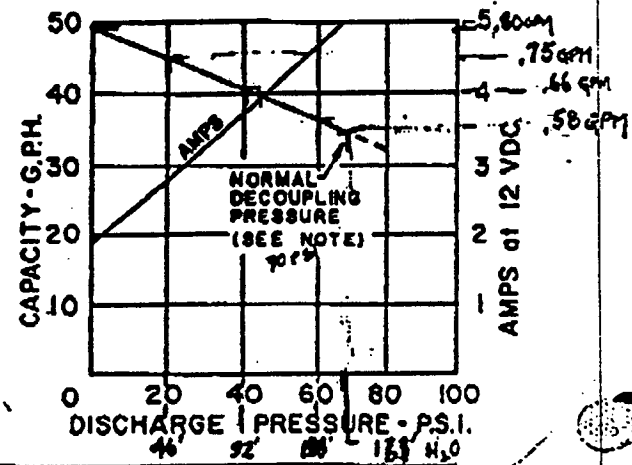


All dimensions are approximate. Obtain certified drawing from factory if space is critical.

PERFORMANCE CURVE MODELS B9235, B9235-MC



PERFORMANCE CURVE MODELS B9241, B9241-T, B9241-C

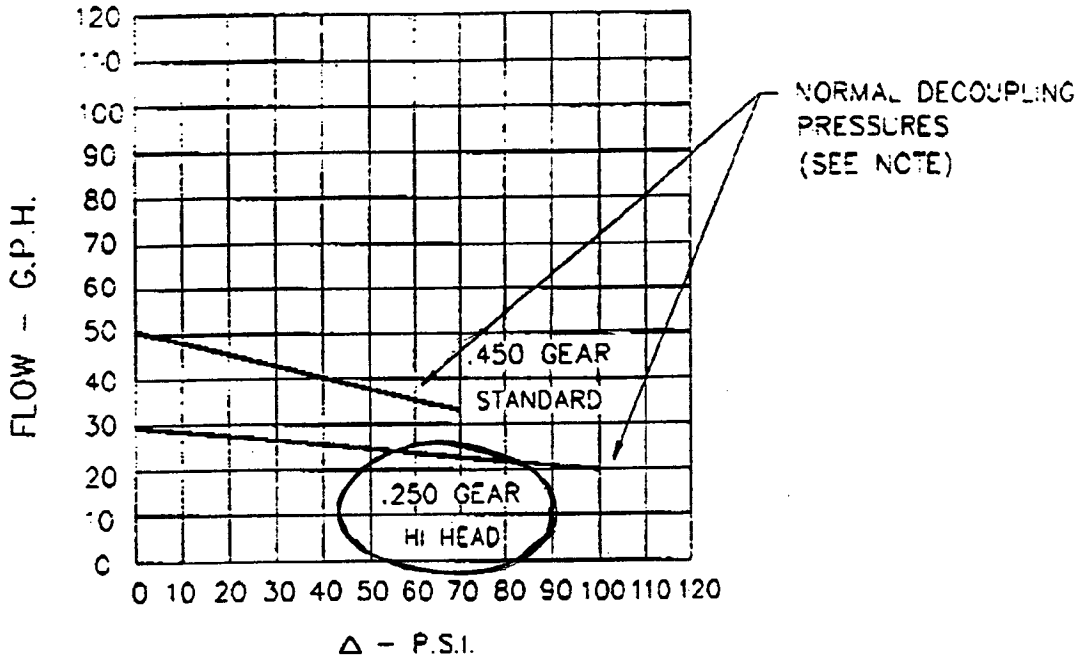


Normal decoupling pressure. On all models described above, decoupling should not occur below the pressure noted when pumping clean water at 75° F. Some factors which tend to reduce the decoupling pressure are higher temperatures, higher viscosities, abrasive fluids, pump wear, etc.

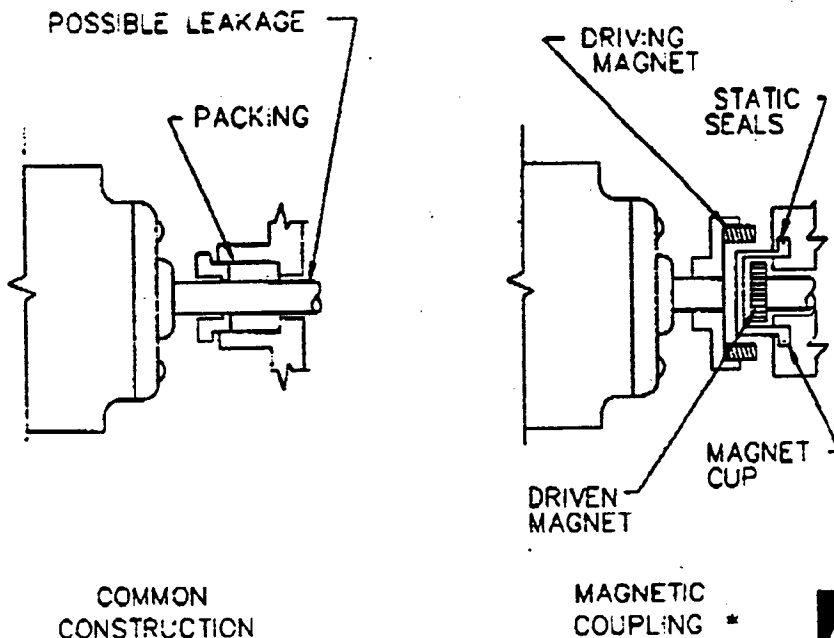
SMALL D.A. FILTER SCAV AND PROBE SCAV.

EC-7

PUMP PERFORMANCE CURVES
70°F WATER



NOTES: SOME FACTORS WHICH TEND TO REDUCE THE DECOUPLING * PRESSURE ARE HIGHER VISCOSITIES, HIGHER TEMPERATURES, ABRASIVE FLUIDS, PUMP WEAR, ETC.



DETAIL OF MAGNETIC COUPLING
VERSUS COMMON CONSTRUCTION

1.2 DEEP WELL PROBE SCAVENGER (4" DIAMETER)

1.2.1 MATERIALS OF CONSTRUCTION

Pump Assembly

Water jacket & cap	304 Stainless steel
1 1/2" coupling	304 Stainless steel
1" plug	304 Stainless steel
1 1/2" X 18" nipple	304 Stainless steel
• Oil tight strain relief	Aluminum with Buna grommet
Discharge compression fitting	Brass
Checkvalve	316 SS with Viton seat
Motor enclosure	304 SS with Viton O-ring
Pump head	316 SS with Riton gears and carbon bearings
Pump elbows	Brass
Compression fitting at cap	Brass
Pump connection tubes	304 Stainless steel
Motor lead sealing compound	Epoxy V40/828 Resin
*• 14/5 Start cable	THHN/THWN 600 V direct burial, PVC jacket/nylon insulation with ether based, urethane sheathing
• Discharge hose	3/8" O.D. X .050 wall nylon TEFLON tubing
** Intake strainer 60/100 mesh	304 Stainless steel
** INTAKE	1" ABOVE THE BOTTOM OF PUMP

*• START CABLE WILL REQUIRE TEFLON SHEATHING

- ALTERNATE DISCHARGE TUBE MATERIAL SHOULD BE CONSIDERED.
- ALUMINUM COMPONENTS MUST BE SUBSTITUTED.

EQUIPMENT DATA SHEET		ITEM NO.	P-206		
SUMP PUMP		NO. REQ'D.	One (1)		
		REQ'N. NO.	COMM. NO.		
		P.O. NO.	PROJ. NO.	23594000	
		PROJ.	OXYCHEM/OLIN REMEDIAL DESIGN		
SERVICE		LOCATION	NIAGARA FALLS, NY		
PROCESS DATA					
Service:	Pumping out a Shallow Containment Area of either Rain Water or Spilled Aqueous Phase Leachate (i.e. Groundwater). The pump will have a suction lift of approximately 5 feet.				
S.G.:	1	Rated Flow	50 GPM		
Temp:	Ambient	TDH:	30 Ft.		
<u>Mechanical Design</u>					
Type:	Self Priming Centrifugal				
Manuf. & Model:	Durco IK 1-1/2 x 1-1/2 US-8 or Approved Equal				
Materials of Const.:	316 SS (304 SS is acceptable, however 316 SS is a Durco standard and is cheaper with better delivery)				
Impeller Diameter:	6-1/4 in.				
Suction:	1-1/2 in.				
Discharge:	1-1/2 in.				
Seal:	Single Mechanical Seal				
Motor:	1-1/2 HP, 1750 RPM/230 V.A.C./1 PH/60 Hz - TEFC				
Est. Weight:	165 lbs.				

* Information to be furnished/verified by Vendor.

Design by B. Somers	Fluor Daniel	App.	Rev. No. B	By A. Bumb
Date 11/03/92	Client	App.	Date 9/8/95	App.

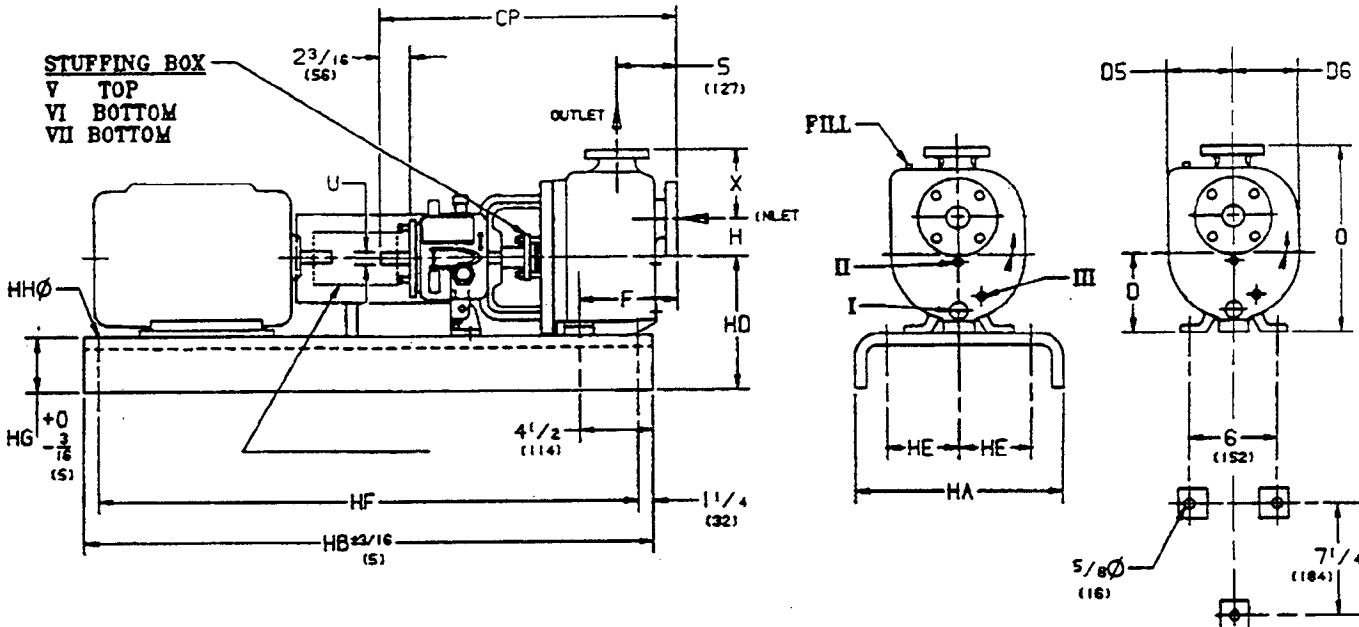


MARK III - 1K UNITIZED SELF PRIMING PUMP

SUPPLEMENT DRAWINGS ATTACHED WHEN LISTED BELOW _____ _____ _____ _____ _____	AVAILABLE FLANGES (ANSI B16.5) CLASS 150 FF <input checked="" type="checkbox"/> CLASS 150 RF <input type="checkbox"/> CLASS 300 FF <input type="checkbox"/> CLASS 300 RF <input type="checkbox"/> SPECIAL _____ <input type="checkbox"/> BASEPLATE STEEL _____ <input type="checkbox"/> SPECIAL _____ <input type="checkbox"/>	OPTIONAL TAP CONNECTIONS <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>TAP</th> <th>REQ'D SIZE</th> <th></th> </tr> <tr> <td>FILL</td> <td></td> <td>PRIMING CHAMBER FILL</td> </tr> <tr> <td>I</td> <td></td> <td>CASING DRAIN</td> </tr> <tr> <td>II</td> <td></td> <td>SUCTION NOZZLE CONN.</td> </tr> <tr> <td>III</td> <td></td> <td>DISCHARGE NOZZLE CONN.</td> </tr> <tr> <td>V</td> <td></td> <td>STUFFING BOX</td> </tr> <tr> <td>VI</td> <td></td> <td>BACK DRILLED SEAL FLUSH CONN.</td> </tr> <tr> <td>VII</td> <td></td> <td>BOTTOM TAP IN STUFFING BOX</td> </tr> </table>	TAP	REQ'D SIZE		FILL		PRIMING CHAMBER FILL	I		CASING DRAIN	II		SUCTION NOZZLE CONN.	III		DISCHARGE NOZZLE CONN.	V		STUFFING BOX	VI		BACK DRILLED SEAL FLUSH CONN.	VII		BOTTOM TAP IN STUFFING BOX
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V		STUFFING BOX																								
VI		BACK DRILLED SEAL FLUSH CONN.																								
VII		BOTTOM TAP IN STUFFING BOX																								

PUMP DIMENSIONS

PUMP SIZE <small>INLET x OUTLET - MAX 1MP DIA</small>	PUMP WT. <small>(lbe(kg))</small>	CP	D	D5	D6	F	H	O	U		X
									SHAFT Ø	KEYWAY	
1K 1 1/2 x 1 1/2 US-8	154 (70)	20 1/2 (521)	7 (178)	5 1/2 (140)	5 1/2 (140)	7 (178)	4 (102)	1 47/8 (378)	7/8 (22)	3/16 x 3/32 (4.8 x 2.4)	3 7/8 (98)



BASEPLATE AND MOUNTING DIMENSIONS

BASE	MAX MOTOR FRAME	HA	HB	HD	HE	HF	HG <small>(NOTE 3)</small>	HHØ	WEIGHT <small>(lbe(kg))</small>
139	184T	15 (381)	39 (991)	10 3/4 (273)	4 1/2 (114)	36 1/2 (927)	3 3/4 (95)	3/4 (19)	111 (50)
148	256T	18 (457)	48 (1219)	11 1/8 (283)	6 (152)	45 1/2 (1156)	4 1/8 (105)		163 (74)
153	286T 326TS	21 (533)	53 (1346)	11 7/8 (302) 12 7/8 (327)	7 1/2 (191)	50 1/2 (1283)	4 3/4 (121)		212 (96)

1. DIMENSIONS IN PARENTHESIS () ARE IN MILLIMETERS.
 2. INSTALLATION DIMENSIONS ARE ±1/8" (3) UNLESS OTHERWISE NOTED.
 3. "HG" DIM. APPLIES TO THE LOWER PAD HEIGHT, WITH SOME BASES THIS WILL OCCUR AT PUMP END AND WITH OTHERS AT MOTOR END.

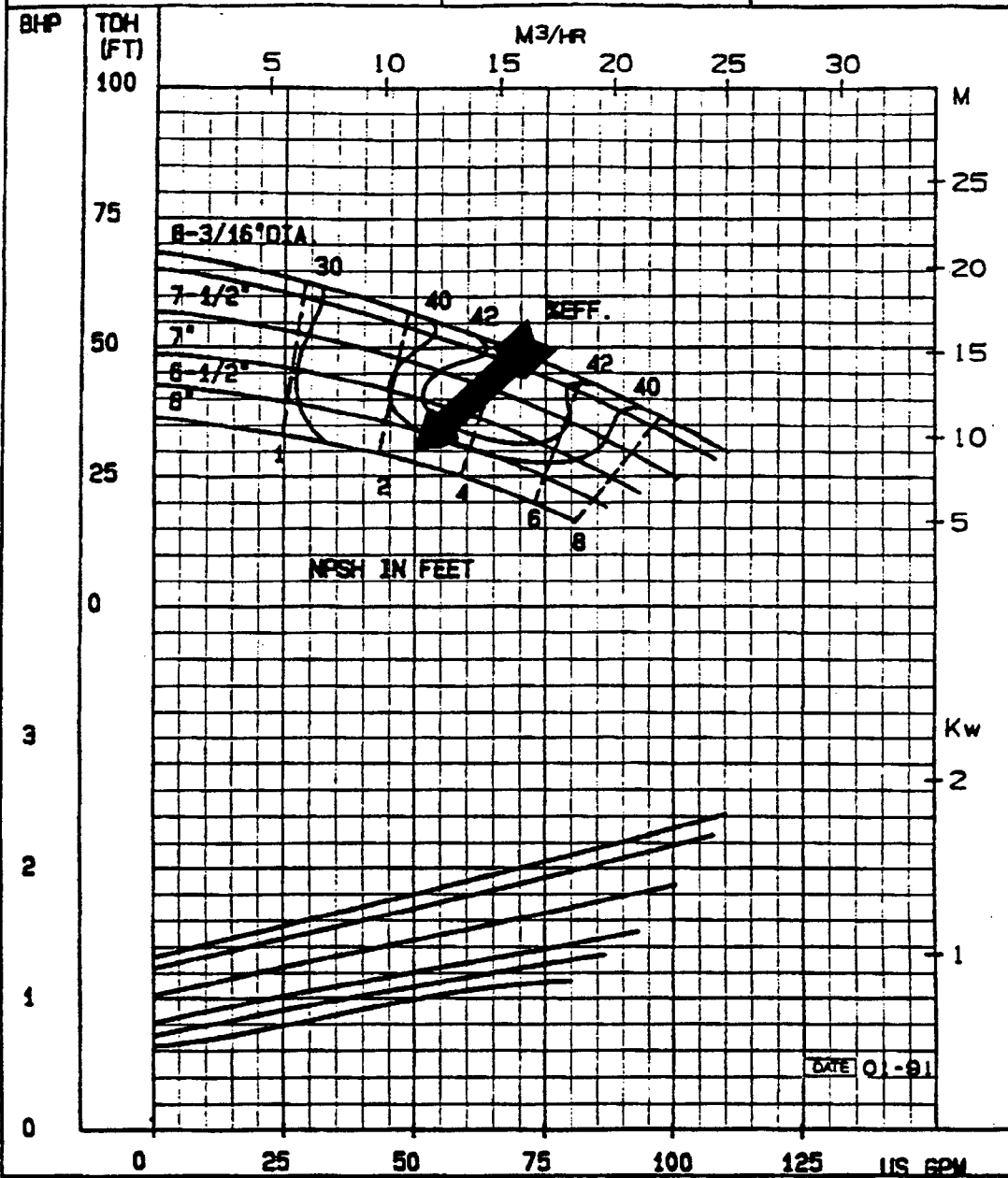
CUSTOMER _____	CUSTOMER P.O. _____	CUSTOMER ITEM No. _____
DURCO ORDER No. _____	SERIAL No. _____	CERTIFIED BY: _____
		DATE _____

THE DURIRON COMPANY, INC.
 DAYTON, OHIO
 DURCOPUMP PERFORMANCE
 CHARACTERISTICS

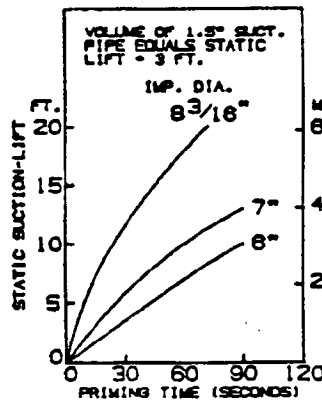
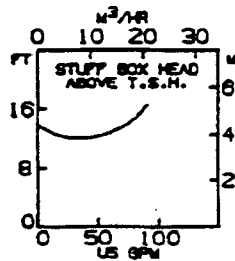
EYE AREA 3.1 SQ. IN.
 MAX SPHERE 11/32 IN.
 IMPELLER REVERSE VANE
STD- N/A

DURCO MARK III
1K1.5X1.5US-B2
 SPEED 1750 RPM
 CURVE NO. 7262

P-206



CONSULT YOUR DURCO REPRESENTATIVE FOR MINIMUM FLOW CONSIDERATION



EQUIPMENT DATA SHEET APL TRANSFER PUMP		ITEM NO.		P-205	
		NO. REQ'D.		One (1)	
		REQ'N. NO.		COMM. NO.	
		P.O. NO.		PROJ. NO. 23594000	
		PROJ.		OXYCHEM/OLIN REMEDIAL DESIGN	
SERVICE		LOCATION		NIAGARA FALLS, NY	
PROCESS DATA					
Service:		Pumping Aqueous Phase Liquid (i.e. Groundwater) from a Storage Tank to a Transfer Tanker Truck.			
S.G.:		1		Rated Flow: 75 GPM	
PH:		6-8		TDH: 25 Ft.	
Temp:		Ambient			
<u>Mechanical Design</u>					
Type:		Centrifugal			
Manuf. & Model:		DURCO 2K-3x1.5-10A or approved equal			
Materials of Const.:		316 SS (304 SS is acceptable, however, 316 SS is a Durco standard and is cheaper with better delivery)			
Impeller Diameter:		8 in.			
Suction:		3 in. 150# Flat Face			
Discharge:		1.5 in. 150# Flat Face			
Seal:		Mechanical			
Motor:		2/HP 1150 RPM/230 V.A.C./1 PH/60 Hz-TEFC			
Est. Weight:		300 lbs.			

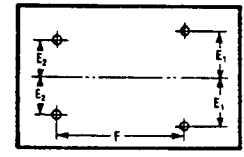
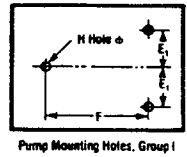
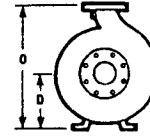
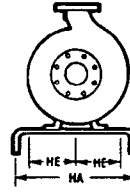
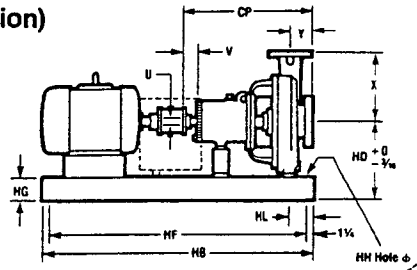
* Information to be furnished/verified by Vendor.

Design by B. Somers	Fluor Daniel	App.	Rev. No. B	By A. Bumb
Date 11/03/92	Client	App.	Date 9/8/95	App.

PUMP AND BASEPLATE DIMENSIONS

P-205

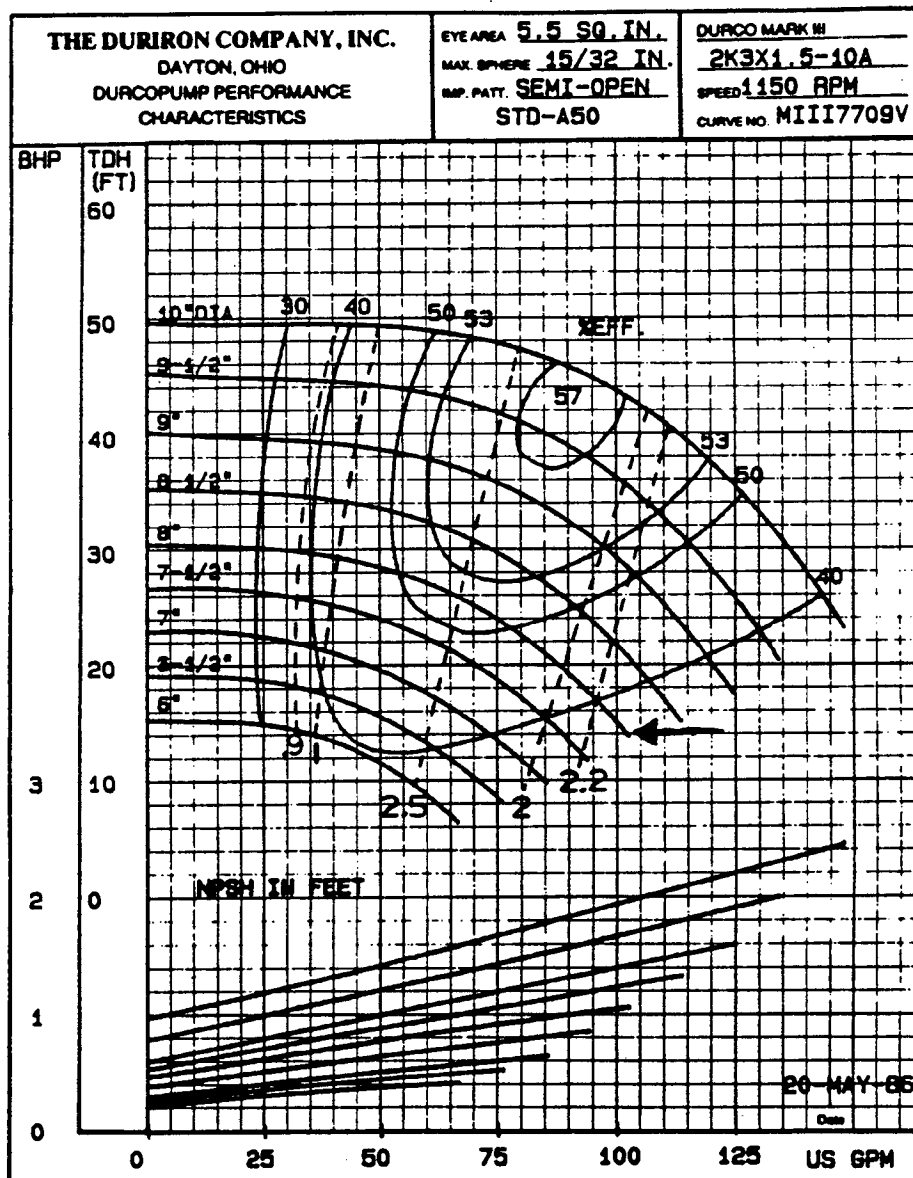
(Not to be used for construction)



Pump Dimensions															
Pump Group	ANSI Desig.	Size Suction X Discharge X Max. Imp. Dia.	Pump Weight lbs. (kg)	X in. (mm)	O in. (mm)	D in. (mm)	E ₁ in. (mm)	E ₂ in. (mm)	CP in. (mm)	F in. (mm)	H in. (mm)	U Dia. in. (mm)	Keyway in. (mm)	V Min. in. (mm)	Y in. (mm)
GP I 1K	AA	1½x1-6	97 (44)	6½ (165)	11¾ (298)	5¼ (133)	3 (76)	0	17½ (445)	7¼ (184)	¾ (16)	7/8 (22.23)	¾x¾ (4.76x2.38)	2 (51)	4 (102)
	AB	3x1½-6	112 (51)												
		3x2-6	116 (53)												
	AA	1½x1-8	103 (47)												
GP II 2K	A60	3x2-8	200 (90)	9½ (242)	17¾ (450)	8¼ (210)	4¾ (124)	3¾ (92)	23½ (597)	12½ (318)	¾ (16)	1½ (28.58)	¾x¾ (6.35x3.18)	2½ (67)	4 (102)
	A70	4x3-8	227 (103)	11 (280)	19¼ (490)										
	A05	2x1-10A	210 (94)	8½ (216)	16¾ (425)										
	A50	3x1½-10A	220 (100)	8½ (216)	16¾ (425)										
	A60	3x2-10A	226 (103)	9½ (242)	17¾ (450)										
	A70	4x3-10	225 (101)	11 (280)	19¼ (490)										
	A40	4x3-10H	249 (112)	12½ (318)	22½ (572)	10 (254)									
	A80	6x4-10	290 (130)	13½ (343)	23½ (597)										
	A80	6x4-10H	328 (149)	13½ (343)	23½ (597)							1½ (38.1)	¾x¾ (9.5x4.76)		
	A20	3x1½-13	250 (112)	10½ (266)	20½ (520)							1½ (38.1)	¾x¾ (6.35x3.18)		
	A30	3x2-13	258 (116)	11½ (292)	21½ (546)										
	A40	4x3-13	281 (126)	12½ (318)	22½ (572)										
A40	4x3-13HH	281 (126)	12½ (318)	22½ (572)											
A80	6x4-13A	324 (145)	13½ (343)	23½ (597)											
GP III 3K	A90	8x6-14A	680 (306)	16 (406)	30½ (775)	14½ (368)	8 (203.2)	4½ (114.3)	33¾ (860)	18¾ (476)	7/8 (22)	2¾ (60.33)	¾x¾ (15.88x7.94)	4 (102)	6 (152)
	A100	10x8-14	899 (408)	18 (457)	32½ (826)										
		6x4-16	641 (291)	16 (406)	30½ (775)										
	A110	8x6-16A	832 (377)	18 (457)	32½ (826)										
	A120	10x8-16	917 (416)	19 (483)	33½ (851)										
A120	10x8-16H	992 (450)	19 (483)	33½ (851)											

Baseplate Mounting Dimensions												
Pump Group	Baseplate	Max. Motor Frame	Weight lbs. (kg)	HA in. (mm)	HB in. (mm)	*HD in. (mm)	*HD ₁ in. (mm)	HE in. (mm)	HF in. (mm)	HG in. (mm)	HH in. (mm)	HL in. (mm)
GP I 1K	50	182T	100 (45.4)	12 (305)	35 (889)	8¼ (210)	10 (254)	4 (102)	32½ (826)	3 (76)	¾ (19)	4½ (114)
	51	215T	98 (44.5)	13 (330)	39 (991)	▲8¾ (219)	10¼ (260)	4¾ (114)	36½ (927)	3¾ (83)	¾ (19)	
	53A	254T	140 (63.5)	17 (432)	44 (1118)	▲9¾ (251)	10¾ (267)	6 (152)	41½ (1054)	3½ (89)	¾ (19)	
		284T				▲10¾ (270)	▲10¾ (270)					
GP II 2K	52	215T	128 (58)	15 (381)	45 (1143)	12 (305)	13¾ (349)	4½ (114)	42½ (1080)	3¾ (95)	¾ (19)	
	53	284T	174 (79)	17 (432)	52 (1321)	12¾ (314)	14¾ (359)	6 (152)	49¾ (1257)	4¾ (105)	¾ (19)	
	54	326T	226 (102.5)	20 (508)	58 (1473)	13 (330)	14¾ (375)	7½ (190)	55½ (1410)	4¾ (121)	1 (25)	
		365T				▲13¾ (352)						
	55	404T	310 (141)	22 (559)	60 (1524)	▲14¾ (378)	▲14¾ (378)	7½ (190)	57½ (1460)	4¾ (121)	1 (25)	
		405TS				▲15¾ (403)	▲15¾ (403)					
		444TS										
56	405T	312 (141.5)	24 (610)	61¾ (1568)	▲14¾ (378)	▲14¾ (378)	7½ (190)	59¼ (1505)	4¾ (121)	1 (25)		
	445T				▲15¾ (403)	▲15¾ (403)						
GP III 3K	58	365T 365TS	412 (187)	20 (508)	68 (1727)	18¾ (476)		8½ (216)	65½ (1664)	9¾ (248)	1½ (28.58)	6½ (216)
	59	445 447TS	494 (224)	22 (559)	80 (2032)	18¾ (476)		9¾ (241)	77½ (1968)	7¾ (197)	1½ (28.58)	
	60	447T	604 (274)	25 (635)	84 (2134)	18¾ (476)		11 (279)	81½ (2070)	6¾ (159)	1½ (28.58)	
		449TS										
61	449T	633 (287)	25 (635)	88 (2235)	18¾ (476)		11 (279)	85½ (2172)	7¾ (197)	1½ (28.58)		

*GPI-HD₁ applies to 3x1½-8 only. ▲ Includes spacer under pump.
 GPII-HD applies to 3x2-8, 4x3-8, 2x1-10A, 3x1½-10A, 3x2-10A, and 4x3-10
 HD₁ applies to 4x3-10H, 6x4-10, 6x4-10H, 3x1½-13, 3x2-13, 4x3-13, and 6x4-13A.



DIVISION 15 - MECHANICAL

15179	Holding Tank
50026	General Requirements - Piping Installation
58023	FRP Tanks

HOLDING TANK

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the minimum requirements to be met in the design, fabrication, supply of a 250,000 gallon temporary Holding Tank.

B. Related Specification

Coordinate work prescribed by this Specification with work prescribed by Specification 11231 - Water Treatment System.

1.2 Submittals

The Holding Tank vendor shall submit the following documents.

A. Submit Shop Drawings Indicating:

1. All engineering data on the equipment supplied
2. Overall dimensions and site preparation requirements
3. Nozzle or inlet sizes, ratings, facings, locations and flow direction
4. Weight of components and total assembled weight.
5. Materials of construction
6. Parts lists

B. Operating Instructions:

1. Installation instructions
2. Operating instructions
3. Winterizing instructions
4. Parts and materials identification list

1.3 Performance

The Holding Tank shall be designed for a capacity of 250,000 gallons and one foot of sediment when full. The tank shall be a temporary installation for holding construction water during the remedial activities on the Site. Total operating time shall be approximately 2 years. During the winter months the tank shall be winterized and shutdown. The system shall provide for required removal of accumulated sediment.

HOLDING TANK

2.0 PRODUCTS

2.1 General Description:

A modular temporary holding tank shall be provided with a capacity of 250,000 gallons. The holding tank shall be designed to sit on a smooth graded, compacted earth base and no concrete shall be required for erection. The holding tank sections shall be constructed of galvanized steel capable of supporting the hydrostatic load. The tank shall be designed to hold an average of 1 foot sediment (specific gravity = 2.0) in the bottom. The sediment depth will most likely be greater than 1 foot at the inlet location and less than one foot at the outlet pipe.

2.2 Liner

The tank shall include a primary reinforced liner for holding the liquid contents and a secondary liner shall also be provided for secondary containment. The liners can be PVC or HDPE. Underlay the liners with a geotextile cushion layer.

2.3 Outlet Piping

Three 4-inch outlet pipes shall be provided with the tank. The pipes shall be designed such that a minimum of 2 feet of water can be maintained in the tank for equalization and settling purposes. The pipes shall be spaced between 2-foot from the bottom to the top. Each outlet pipe shall include a 4-inch valve for leak tight shutoff. A bottom drain and valve shall also be provided so the tank can be completely emptied. For tanks with a sidewall height greater than 5 feet, a level indicator shall be provided with the indicator near the outlet pipe.

2.4 Approved Vendor:

Modutank Inc. or approved equal.

3.0 EXECUTION

3.1 Subgrade Preparation

The compacted earth base shall be graded smooth and level with no sharp projections.

3.2 Installation

The Holding Tank shall be delivered to the site for installation by the on-site contractor. Install in accordance with manufacturer's guidelines. The location of the Holding Tank is shown on Drawing 594000-10Q-01.

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 15179
Page 3 of 3
2-5-96/Rev. No. 1

HOLDING TANK

3.3 Removal

Contractor may decontaminate tank and liners for salvage at end of project. If not suitable for salvage, place under cap in accordance with Specification 02200-Earthwork.

END OF SPECIFICATION

GENERAL REQUIREMENTS - PIPING INSTALLATION

1.0 DESCRIPTION OF WORK

This specification covers the above-ground piping installation for the APL loadout facility, as shown on drawings 594000-55N-01 and 25J-02.

1.1 Quality Assurance

Project Engineers shall monitor and review the activities of the fabrication and installation to ensure that applicable codes, standards, and procedures are being followed to meet project quality goals.

- A. The Field Fabricator shall be responsible for fabrication and installation accuracy. Each component shall be subject to inspection by Owner's representative.
- B. The Inspection and Testing Agency Inspectors shall examine and inspect the final product to ensure that quality criteria have been met.
- C. The Contractor shall examine and inspect piping components for damage and improper manufacturing prior to beginning fabrication, in accordance with ASME / ANSI B31.3, Paragraph 341. After fabrication has been completed, components shall be re-examined and re-inspected for possible damage. Repairs shall be made before installation.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect at the time of issue of contract and of issue of this specification unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, Work included in this specification shall conform to the applicable provisions of these publications.

- A. **ANSI (American National Standards Institute)**
B16.5 Pipe Flanges and Flanged Fittings.
- B. **ASME/ANSI (American Society of Mechanical Engineers / American National Standards Institute)**
B31.3 Code for Pressure Piping. Chemical Plant and Petroleum Refinery Piping.

2.0 PRODUCTS

2.1 Materials

- A. Piping Materials and valves shall be new and in accordance with Drawing 594000-55N-01.
 - B. Substitutions, including thicker wall materials, are not permitted without written authorization from Owner's representative.
-

GENERAL REQUIREMENTS - PIPING INSTALLATION

- C. Nonpressure attachments shall be supplied and installed in accordance with the appropriate installation drawings.
- D. Bolting
 - 1. Bolt lengths shall be in accordance with ASME B31.3 paragraph 335.2.3, latest edition.
 - 2. Machine bolt length shall be measured from the bearing surface of the head to the extreme point.
 - 3. Stud bolt length measurement shall be based on the effective thread length.
 - 4. Bolt length shall be specified in 1/2 inch increments.
- E. Welding rod for the stainless socket weld piping shall be 316 stainless steel material.

2.2 Material Receiving And Storage

- A. Store material purchased for this project, in an area where exposure to heat, dirt, and contamination is avoided.
- B. Within the storage area, segregate pipe and fittings by material type, size, and schedule.
- C. Store stainless steel piping under cover and clear of the ground. Contact with ferritic steel is not permitted and contamination from ferritic sources is not acceptable. Protect slings and hooks by plastic insulation or nylon. Storage banding for pipe shall be of a noncontaminating and compatible material.
- D. Upon receipt, Contractor shall visually inspect every pipe and component and then reject items that contain an injurious defect. Injurious defects are internal or external surface gages, scars, scratches, blisters, or discontinuities that produce a notch effect or reduce the specified wall thickness by 5 percent or more.

3.0 EXECUTION

3.1 Field Fabrication

A. Piping

- 1. Wherever possible, the Fabricator shall not position the longitudinal weld seam on the top or bottom of the line, in order to avoid locating branch connections such as couplings and stub-ons on the seam.

GENERAL REQUIREMENTS - PIPING INSTALLATION

B. Flanges and Fittings

1. Orient flange bolt holes as follows, unless otherwise indicated on the piping drawings:
 - Flange face vertical - bolt holes to straddle vertical centerline.
 - Flange face horizontal - bolt holes to straddle north-south centerline.
2. Where line taps are called for, drill the hole square to the axial centerline; in addition, make the hole clean, sharp, and free from burrs, wire edges, or other irregularities. Drill the hole after attaching the connection fitting.
3. Weld slip-on flanges inside and outside. Refer to Figure 328.5.2B of ASME/ANSI B31.3. Apply the weld so that the flange face shall be free of weld spatter and shall not require refacing.

C. Bending

Piping bends are not permitted.

D. Pup-Pieces

Pup-pieces installed to make up a length shall be a minimum of 2 pipe diameters long or 6 inches long, unless authorized otherwise by Owner's representative.

3.2 Installation

A. General

Except where shown otherwise on the drawings, piping shall be run level and plumb, and be run on North-South and East-West axes.

B. Flange Bolting

1. Use a logical sequence of bolt tightening to ensure even gasket compression, as indicated in ANSI B16.5.
2. Unless specified otherwise, provide a bolt stress of 30,000 psi minimum or 45,000 psi maximum using a lubricant on the bolt threads.
3. Prior to bolt-up, inspect flange faces. Flange faces shall be in as-new condition, and shall be wiped clean of any debris, excess oil, grease, and dirt. Restore damaged flange faces to as-new condition. Do not perform weld repairs on flange faces or flanges unless previously authorized by Owner's representative.
4. Do not use washers or spacers to make up bolt length.

C. Joints

1. Lubar #404 joint compound shall be used for threaded connections.

GENERAL REQUIREMENTS - PIPING INSTALLATION

2. Do not apply insulation over any joints until testing has been completed.
3. Gaskets on flanged joints shall be used only once.
4. FRP piping shall be installed in strict adherence to the piping manufacturer's installation instructions for joint preparation and bonding. The FRP pipe manufacturer's recommended adhesive shall be used.

D. Supports

1. Furnish and install supports as indicated on Drawing 594000-55N-02.
2. After fabrication, but prior to installation, Contractor shall blast and paint supports. Blasting shall be in accordance with SSPC-SP6 "Commercial blast." Immediately following blasting and dust removal, steel shall be painted with 2 to 4 mils of self-curing primer, Ameron Dimecote 9 or approved equal. Contractor is responsible for touch-up of paint following installation.
3. Temporary supports required during installation of hydrostatic testing shall be the responsibility of the field fabrication/installation Contractor.

E. Vents and Drains

1. Piping system vents and drains may not be shown on the piping design drawings. Vent high points and drain low points. The Piping Contractor doing the erection shall furnish and install additional vents and drains needed. Unless they are connected to a header or run to a drain or tail pipe, plug or cap additional vents and drains in accordance with the material specification for the service.
2. Vent and drain valve sizing shall be as follows:
 - 3/4 of an inch minimum for lines 3/4 of an inch through 2 inches (screwed/sw)
 - For FRP pipe, use saddle with 1" 316SS bushing and plug.

F. Cleanliness of Piping

1. Open-end and flange protection shall be used throughout installation. Protect open pipes at times when work on them is not actually taking place.
 2. Inspect individual pipe section, prefabricated spools, and pipeline items internally during installation, and remove any foreign matter before final welding or bolting.
 3. Completely remove weld slag, flux, debris, grease, oil, and any foreign matter on the surfaces of field fabricated items.
 4. The internal cleaning of piping after fabrication or installation shall comply with Attachment 01 of this Specification (see Field Leak testing, Section 3.3).
-

GENERAL REQUIREMENTS - PIPING INSTALLATION

3.3 Field Leak Testing

- A. After piping installation is complete, but prior to heat tracing or insulation, the Contractor shall perform leak testing as described herein.
- B. Prior to leak testing, the Contractor shall ensure that adequate curing time has passed for the FRP piping system.
- C. Leak testing shall be executed in accordance with Cleaning Procedures on Attachment 01 of this specification.
- D. Testing procedure is as follows:
 - 1. Contractor is to provide clean city water for the testing. Water shall be pumped into either of the 10,000 gallon FRP APL tanks. A minimum of 3,000 gallons of water shall be provided for testing.
 - 2. Contractor shall provide a temporary flanged connection in line 2"-F1-2100-APL-RPH-ET in place of the check valve to be installed at the system inlet from the well header, line 1.5"-HDPE-1200-APL. Contractor shall provide, and run a hose from the APL Transfer Pump P-205 tanker connection to the temporary testing connection. Ensure that power to sump pump P-206 is disabled.
 - 3. With the inlet and outlet valves to the empty tank closed, open all valves in the piping loop to be tested. Start pump P-205 and allow the system to run continuously for 8 hours. During this time, liquid level in the tank is to be monitored to ensure flow to the pump.
 - 4. With the pump operating, inspect the system for leaks. If any leaks are discovered, shut down the system, drain the lines, and repair the leaks. Following repair, restart the system and allow to run for 8 continuous hours.
 - 5. Once the first loop to be tested is determined to be leak free, configure the valves to allow water into the second tank. Repeat the test procedures in parts 3) and 4) above.
 - 6. Discharge lines for Sump Pump P-206 shall be tested in a similar fashion by allowing the discharge hose to empty into the sump.
- E. Upon completion of leak testing, the contractor shall discharge the water on to the ground at a reasonable distance from the construction site.

3.4 Insulation

A. General

- 1. Applications of insulation shall be in strict accordance with this specification or Manufacturer's recommendations. Submit to Engineer for approval, materials insulation details, or intended practices of insulation application not covered in this specification. Omission of details from this specification shall not relieve

GENERAL REQUIREMENTS - PIPING INSTALLATION

Subcontractor from the obligation to supply a properly designed installation in accordance with current acceptable construction practices.

2. Materials shall be new and in accordance with Drawing 594000-55N-01.
3. Craftsmen regularly engaged in the insulation industry shall install the insulation. The quality of workmanship shall be the best obtainable. Make finished work uniform and neat in appearance.
4. Apply no insulation to piping or equipment that is to be hydrostatically tested until such tests have been successfully completed and the related piping or equipment has been released for insulation.
5. Protect insulation materials against the elements at all times. Take every precaution to ensure that each day's work is weatherproofed during erection and before leaving for the night.
6. Maintain orderly work areas free of debris at all times. Store only the materials that shall be used in a given work day in the immediate work area.
7. Keep insulation dry before and during application. If applied insulation has become wet before it is properly finished, dry it thoroughly by suitable means or else replace before a vapor barrier is applied and sealed or weatherproofing is applied.
8. Clean the surfaces by removing loose scale and other surface contaminants such as oil, grease, dirt, moisture, ice, or snow, prior to the insulation application.
9. Leave code inspection plates or stamping, nameplate, dataplates, test plugs, and system components, on equipment permanently visible by cutting back the insulation where necessary, and properly sealing it against moisture penetration.
10. Avoid contact between dissimilar materials that might cause galvanic corrosion.

B. Application of Insulation

1. Insulation Application
 - a. Apply single thickness sectional pipe insulation in such a manner that all voids are eliminated. Coat the butt edges with a 1/16 inch thick layer of joint sealer. Secure each layer of insulation with pressure sensitive tape or bands on approximately 9 inch centers. Place tape or bands within 1/2 of an inch of the end of each section. When applying double layer insulation, stagger or offset outer layer joints from the inner layer joints. Only the outer layer of double layer insulation shall have a vapor barrier. Seal the longitudinal overlaps of the vapor barrier jacketing with an adhesive. Seal circumferential joints with a foil-to-mylar 3 inch wide strip over the vapor barrier jacketing.

GENERAL REQUIREMENTS - PIPING INSTALLATION

- b. Insulate and completely vapor seal attachments fastened to piping. Extend the insulation a minimum distance of 4 times the pipe insulation thickness from the pipe.
 - c. Insulate fittings, except valve bodies, with prefabricated fitting covers or mitered sectional pipe insulation, securely wired in place. Insulate fittings 2 inches and smaller, such as elbows, tees, caps, reducers, screwed and socketweld valves, swages and stub-in connections with cement applied in 1/2 inch thick layers of continuous pipe insulation to a thickness equal to the insulation on adjacent piping.
2. Weatherproofing Application
- a. Jacket the basic insulation or straight portions of insulated lines with metal jacket, lap all joints 2 inches, and arrange to shed water. Secure the jacketing with bands on 12 inch centers. Apply band over each circumferential lap joint. On horizontal piping jacketing locate the longitudinal seam in the 3,4,5,7,8 or 9 o'clock positions only. Support jacketing on vertical lines 6 inches and smaller by a minimum of 2 S-clips.
 - b. Weatherproof the fittings with prefabricated metal covers that have weatherproof seams. Secure metal covers with screws or bands.
 - c. Install watertight metal flashing ring where pipe insulation terminates.
 - d. Apply heavy fillets of flashing compound at all possible sources of moisture penetration.
 - e. Finish irregularly shaped surfaces that cannot be suitably weatherproofed with metal jacketing with a 3/8 inch thick layer of insulating and finishing cement. Apply a 1/16 inch thick tack coat of mastic over the dry cement, followed by a layer of reinforcing fabric installed wrinkle-free. Over the reinforcing fabric, apply a 1/8 inch thick dry coat of mastic weathercoat with a smooth finish. This finish shall extend approximately 2 inches under the adjacent pipe jacketing. No porosity shall exist in mastic weathercoating when dry.

C. Application Vessels and Equipment Insulation

1. General
- a. Insulate vessels and equipment indicated on the Engineering and Utility Flow Diagrams as noted on the vessel or piping drawings.
 - b. Insulate attachments secured to the vessel or equipment that project through the insulation. Insulate projections externally from the point where they project through the insulation for a distance of 4 times the thickness of the base insulation.
 - c. Insulate manhole covers, flanges, nameplates, and all other appurtenances. Where periodic maintenance or inspection is required,

GENERAL REQUIREMENTS - PIPING INSTALLATION

such as at manholes and nameplates, design provision for removability and replacement without damage to the insulation.

- d. Insulate stiffener rings on vessels and equipment with the same thickness of insulation as the adjacent surfaces. Box the stiffener rings with insulation, and leave void the areas between the outer flange and the vessel.

2. Insulation Application

- a. Apply block insulation on vessels and equipment with stagger joint arrangement. Coat the butt edges with a 1/16 inch thick layer of joint sealer. In cases of double layer insulation, apply the inner layer without joint sealer. Secure each layer of insulation with bands on 12 inch centers. When applying double layer insulation, stagger or offset outer layer joints from the inner layer joints. Only the outer layer of double layer insulation shall be a vapor barrier. Seal joints with a foil-to-mylar 3 inch wide strip applied over the vapor barrier jacketing.
- b. Provide insulation contraction joints on 12 foot maximum center. Joints shall be 1- 1/2 inch wide, packed with 2 inches of fiberglass blanket. Seal joints with foil-to-mylar strip to serve as a vapor barrier.
- c. Shape block heads so that sections closely fit the contour of the head. Coat butt edges with a 1/16 inch thick layer of joint sealer. In cases of multiple layers, seal only the outermost layer. Secure insulation for exposed heads with band attached to a floating ring on the top and to a circumferential band at the tangent line of the vessel head. Band spacing shall be on 12 inch maximum centers at the tangent line.
- d. Shape vessel transitions' block insulation so that sections closely fit the contour of the shell. Coat butt edges with a 1/16 inch thick layer of joint sealer. Secure insulation in place with bands.
- e. Enclose stiffener ring in block insulation. Coat butt edges of insulation with a 1/16 inch thick layer of joint sealer. Secure insulation in place with a band in the center of each stiffener ring.
- f. Enclose pumps in block insulation. Coat butt edges of insulation with a 1/16 inch thick layer of joint sealer. Secure the insulation in place with bands.
- g. Apply vapor barrier coating at 1/16 inch dry thickness to seal protrusions, joints, or other discontinuities in the vapor barrier jacketing.

3. Weatherproofing Application

- a. Finish vessels with metal jacketing.

GENERAL REQUIREMENTS - PIPING INSTALLATION

- b. On horizontal vessels, secure the metal jacketing with bands spaced on 12 inch centers with one band at each circumferential overlay. Equip each band with one breather spring.
- c. Make longitudinal laps on 1- 1/3 inch corrugated metal jacketing 1- 1/2 corrugations. Make longitudinal laps on 3/16 inch corrugated metal jacketing a minimum of 2 inches. Make circumferential laps a minimum of 3 inches.
- d. Finish heads on horizontal vessels with metal jacketing with a minimum of 6 inches turned under the shell metal jacketing. Secure metal head covers in place at the circumferential overlap with a band equipped with a breather spring. Make metal joints weatherproof seams.
- e. Finish transitions and stiffener rings with metal jacketing with weatherproof seams. Extend jacketing under the upper shell jacketing a minimum of 6 inches and down over the lower shell jacketing a minimum of 6 inches. Secure metal covers in place at the circumferential overlaps with a band equipped with a breather spring.
- f. Finish pumps and irregularly shaped surfaces that cannot be suitably weatherproofed with metal jacketing, with a tack coat of mastic applied over the vapor barrier, followed by a layer of reinforcing fabric installed wrinkle-free. Over the reinforcing fabric, apply a 1/8 inch thick dry coat of mastic weathercoat with a smooth finish. Extend finish approximately 6 inches beyond the insulation at all metal projections to assure a good seal.
- g. Apply heavy fillets of flashing compound as flashing at all possible sources of moisture penetration, such as nozzles and other protrusions through the metal surface.

D. Application - Instrument Insulation

- 1. General
 - a. Insulate instruments, including components, valves, tubing, and piping whenever indicated on the Mechanical and Utility System Flow diagrams.
 - b. Insulate flanges and unions in instrument lines unless otherwise noted on the drawings.
- 2. Insulation application

Insulation materials and application shall be in accordance with the piping arrangement drawing.
- 3. In-Line Instruments
 - a. In-Line instruments are instruments that are an integral part of a piping system; they cannot be removed without affecting normal process flow.

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 50026
Page 10 of 13
2-5-96/Rev. No. 1

GENERAL REQUIREMENTS - PIPING INSTALLATION

- b. Insulate in-line instruments with the same material and thickness as that specified for the adjoining pipe.
- 4. Remote Instruments
 - a. Remote instruments are defined as those that are not an integral part of a piping system; they can be removed without affecting normal process flow.
 - b. Install remote instruments that require insulation in prefabricated insulated houses and insulate lead lines in the normal manner after installation.

END OF SPECIFICATION

GENERAL REQUIREMENTS - PIPING INSTALLATION

Attachment 01 ...Sheet 1 of 2

CLEANING PROCEDURES AFTER INSTALLATION:

Cleaning and Water Flushing

A. Scope of Procedure

This procedure covers flushing and cleaning of piping systems after assembly and erection.

B. Preparation for Cleaning Procedure

1. All pipe runs and joints will be visually inspected for proper installation and continuity.
2. Equipment with restricted flow passages or inaccessible areas where sediment could collect shall either be bypassed or furnished with adequately sized temporary protection strainers.
3. If system pumps are to be used for flushing and do not have a permanent suction strainer, they will then have a temporary strainer installed between the suction valve and the pump.
4. Where flushing water is recirculated and not wasted to sewers, temporary strainers and/or baskets will be installed at all sumps, tanks, and other accessible areas where extraneous material flushed from the piping system can be collected and removed.
5. To prevent contamination of instruments, all instrumentation lines will be disconnected during the flushing operation. These lines will be cleaned separately by blowing out with air or flushing with water. All instrumentation lines are to be reconnected after completion of the cleaning operation.

C. Materials

Fresh, clean water is to be provided by the Contractor for use as the flushing and cleaning agent.

D. Cleaning Procedure

1. All pipe lines shall be flushed at no less than their design flow rate. Where possible, piping systems should be sectionalized, and full system flow rates provided through individual sections.
2. Strainers and baskets should be inspected frequently during the flushing operation and cleaned if necessary.

E. Degree of Cleaning

Removal of all loose nonadherent material together with all adherent material that could break away during operation of the equipment.

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 50026
Page 12 of 13
2-5-96/Rev. No. 1

GENERAL REQUIREMENTS - PIPING INSTALLATION

Attachment 01 ...Sheet 2 of 2

F. Inspection Procedure

Flushing operations shall continue until extraneous material is no longer collected at strainers and baskets.

G. Post-Cleaning Procedure

Upon completion of flushing, all temporary strainers and baskets will be removed from the piping system unless otherwise specified by Owner's representative. Tanks and sumps are to be drained and thoroughly cleaned. Equipment and piping will be returned to their preflush condition.

GENERAL REQUIREMENTS - PIPING INSTALLATION

Attachment 02 ... Sheet 1 of 1

FASTENERS FOR REMOVABLE AND REUSABLE FLEXIBLE TYPE COVERS

Item	Material
Lacing Hooks	0.040 inch thick by 3/4 or 7/8 inch diameter, Type 304 stainless steel
Lacing	Type 302 or 304 stainless steel wire, annealed, minimum 16 gage (0.051 inch diameter)
Bands	Nomex loop and stainless steel hook Velcro with stainless steel D ring
Drawcord	Braided Nomex cord, 1/8 inch diameter

FRP TANKS

1.0 GENERAL

1.1 Summary

A. Scope of Specification

1. This specification prescribes standards for the design, fabrication, inspection, and testing of fiberglass reinforced polyester tanks complete with accessories as shown on the attached tank drawings, standard drawings, data sheets, and as specified herein.
2. FRP (Fiberglass reinforced polyester) tanks shall be shop fabricated, either horizontal or vertical.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, Work included in this specification shall conform to the applicable provisions of these publications.

A. ASTM (American Society for Testing and Materials)

1. ASTM D3299 Standard specification for Filament Wound Glass-Fiber-Reinforced Thermosel-Resin Chemical Resistant Tanks
2. ASTM D4097 Standard specification for Contact Molded Glass Fiber Reinforced Thermosel-Resin Chemical Resistant Tanks

B. SPI (Society of the Plastics Industry)

Standard TS-5867

1.3 Performance Requirement

The vessel shall be designed and constructed to support all loadings due to internal, external, thermal, and mechanical forces resulting from but not limited to the design requirements, vessel dead load, contents, wash water; moreover, the vessel shall support the greater of seismic or wind load specified, the loads generated by Seller supplied items, and loads due to acceleration and shocks generated by a transport vehicle (when the vessel is intended to be transported in a container). Roofs or heads shall be designed and constructed to support a minimum live load of 50 pounds per square foot. Supplier shall ensure the satisfactory performance and compliance of Supplier purchased items with the established design criteria.

FRP TANKS

1.4 Submittals

A. General

1. Supplier's drawings, calculations, and engineering data shall be in English and in customary United States units (foot-pound-second system).

B. Documents for Review

1. Supplier shall submit the following engineering data for review. Documents shall be in reproducible form and the quality shall allow for microfilming without loss of clarity. Documents shall be signed as checked before submittal. Unchecked data will not be accepted for review. Supplier shall not proceed with fabrication until authorized by Owner.
2. Review of Supplier's documents by Owner does not relieve Supplier of the responsibility for compliance to the applicable codes, standards, Owner data sheet(s) and specifications, or the accuracy of shop dimensions.

C. Drawings

1. Drawings are required for the complete fabrication of tank or vessel, including those of subsuppliers.
2. Drawings shall be complete and shall include as a minimum the following information:
 - a. Item Number and Purchase Order Number
 - b. References: Supplier shall include on drawings a reference to all applicable codes, standards, Owner Specifications, and any applicable Supplier's standards. When reference is made to Supplier's own standards, copies of such standards shall be submitted with drawings.
 - c. External/internal design pressure and temperature. Minimum tank design temperature.
 - d. Thickness and materials specifications for all components.
 - e. Hydrostatic test pressure and test water temperature.
 - f. Relevant fabrication, inspection and nondestructive examination requirements.
 - g. Estimated weight of vessel empty and full of water.

FRP TANKS

- h. Pertinent dimensions, including joint locations, nozzle location and projection, location of vessel supports and other information necessary for complete description of the tank or vessel.
- i. Supplier's drawing shall show internal supports and nozzles numbered and lettered identically with Owner vessel drawing/sketch.
- j. Proposal shall include blind flanges, nuts, bolts and 2 gaskets for all the nozzles and other accessories as required by the individual equipment data sheet, drawing(s), or both.
- k. The vessel manufacturer shall submit recommendations for foundation cushion (grout, foam board, roofing felt) compatible for vessel design and process application. This information will be submitted with quotation.
- l. Installation and field handling requirements shall be submitted with certified drawing(s).
- m. Drawings and additional information shall be submitted in accordance with the attached Supplier Data Requirements Sheet.
- n. Where drawing(s) make exception to this specification, the drawing(s) shall be adhered to.

D. Calculations

Supplier shall submit checked design calculations for Owner review.

E. Reference Samples

Reference samples of laminate quality at critical sections shall be submitted by supplier.

1.5 Site Conditions

Supplier shall design the tank or vessel for site conditions such as wind zone or seismic zone, as stated in equipment data sheet or in other relevant specifications.

2.0 PRODUCTS

2.1 General

- A. This specification together with the accompanying tank drawing(s), and data sheet(s), along with the Inquiry and Purchase Order, shall provide the general requirements and quality standards; it also forms the basis for furnishing fiberglass reinforced polyester liquid storage vessels.

FRP TANKS

- B. The fabricator is encouraged to submit a quotation on alternative methods of construction. However, for supplier's bid to be considered, supplier must quote as specified herein. It is the responsibility of the fabricator to insure that details called out on the tank drawing(s) and data sheet(s) as well as the fabricator's proposal alternates will meet the requirements of the job regarding strength, corrosion resistance, and workability.

2.2 Performance Warranty

- A. The fabricator shall warrant the structural integrity of all vessels fabricated in accordance with this specification and shall further warrant above and over the requirement of Section 1.3 that each vessel fabricated under this specification shall be suitable for the intended application and service requirement as identified on the individual data sheet(s) for each item.

2.3 Design Requirements

A. Design Criteria

1. Material thickness shall be sufficient to withstand the hoop stresses developed with a vessel completely full of liquid based on density given on data sheet (or 10 pounds/US gallon whichever is greater) and with a factor of safety of 10 applied. Unless noted otherwise, a 25 pound per square foot wind loading over 80 percent of the projected vertical area shall also be incorporated into the design of tanks to be installed outdoors. The proposed design shall be fully defined including (but not limited to) materials of construction, method of construction, total laminate thickness, and details of the sequence of laminate buildup for each item specified in this specification.
 2. In calculating the strength of a tank wall, the strength of the resin-rich corrosion resistant surfacing mat inner layer shall be neglected.
 3. Tank openings shall be reinforced to withstand the static pressures developed and external pipe loads as required (such as surge, vibration).
 4. ASME top head shapes shall be used and shall be capable of withstanding a 200 pound concentrated load at any point.
 5. Tank bottom shall be designed for flexure induced by variation in tank liquid level and by agitation of the liquid when a mixer is used.
 6. Internal baffles shall be designed to withstand static pressure and agitator loading when a mixer is used.
 7. Hold-down lugs and leg systems shall be designed to restrain vessel, vessel contents, and vessel agitator from overturning or shifting due to
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FRP TANKS

seismic forces as determined by code specified on Owner tank drawing(s).

8. Lifting lugs for each vessel are required for job site offloading.

B. Basic Materials and Methods

1. Resin

- a. The resin of the resin-rich layer and subsequent structural layers shall be provided as specified on the Owner tank drawing(s). This includes nozzles, bosses, flange faces, manways, and tank internals that will contact the vessel contents.
- b. Where fire retardancy is specified on the tank drawing(s), the outer 2 structural layers of the laminate shall be a compatible resin to that specified for the structural layer and that contains 3 percent clear antimony trioxide based on resin weight.

2. Resin Additives

- a. No more than 10 percent styrene, based on resin weight, may be added to the as received resin.
- b. Based on resin weight, up to 2 percent thixotropic agent Cab-O-Sil may be added for viscosity control to the paraffinated top coat.
- c. Tanks shall not contain dyes or pigments unless specified on tank drawing(s). If specified, pigments shall be uniformly dispersed in the resin used for laminate finish coat only. This finish coat is to be applied after equipment inspection and approval by Buyer.

3. Resin Reinforcement

- a. All reinforcement shall be borosilicate glass unless specified otherwise on tank drawing(s).
 - b. Surfacing mat shall be Type C glass 10 mils thick with a silane finish and styrene soluble binder.
 - c. When abrasive services are called out on attached drawing(s), Dynel or Nexus veil followed by C glass veil shall be used to reinforce the resin-rich interior corrosion barrier.
 - d. Chopped strand mat shall be 1- 1/2 ounces to 2 ounces per square yard, Type E glass, with a silane finish and styrene soluble binder.
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FRP TANKS

- e. Continuous or woven roving shall be Type E glass, 60 ends per strand, with silane finish. Woven roving shall be a nominal 24 ounces per square yard.

4. Physical Properties

For determining adequate wall thicknesses, physical properties of laminates have been established without respect to resin reinforcement or method of manufacture according to Attachment 1.

5. Substitutions

Only those materials specified on tank or vessel drawing or data sheet shall be used for construction. Any other substitute material shall have prior written approval from buyer before being used in construction. A request by Supplier for substitution of material must be accompanied by complete information, including proposed thickness.

C. Fabrication and Manufacture

1. General

- a. Positive construction methods shall be used to ensure uniform glass-to-resin ratio and uniform total thickness. Laminates shall be dense without visible voids, dry spots, surplus resin, or unsaturated glass. Air bubbles shall be held to the criterion outlined in Attachment 2. When specified by Buyer, reference samples of representative laminate quality shall be submitted by Supplier for approval before tanks are made. Extreme care shall be exercised in mixing resin components to ensure proper proportions of hardener to resin. (This proportion effects the curing of the resin system.) No other method of curing during fabrication shall be allowed other than the normal curing resulting from the exothermic reaction between the resin and hardener.
- b. Internal weld layups and surfaces exposed to vapors and liquids shall have a resin-rich surface (10 mils overlay of the surfacing mat) and shall contain 0.4 percent maximum paraffin by weight of resin added, to prevent air inhibiting the final cure.
- c. The inner tank surface shall be smooth, without seams or flat areas resulting from a collapsible form. All spillages or foreign material of any nature shall be removed and affected areas touched up with resin as required.
- d. The outer surface shall be relatively smooth, without spillages, foreign material, or exposed glass fibers.

FRP TANKS

- e. All cut edges or exposed glass fibers of any kind shall be overlaid with surfacing mat and the appropriate resin type according to Sections 2.3C.1 and 2.3C.2.
- f. The minimum laminate thickness shall be 3/16 of an inch regardless of operating conditions.
- g. The knuckle radius between the bottom and side of all flat-bottom tanks shall be 1- 1/2 inches minimum. Shell joints, if required, shall be overlaid on the inner surface and on the exterior surface according to Sections 2.3C.2.g and 2.3C.2.h. Overlays must be at least equal to the thickness of the heaviest section joined. Exterior joint width shall be 8 inches for tanks up to 6 feet in diameter, 15 inches for tanks 7 to 12 feet in diameter, and 24 inches for tanks larger than 12 feet in diameter. Shell joints are not acceptable in tanks of straight side heights less than 20 feet without prior approval. Vessels that fabricators indicate require a shell joint shall be identified in the proposal with a detailed explanation.

2. Layup Procedures

- a. Areas exposed to vapors or liquids shall be resin-rich and reinforced with a 10 mil thick Type C glass surfacing mat. This mat should be the initial inner layer; a separately cured unreinforced gel coat is not acceptable. The glass content of this layer shall be 10 percent by weight.
- b. Over the resin-rich surface, multiple layers of resin with 1- 1/2 to 2 ounce Type E glass chopped strand mat shall be applied to a total thickness, together with the resin-rich inner layer, of about 150 mils. The glass content of the composite structure to this point shall be 25 percent by weight.
- c. This layed-up portion shall be allowed to cure before subsequent reinforcement to maintain proper resin content in the chopped strand mat laminate.
- d. Subsequent reinforcement of the cylindrical section shall be by filament winding with continuous strand roving according to Section 2.3C.2.e. maintaining a glass content of 50 to 60 percent by weight in the filament wound portions. Hand layup reinforcement shall also be acceptable when specified by Buyer. This reinforcement shall consist of alternating layers of chopped strand mat and woven roving as described in Sections 2.3B.3.d. and 2.3B.3.e.
- e. If possible, filament winding shall include continuous shell reinforcement over the tank head and bottom to eliminate structural

FRP TANKS

top and bottom shell joints. Hand layup head-to-shell joints shall consist of alternating layers according to Section 2.3C.2.

- f. The entire outer surface shall be coated with a 10 mil gel coat. Color shall be natural color of resin unless otherwise specified.
 - g. The interior joints where top and bottom heads have been joined to the shell shall be layed up with 2 thicknesses of 1- 1/2 to 2 ounce chopped strand mat with a composite thickness of about 150 mils. The final layer shall be paraffinated, resin-rich, and finished to a smooth surface to maintain a continuous unbroken inner corrosion resistant surface. The layup shall extend a minimum of 3 inches on either side of joint line.
 - h. Top, end, and bottom heads (for subsequent winding or layup onto the shell) shall be constructed according to Section 2.3C.2., followed by further reinforcement with alternating layers of continuous strand woven roving and chopped strand mat according to Section 2.3B.3. to such a thickness that the structural strength requirement is satisfied. All edges of the reinforcements shall be lapped 2 inches minimum for woven roving and 1 inch minimum for mat. Adjacent laps shall be staggered. The final exterior layer of reinforcement shall be chopped strand mat. The glass content of the layer reinforced with woven roving shall be between 50 and 60 percent by weight of resin.
 - i. Horizontal tanks shall be provided with axial foundations supports to eliminate compressive and tensile forces resulting from cantilevered support systems.
 - j. On laminates containing woven roving, cut edges exposed to the chemical environment shall be coated with resin and surfacing mat. All machined flange faces shall be faced with Type C glass veil according to Section 2.3C.3. All other cut edges may be coated with resin only.
3. Nozzles, Flanges, and Accessories
- a. Flanges shall be made by hand layup. Press molded or glue-on flanges are not acceptable.
 - b. Flanges and nozzles shall be constructed of reinforced resin as specified by the tank drawing(s) for the resin rich layer. Flange thickness shall be in accordance with SPI Standard TS-5867 with 75 pound rating. All flanges shall have ANSI B-16.5 drilling for 150 psi pressure class.

FRP TANKS

- c. Flanges and nozzles shall be joined to the tank with resin and reinforcing material as herein specified, layed up to a thickness that satisfies structural requirements. Construction of the interior surface in contact with vapor or liquid and of the exterior surface shall follow Section 2.3C.2.
- d. Unless otherwise specified, all nozzles shall be reinforced with gussets, of FRP construction, joining together the tank wall, nozzle, and flange. Reinforcement shall include 3 layers minimum of 1- 1/2 ounce mat. The gusset shall make an included angle of approximately 60 degrees with the tank wall and shall support the entire flange width. Nozzles less than 10 inches in diameter shall have 4 gussets, and those 10 inches in diameter and larger shall have 8 gussets.

2.4 Inspection and Tests

A. Inspection

- 1. Inspection and acceptance or rejection shall be based on compliance with all sections of this specification and guidelines set forth in Section 2.3B.2. Acceptance by the inspector shall not relieve the manufacturer of contractual responsibilities. The decision of the inspector about rejection of material, workmanship, or performance for noncompliance with the specifications shall be final.
- 2. A visual inspection of the laminate shall be made. Laminate defects and their permissible limits shall be in accordance with the provisions of Attachment 2.
- 3. Tolerances

Dimensional tolerances shall be held within the limits outlined in Attachment 3.
- 4. Use acetone wipe test to check surface cure. No surface tackiness is permitted.
- 5. It is the responsibility of the fabricator to ensure that laminates meet or exceed this specification, that vessels are adequately prepared for shipment, and that vessels will arrive defect- and leak-free at the jobsite. All vessels will receive a jobsite inspection in conformance to this specification. Laminate sections failing to comply with this specification or that are damaged in transit must be repaired before acceptance by Buyer. The fabricator will be responsible for the expenses of repairing laminate defects and damage.

FRP TANKS

6. The fabricator shall supply a 4 inch by 4 inch sample specimen of the proposed tank construction, for every thickness and type of construction to be utilized; also, cutouts are to be saved as samples. These samples are to be used as a quality control inspection standard.
7. Supplier shall coordinate the design activity with other suppliers for internal trays, internal packings, and other additional equipment that is a part of tank/vessel/column being manufactured by supplier. Owner shall specifically authorize Supplier to coordinate such activity.

B. Tests

1. Test for conformance with the required physical properties shall be done on samples that have cured to the required hardness.
2. Hardness tests shall be made on the resin-rich interior surface.
3. Flexural tests shall be made with the resin-rich surface in compression.
4. The Vendors standard testing procedures are acceptable and results shall be made available to Owner if requested.
5. Tanks shall also be subject to on-site or in-plant inspections by a representative of Buyer at any stage of construction. Such inspections would consist of verification of fabrication procedures and workmanship, material checks, dimensional checks, and verification of pressure tests (filling with water) on completed tanks. To facilitate such inspections, Supplier shall advise Buyer of the production schedule for each tank at least 1 week in advance of initiating fabrication. Buyer may establish hold points in fabrication where mandatory inspections are to be performed.
6. Upon completion of final inspection and acceptance by Buyer, the tank shall be hydrostatically tested by filling with water. Duration of test shall be no less than 1 hour.

2.5 Identification and Tagging

- A. Tank/vessel shall have securely and permanently attached, a stainless steel metal tag bearing following information:
 - Name of producer/fabricator
 - Date of manufacture
 - Capacity
 - All resins used
 - Design temperature (maximum/minimum)
 - Design pressure
 - Purchase order number
 - Specific gravity

FRP TANKS

- Inner surface reinforcements
 - Any additional markings as required by local and state laws or codes. (This information to be supplied by Buyer to tank manufacturer.)
 - Model number
- B.** The center of gravity shall be marked on all vertical vessels by painting a continuous 3 inch wide circumferential stripe. The letters C-G and shipping weight in tons shall be painted on 2 locations diametrically opposite and adjacent to the stripe. The location of the center of gravity specified on Owner vessel drawings is that of the vessel as fabricated; Supplier shall make suitable adjustment for shipping supports and similar features, if they cause the center of gravity position to move more than 6 inches.

2.6 Preparation for Shipment

- A.** Whenever feasible, shipments shall be made by truck.
- B.** Tanks and cylindrical equipment that are shipped horizontal shall be mounted on padded cradles. All tank end blocking used to prevent shifting of tanks must be padded and bear only upon the knuckle radius of flat or dished head. When shipped vertical, such equipment shall be secured to a pallet or skid. Other types of equipment shall be mounted on skids or pallets.
- C.** Tanks and equipment shall be secured to the cradles or skids to prevent rotation or other movement. In turn, the cradles or skids shall be fastened securely to the truck bed or railroad car.
- D.** Tiedown straps shall have provision for thermal expansion and shall be padded where in contact with the equipment.
- E.** Flange faces shall be protected from damage by covering with suitable plywood or hardboard, securely fastened.
- Note !!! Tanks shall be positively vented at all times.
- F.** Open-top tanks and equipment shall be fitted with internal cross bracing to prevent damage from distortion during transit and handling.
- G.** Pipe and tubing, fittings, and miscellaneous small parts shall be crated. Additional protection, such as battens, end wrapping, cross bearing, or other interior fastening may be required to ensure such individual equipment pieces are not damaged in transit.

3.0 EXECUTION

Not applicable.

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 58023
Page 12 of 15
2-5-96/Rev. No. 1

FRP TANKS

4.0 ATTACHMENTS

Attachment 1: Laminate Wall Thickness

Attachment 2: Laminate Defect Tolerances

Attachment 3: Dimensional Tolerances

Attachment 4: Drawing No. T201: APL Storage Tank T-201-A/B

End of Specification

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 58023

Page 13 of 15
2-5-96/Rev. No. 1

FRP TANKS

ATTACHMENT 1

LAMINATE WALL THICKNESS

	Thickness in Inches			
	3/16	1/4	5/6	3/8 & Up
Ultimate Tensile Strength ASTM D638- psi, min	9,000	12,000	13,000	15,000
Flexural Strength ASTM D790 - psi, min	16,000	19,000	20,000	22,000
Compressive - Edge Strength ASTM D695 - psi, min	18,000	18,000	20,000	20,000
Modulus of Elasticity ASTM D760 - psi, min	700,000	800,000	900,000	1,000,000
Barcol Hardness ASTM D785	26 Minimum - Measured with Barcol Impresser Model GYZJ 934-1			
Glass Content Measured By Ignition	Calculated on the basis of Total Thickness <ul style="list-style-type: none">• Corrosion Resistant Inner Layers 25%• Filament Wound Layers 50%-60%• Layup Reinforced with Woven Roving 50-60%			

FRP TANKS

ATTACHMENT 2

LAMINATE DEFECT TOLERANCES

Defect	Process Surface	Non-process Surface
Blisters	None	Max 1/4" dia. 1/16" high
Burned Areas	None	None
Chips	None	Max 1/4" with max thickness 20 % of wall
Cracks	None	None
Crazing	None	Slight
Dry Spots	None	Max 2 sq in/sq ft
Entrapped Air	None in resin-rich layers. If in laminate 1/16" dia max & 10 sq in max.	1/8" dia. max - no more than 3% of area
Exposed Glass	None	None
Exposed Cut Edges	None	None
Foreign Matter	None	None if it affects the properties of the laminate
Pits	Max 1/8" dia. X 1/32" deep, max 10/sq ft	Max 1/8" dia. x 1/16" deep
Scratches	None (Coated)	None
Surface Porosity	None	None
Wrinkles	Max deviation 20% of wall thickness, but not exceeding 1/8"	Max deviation 20% of wall thickness, but not exceeding 3/16"
Sharp Discontinuity	None	None

FRP TANKS

ATTACHMENT 3

DIMENSIONAL TOLERANCES

Diameter (including out-of-roundness)	$\pm 1\%$
Sidewall Taper	$1/2^\circ$
Height	$\pm 1/2\%$ with max of $\pm 1/2''$
Flange Alignment	$1/2^\circ$
Manhole (Inspection Cover Alignment)	1°
Nozzle Centerlines	$1/64''$ per ft of height with max of $\pm 1/4''$
Knuckle radius at top & bottom head-sidewall joints	$1-1/2''$ min
Nozzle Squareness	$\pm 1^\circ$ with sidewall

INSPECTION AND TESTING SERVICES

If the Contractor covers any part of the Work that has been designated for special tests, inspections or approvals prior to such being made, the Contractor shall uncover such work, have inspections or tests satisfactorily completed and make good such work at no additional cost to OxyChem/Olin.

OxyChem/Olin may order any part of the Work to be examined if such work is suspected to be not in accordance with the Contract Documents and Specifications. If, upon examination such work is found not to be in accordance with the Contract Documents and Specifications, the Contractor shall correct such work and pay the cost of examination and correction. If such work is found to be in accordance with the Contract Documents and Specifications, OxyChem/Olin will pay the cost of examination and replacement.

A. Earthwork/Trenching

1. General

Monitor all earthwork operations including excavation, fill and backfill to verify that all existing soils exposed by the Work and borrow materials furnished are suitable for use and that the Work is accomplished in accordance with all applicable specifications, codes and standards. All inspection and testing of earthwork shall be performed by or under the direct supervision of a registered engineer qualified to perform geotechnical engineering.

2. Quality Control

a. Laboratory Control - All Soil Material Imported to Site (Other than Bulk Fill Being Placed at the Site By OxyChem/Olin)

The Inspection and Testing Agency shall, for each different soil material to be used as compacted fill/backfill, determine the following:

<u>Parameter</u>	<u>Laboratory Test</u>	<u>Frequency</u>
Maximum density and optimum moisture content	ASTM D698	One test per 5,000 cubic yards to be placed
Grain size distribution	ASTM D422	One test per 1,000 cubic yards to be placed

INSPECTION AND TESTING SERVICES

Moisture content	ASTM D2216	One test per 1,000 cubic yards to be placed
Atterberg limits	ASTM D4318	One test per 5,000 cubic yards to be placed
Soil classification	ASTM D2487	One test per 5,000 cubic yards to be placed
Permeability	ASTM D2434	One test per 5,000 cubic yards of bulkhead soil to be placed
Target Analyte List (TAL)/Target Compound List (TCL)	--	One test per material type from each borrow source

The Inspection and Testing Agency shall provide in writing the laboratory results for these tests to OxyChem/Olin for its approval at least 15 calendar days before delivery of off-Site materials to the jobsite.

b. Field Quality Control - General Earthwork

The Inspection and Testing Agency shall, for each soil material to be used as compacted backfill, perform the following tests:

<u>Parameter</u>	<u>Laboratory Test</u>	<u>Frequency</u>
Density	ASTM D2922	One test per each 10,000 square feet, and/or fraction thereof per day, of each lift
Moisture content	ASTM D3017	One test per each 10,000 square feet, and/or fraction thereof per day, of each lift
Grain size distribution	ASTM D422	One per 5,000 cubic yards placed

INSPECTION AND TESTING SERVICES

Atterberg limits ASTM D4318 One per 5,000 cubic yards placed

The Inspection and Testing Agency shall provide the results of these tests to OxyChem/Olin within 24 hours of their completion.

c. **Field Quality Control - Backfill of Trenches**

The Inspection and Testing Agency shall, for each soil material to be used as compacted backfill, perform the following tests:

<u>Parameter</u>	<u>Laboratory Test</u>	<u>Frequency</u>
Density	ASTM D2922	One test per 18 inches of backfill per 100 LF, or fraction thereof, of trench or upon request by OxyChem/Olin
Moisture content	ASTM D3017	One test per 18 inches backfill per 100 LF, or fraction thereof, of trench or upon request by OxyChem/Olin
Grain size	ASTM D422	One test per 18 inches backfill per 100 LF, or fraction thereof, of trench or upon request by OxyChem/Olin
Atterberg limits	ASTM D4318	Upon request by OxyChem/Olin

The Inspection and Testing Agency shall provide the results of these tests to OxyChem/Olin within 24 hours of their completion.

B. Aggregate Roadway and Pavement Base Material

1. **Laboratory Control**

The Inspection and Testing Agency shall, for each source of aggregate material, perform the following tests:

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 02006
Page 7 of 8
2-5-96/Rev. No. 1

INSPECTION AND TESTING SERVICES

<u>Parameter</u>	<u>Laboratory Test</u>	<u>Frequency</u>
Gradation	ASTM C117, D136	One test per 200 tons, or fraction thereof, delivered to the Site
Atterberg Limits	ASTM D4318	One test per 200 tons, or fraction thereof, delivered to the Site
Percentage Wear	ASTM C131	One test per 200 tons, or fraction thereof, delivered to the Site

The Inspection and Testing Agency shall provide in writing the laboratory results for these tests to OxyChem/Olin for its approval at least 15 calendar days before delivery of off-Site materials to the jobsite.

2. **Field Quality Control**

The Inspection and Testing Agency shall, for source of aggregate material, perform the following tests:

<u>Parameter</u>	<u>Laboratory Test</u>	<u>Frequency</u>
Density	ASTM D2922	One test per each 2,000 square feet, and/or fraction thereof per day, of each lift

The Inspection and Testing Agency shall provide the results of these tests to OxyChem/Olin within 24 hours of their completion.

C. HDPE Geomembrane, Geotextile, Geonet, Geosynthetic Clay Liner

Inspection and testing for these items shall be in accordance with Specification 02776.

D. Underground Piping

Inspection and testing of underground piping shall be in accordance with Specification 02725.

E. Slurry Wall

Inspection and testing of slurry wall shall be in accordance with Specification 02901.

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 02006
Page 8 of 8
2-5-96/Rev. No. 1

INSPECTION AND TESTING SERVICES**F. APL Collection Trench**

Inspection and testing of APL Collection Trench shall be in accordance with Specification 02902.

G. Cast-in-Place Concrete

Inspection and testing of Cast-in-Place concrete shall be in accordance with Specification 03300.

H. Aboveground Piping

Inspection and testing of aboveground piping shall be in accordance with Specification 59026.

I. Electrical Systems

Inspection and testing of Electrical Systems shall be in accordance with Specification 65000.

J. Instruments

Field checkout of instruments shall be in accordance with Specification 70002.

END OF SPECIFICATION

MONITOR WELL AND PIEZOMETER INSTALLATION

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes requirements for the installation of post-closure monitor wells, post-closure bedrock monitor wells, and piezometers at the Owner's 102nd Street Landfill Site (Site) in Niagara Falls, New York. The Work shall be complete and shall include the mobilization of equipment and materials, the preparation of drilling locations, the advancement of the borings and completion of the monitor wells/piezometers, the installation of geomembrane boots, the construction of concrete pads and the installation of protective casings. The Contractor shall furnish all materials, labor, tools, supervision and equipment necessary to complete the Work of this Specification. Details of the wells and piezometers are shown on Drawing 594000-30K-06.

B. Attachments

The following Attachments prescribe Work related procedures, protocols and requirements:

- Attachment A: Owner's Site Specific Health and Safety Plan (SSHSP)
- Attachment B: Health and Safety Plan (HASP) Addendum and Appendices

Coordinate Work prescribed by this specification with Work and requirements prescribed by the above listed specifications and attachments.

C. Terminology

Where used in this specification, the following terms shall have the meanings indicated below, unless clearly indicated otherwise by the context of their use.

1. Contractor: The individual, partnership, company or corporation obligated to the Owner to perform the post-closure monitor well, post-closure bedrock monitor well, and piezometer installation.
2. Tremie Method: The method of placing sand, gravel, bentonite pellets or other material at the bottom of a borehole by running water through a pipe and washing the material out the bottom of the pipe. The tremie pipe is raised periodically as the filter material or bentonite builds up around the well screen or riser. No water is used if grout is being injected through the tremie pipe.

D. Supplied by Owner

The Owner shall provide access to the Site and interface with all federal, state and local agencies. The Owner shall supply any available drawings showing known underground utilities. The Contractor shall verify actual locations before drilling.

MONITOR WELL AND PIEZOMETER INSTALLATION

1.2 References and Codes

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, work covered by this specification shall conform to the applicable provisions of these publications.

A. ASTM (American Society for Testing and Materials) Standards

1. ASTM C150 Standard Specification for Portland Cement
2. ASTM D1586 Standard Method for Penetration Test and Split-Barrel Sampling of Soils
3. ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

B. The Owner shall obtain the necessary permits and certificates required for the execution of this work. The Contractor shall provide any assistance and documentation that the Owner requires to obtain these permits and certificates.

C. Contractor shall comply with all federal, state or local laws, ordinances, or rules and regulations relating to the performance of the Work of drilling and installing the monitor wells and piezometers.

1.3 Submittals

A. Draft Report

The Contractor shall present the results of the monitor well and piezometer installation and development in a written draft report in three (3) copies to Owner within four (4) weeks after completion of all monitor wells and piezometers. This draft report shall be complete in itself and shall contain all previously given and still valid recommendations and pertinent data. It shall include, but not necessarily be limited to, the following information:

1. Final boring logs, including:
 - soil/fill descriptions
 - moisture conditions
 - blow counts
 - NAPL presence, if any
2. As-built construction drawings
3. Groundwater measurements
4. Air quality monitor results
5. Well development results

MONITOR WELL AND PIEZOMETER INSTALLATION

6. All data and recommendations required by this specification
7. Documentation of any deviations in performance of work in regard to these specifications and evidence of Owner's approval.

B. Final Report

Submit five (5) bound copies and one (1) unbound reproducible copy of the final well installation report to Owner within two (2) weeks of the receipt of the review comments on the draft report.

C. Data and Records

All data required to be recorded in accordance with ASTM or other standard test methods in this specification shall be obtained and recorded by the Contractor and submitted to the Owner.

D. Permits and Licenses

The Contractor shall furnish to the Owner three copies of the following document:

- Drilling license and/or any other license required by federal, state, and/or local government agencies necessary to perform the Work of this specification.

2.0 PRODUCTS AND MATERIALS

2.1 General

Monitor well and piezometer construction materials shall conform to ASTM D5092.

2.2 Materials

A. Water

Water used in the drilling process, to prepare grout mixtures and to decontaminate the well screen and riser shall be potable.

B. Sand Pack

1. The sand pack shall be installed in the annulus between the well screen and the borehole wall from the bottom of the borehole to one (1) foot above the top of the well screen.
2. The sand pack shall consist of clean, well rounded silica sand free of loam, dust, and other foreign particles. The sand pack gradation shall be No. "00N" grade Morie Company sand or conforming to the following gradation:

MONITOR WELL AND PIEZOMETER INSTALLATION

<u>U.S. Standard Sieve Number</u>	<u>U.S. Standard Sieve Opening (Inches)</u>	<u>Cumulative Percent Retained (By Weight)</u>
20	0.033	0-1
25	0.028	5-15
30	0.023	30-50
35	0.020	85-93
40	0.016	95-98
50	0.012	98.5-99.7
70	0.008	100

C. Well Screen

1. The well screen shall be two (2)-inch inner diameter (ID), threaded-flush-joint (TFJ), continuous wrapped wire-wound No. 6 (0.006 inch) slot Type 304 stainless steel. The length of screen for each piezometer and monitoring well is provided on the drawings. The well screen shall be plugged at the bottom and the plug shall be constructed of the same material as the well screen.
2. Immediately prior to installation, the well screen shall be steam cleaned or high pressure water cleaned with clean, potable water; if not certified by the manufacturer, delivered to the site in a factory sealed protective wrapping, and maintained clean at the site.

D. Riser Casing

1. The riser casing shall be two (2)-inch ID, TFJ, Schedule 5, Type 304 stainless steel, and shall have a length equal to the distance from the top of the well screen to approximately two (2) feet above the final ground surface. The depth of the piezometer and the monitoring well borehole is shown on the drawings.
2. Joints shall consist of square profile flush joint threads to prevent seepage of water into the riser and to eliminate the need for polytetrafluoroethylene (PTFE) tape.
3. Immediately prior to installation, the riser casing shall be steam cleaned or high pressure water cleaned with clean, potable water; if not certified by the manufacturer, delivered to the site in a factory sealed protective wrapping, and maintained clean at the site.

E. Outer Casing for Bedrock Monitoring Wells

1. The outer casing shall be ten (10) inch diameter, schedule 10, Type 304 stainless steel, and shall have a length equal to the distance from 18 inches into the Clay/Till to approximately two (2) feet above the ground surface.
2. Joints for outer casing shall be welded together or consist of square profile flush joint threads to prevent seepage of water into the casing and to eliminate the need for polytetrafluoroethylene (PTFE) tape.

MONITOR WELL AND PIEZOMETER INSTALLATION

3. Immediately prior to installation, the outer casing shall be steam cleaned or high pressure water cleaned with clean, potable water; if not certified by the manufacturer, delivered to the site in a factory sealed protective wrapping, and maintained clean at the site.

F. Secondary Casing for Bedrock Monitoring Wells

1. The secondary casing shall be six (6) inch diameter, schedule 10, Type 304 stainless steel, and shall have a length equal to the distance from 24 inches into the bedrock to approximately two (2) feet above the ground surface.
2. Joints for secondary casing shall be welded together or consist of square profile flush joint threads to prevent seepage of water into the casing and to eliminate the need for polytetrafluoroethylene (PTFE) tape.
3. Immediately prior to installation, the secondary casing shall be steam cleaned or high pressure water cleaned with clean, potable water; if not certified by the manufacturer, delivered to the site in a factory sealed protective wrapping, and maintained clean at the site.

G. Protective Casing

The protective casing shall be constructed of cast iron, approximately six (6) feet long and four (4) to six (6)-inch diameter with a lid capable of being slipped over the protective casing and locked. Protective casings for the monitor wells will be seated a minimum of two feet. Protective casings for the piezometers will be seated a minimum of two feet, six inches.

H. Annular Sealants

1. Bentonite

The bentonite to be used for a seal above the sand pack shall be pelletized and a minimum 0.25 inches in diameter. The pellets shall consist of sodium montmorillonite furnished in sacks or buckets from a commercial source and free of impurities. The bentonite seal thicknesses are shown in Drawing 594000-30K-06.

2. Cement-Bentonite Grout

The cement-bentonite grout to be used as backfill from the top of the bentonite pellet annular seal to the ground surface and seal annular space between borehole and outer/secondary casings shall consist of about six (6) to seven (7) gallons of clean and potable water per ninety-four (94) pound bag of Type I Portland cement. Portland cement shall conform to ASTM C150, Type I. Four (4) percent (by dry weight of cement) of unaltered bentonite powder shall be added after the initial mixing of cement and water to retard shrinkage and provide plasticity. The bentonite shall be added dry to the cement-water slurry without first mixing it with water.

MONITOR WELL AND PIEZOMETER INSTALLATION

I. Geomembrane Boot

The geomembrane boot which is to be used to seal the geomembrane landfill liner to the piezometers shall be manufactured of the same material as the geomembrane liner and sealed to the liner following the manufacturer's recommended procedures. Details of the geomembrane boot installation are shown on Drawing 594000-30K-06.

J. Concrete Well Pad

A concrete pad that will provide well protection shall be completed by constructing a six (6) inch thick by two (2) feet square concrete pad, slightly sloped, to provide water drainage away from the monitor well or piezometer. The concrete pad shall meet the requirements of Specification 03300: Cast-In-Place Concrete. The concrete pad shall not be rigidly attached (cemented) to the protective casing to prevent cracking if subsidence should occur. A rubber, plastic, or foam sleeve shall be utilized to prevent rigid attachment. The concrete well pad shall have No. 4 reinforcement @ 12-inch OC, each way at mid-depth. Details of the monitor well/piezometer pad are found on Drawing 594000-30K-06.

K. Lock

Contractor shall furnish and install keyed-alike locks for all monitor wells and piezometers installed under this contract. Locks shall be suitable for long-term outdoor service.

3.0 EXECUTION

3.1 General

Monitor wells and piezometers shall be located as indicated on the drawings. Locations may be changed by the Owner after award of contract but prior to the mobilization for drilling. Contractor shall install monitor wells and piezometers in conformance to these specifications. Air monitoring of the breathing zone shall be performed by the Contractor in accordance with the requirements of Attachment A and B.

3.2 Equipment Mobilization/Demobilization

The Contractor shall furnish a truck and/or all terrain vehicle (ATV) mounted hollow stem auger drill rig, all necessary tools and equipment, 55-gallon steel drums for waste material handling, decontamination equipment, labor, supplies, and miscellaneous materials required to complete the described program. This shall include all work associated with moving equipment and supplies to the Site prior to beginning work, and moving equipment off site after the work has been completed.

3.3 Site Preparation

The Contractor is responsible for providing his own access to all drilling locations. This may include clearing of trees or brush inhibiting access to each drill site. The amount of clearing/disturbance shall be kept to a minimum to reduce environmental impacts and disturbance to the landfill surface. All ruts and holes shall be restored to original grade.

MONITOR WELL AND PIEZOMETER INSTALLATION

3.4 Equipment Decontamination

Prior to mobilizing to the site, the Contractor shall clean the drill rigs, and drilling equipment. Each power head shall be cleaned using a power washer, steam jenny, or, alternatively, it shall be hand washed with a brush using detergent to remove oil, grease and hydraulic fluid from the exterior of the rig. The drill rigs shall be inspected by the Owner when mobilized to determine that there are no fluid leaks. If necessary, down-hole drilling and sampling equipment shall be sandblasted to remove any paint, dried caked-on mud or heavy rust accumulation. Down hole equipment, and items in the immediate vicinity of the boring shall be clean of oil and grime. Grease, oil, or other petroleum-based material shall not be applied to any threads.

The back of the drill rig, auger flights and drill tools shall be steam cleaned prior to each monitor well boring. The Contractor shall utilize the temporary decontamination pad (Specification 01120: Decontamination) for equipment decontamination. The drill rig(s) and drill tools shall be decontaminated using a powered steam system furnished by the Contractor. Detergent (Alconox) solutions may be used as necessary to properly clean equipment. Decontamination water shall be pumped to the storage tank furnished by the Contractor. The Contractor shall be responsible for containerizing used protective clothing during decontamination procedures and disposing of these materials following the procedures of Section 3.9 of this Specification.

The drill rig(s), vehicles, and drill tools shall be steam cleaned prior to leaving the Site using the procedures described above.

3.5 Post-Closure Monitor Well Installation

The Contractor shall use hollow stem auger drilling techniques (ASTM D1586, Standard Method for Penetration Test and Split Barrel Sampling of Soils) to advance the borehole for completion of the monitor wells. The hollow stem auger shall have a minimum internal diameter of four (4)-inches and the auger flight diameter will be between eight (8) and ten (10)-inches. Borehole locations shall be surveyed in the field by the Contractor and the locations will be reviewed and approved by the Owner prior to initiation of drilling.

During advancement of the borehole, soil samples shall be collected every two (2) feet according to the procedures of ASTM D1586 to provide a continuous stratigraphic record of the borehole. The samples shall be geologically logged according to the procedures of ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), by the Contractor. Samples shall be placed in clean glass jars furnished by the Contractor and held for secure storage.

The Contractor shall provide the necessary supervision and direction to his drilling crew. The Owner may elect to geologically log the borehole and view the samples. The drilling crew will provide any necessary assistance. Should the Owner log the samples, this shall not relieve the Contractor of the requirement to log the samples independently and prepare a boring log report.

The borehole shall be advanced to the top of the glaciolacustrine clay (Clay) or glacial till (Till) surface. The well screen shall be installed and extend from the Clay/Till surface to one (1) foot above the water table, as determined during drilling. No glue or solvents shall be

MONITOR WELL AND PIEZOMETER INSTALLATION

used during the assembly or installation of the monitor well. Approximate depths and amount of well screen for each monitor well is provided on the drawings.

The annular space surrounding the screen shall be filled with sand pack from the bottom of the screen to approximately one (1) foot above the screen by the tremie method or as approved by the Owner. A two (2)-foot thick bentonite pellet seal shall be placed above the sand pack by the tremie method. A minimum of eight hours must elapse to allow hydration of the bentonite before the remaining annular space is backfilled with cement-bentonite grout pumped to the top of the bentonite seal through a tremie pipe.

Locking protective casings and the concrete pad shall be installed after completion of the cap to final grade. Construction details are provided in the drawings.

Drill spoils shall be placed into 55 gallon drums during the drilling operation and shall be handled in accordance with Section 3.9.

3.6 Post-Closure Bedrock Monitor Well Installation

The Contractor shall provide the necessary supervision and direction to his drilling crew. The Owner may elect to geologically log the borehole and view the samples. The drilling crew will provide any necessary assistance. Should the Owner log the samples, this shall not relieve the Contractor of the requirement to log the samples independently and prepare a boring log report.

Borehole locations shall be surveyed in the field by the Contractor and the locations will be reviewed and approved by the Owner prior to initiation of drilling. The Contractor shall use hollow stem auger drilling techniques (ASTM D1586) to advance the borehole to the top of Clay/Till. The hollow stem auger shall have a minimum internal diameter of twelve (12)-inches.

During advancement of the borehole to the Clay/Till, soil samples shall be collected every two (2) feet according to the procedures of ASTM D1586, to provide a continuous stratigraphic record of the borehole. The samples shall be geologically logged according to the procedures of ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), by the Contractor. Samples shall be placed in clean glass jars furnished by the Contractor and held for secure storage.

A ten (10) inch diameter, schedule 10, Type 304 stainless steel outer casing shall be installed inside the hollow stem auger. The annular space between the outer casing and the borehole shall be backfilled with cement-bentonite grout by the tremie method. The grouting process may be completed by filling the ID of the auger with grout by the tremie method and then installing the outer casing, which is plugged at the base with a minimum thickness of two (2) feet of hardened grout, to the bottom of the borehole. The grouting process may also be completed by installing the outer casing within the ID of the auger to approximately six (6) inches above the base of the borehole, filling the ID of the casing with grout by the tremie method, and then pushing the grout downward with a plug attached to the drill stem causing the grout to flow upwards within the annular space. The auger flights shall be removed as grouting proceeds. The outer casing shall be lowered to the base of the borehole following installation of the grout. The bottom two (2) feet of the inside of the outer casing shall be

MONITOR WELL AND PIEZOMETER INSTALLATION

filled with the cement-bentonite grout. No further work shall be done until the grout has firmly set (a minimum of 24 hours).

After the grout has set, the borehole shall be advanced to two (2) feet into the bedrock using 9-7/8 inch diameter tricone roller bits. A six (6)-inch diameter, schedule 10, Type 304 stainless steel secondary casing shall be installed inside the borehole. The annular space between the secondary casing and the outer casing/borehole shall be backfilled with cement-bentonite grout. The grout shall be placed by same method used to place grout in the annular space outside the outer casing. Bottom two (2) feet of the inside of the secondary casing shall also be filled with the cement-bentonite grout. No further work shall be done until the grout has firmly set (a minimum of 24 hours).

After the grout has set, the borehole shall be advanced to fifteen (15) feet into the bedrock using 5-5/8 inch diameter tricone roller bits. The ten (10)-foot length of well screen shall be installed in the bottom of the borehole. No glue or solvents shall be used during the assembly or installation of the monitor well. Approximate depth for each monitor well is provided on the drawings.

The annular space surrounding the screen shall be filled with sand pack from the bottom of the screen to approximately one (1) foot above the screen (for a minimum filter pack thickness of 11 ft.) by the tremie method or as approved by the Owner. Approximately six (6)-foot thick bentonite pellet seal shall be placed above the sand pack to two (2) feet above the top of the bedrock by the tremie method. A minimum of eight hours must elapse to allow hydration of the bentonite before the remaining annular space is backfilled with cement-bentonite grout pumped to the top of the bentonite seal through a tremie pipe.

Locking protective cover on the secondary casing and the concrete pad shall be installed after completion of the cap to final grade. Construction details are provided in the drawings.

Drill spoils shall be placed into 55 gallon drums during the drilling operation and shall be handled in accordance with Section 3.9.

3.7 Piezometer Installation

The Contractor shall use hollow stem auger drilling techniques to advance the borehole for the completion of the piezometer. The hollow stem auger will have a minimum internal diameter of four (4)-inches and the auger flight diameter will be between eight (8) and ten (10)-inches. Borehole locations shall be surveyed in the field by the Contractor. Each location will be reviewed and approved by the Owner prior to initiation of drilling.

During advancement of the borehole, soil samples shall be collected every two (2) feet according to the procedures of ASTM D1586, Standard Method for Penetration Test and Split-Barrel Sampling of Soils, to provide a continuous stratigraphic record of the borehole. The samples shall be geologically logged according to the procedures and protocols of ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) by the Contractor.

The Contractor shall provide the necessary supervision and direction to his drilling crew. The Owner may elect to geologically log the borehole and view the samples. The drilling crew shall provide any necessary assistance. Should the Owner log the samples, this shall not

MONITOR WELL AND PIEZOMETER INSTALLATION

relieve the Contractor of the requirement to log the samples independently and prepare a boring log report.

The piezometer boring will be advanced to the elevations shown in the drawings but not to advance past the top of the Clay/Till layer as determined by geologic logging of the soil samples. The approximate depth of each piezometer and the length of well screen is provided in the drawings.

The piezometer well screen and riser shall be placed through the hollow stem augers. The sand pack shall be placed in the annular space over the well screen interval from the bottom of the borehole to one (1) foot above the screen. The sand pack shall be placed by the tremie method. A two (2)-foot seal of bentonite pellets shall be placed above the sand pack. The bentonite pellets shall be placed by the tremie Method and be allowed to hydrate for a minimum of eight (8) hours prior to placement of the grout.

The borehole shall be completed to existing ground surface by pumping cement-bentonite grout through a tremie pipe to the top of the bentonite pellet seal.

The geomembrane boot will be attached to the piezometer and welded or glued to the landfill liner as shown on the drawings and in accordance with the manufacturer's recommended procedures.

The protective casings and concrete pad will be installed after completion of the landfill cap to final grade. Construction details are provided on the drawings.

Drill spoils will be placed into 55 gallon drums during the drilling operation and handled in accordance with Section 3.9.

3.8 Monitor Well and Piezometer Development

Upon completion of the monitor well and piezometer installation, each monitor well and piezometer shall be developed by pumping, surging and/or air lifting. The Contractor shall develop the well until the water pumped from the well is visibly free of fines or until approved by the Owner. This shall allow the proper set-up of the sand pack and the free flow of groundwater into the well.

Development water and decontamination rinsate shall be handled according to the specifications as outlined in Section 3.9.

3.9 Procedures for Handling Program-Derived Wastes

All solid wastes and drill cuttings (drill spoils) derived from the monitoring well and piezometer installation shall be containerized in drums or water tight containers for transportation to a designated section of the landfill for disposal. Solid waste and soils shall be placed in the landfill and the drums or containers re-used until completion of the program.

The solid waste, drill spoils and cuttings shall have free water decanted from them to the extent that is practical. The material shall then be stabilized as necessary by the addition of Portland cement or blending with other soils that are available. The stabilized soils shall be placed in the portion of the landfill designated by the Owner and compacted as required to meet the provisions of Specification 02200: Earthwork.

Client Name: OxyChem/Olin
Project Name: Remedial Action
102nd Street Landfill Site

Project Specification 02011
Page 11 of 11
2-5-96/Rev. No. 1

MONITOR WELL AND PIEZOMETER INSTALLATION

Liquid wastes shall be stored in the tank furnished by the Contractor and transported by the Contractor or his licensed hauler to the Owner's designated Niagara Falls plant for treatment and disposal. Liquid wastes shall include decontamination fluids collected from the decontamination pad.

END OF SPECIFICATION

NAPL RECOVERY WELL INSTALLATION

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This Specification prescribes requirements for the installation of non-aqueous phase liquid (NAPL) recovery wells at the Owner's 102nd Street Landfill Site (Site) in Niagara Falls, New York. The Work shall be complete and shall include the mobilization of equipment and materials, the preparation of drilling locations, the advancement of the borings and completion of the wells, the installation of geomembrane boots, and the construction of concrete pads. The installation of pumps and sensors is discussed in Division 11 of these Specifications. The Contractor shall furnish all materials, labor, tools, supervision and equipment necessary to complete the Work of this Specification.

B. Attachments

The following Attachments prescribe Work related procedures, protocols and requirements:

- Attachment A: Owner's Site Specific Health and Safety Plan (SSHSP)
- Attachment B: Health and Safety Plan (HASP) Addendum and Appendices

Coordinate Work prescribed by this Specification with Work and requirements prescribed by the above listed Specifications and attachments.

C. Terminology

Where used in this Specification, the following terms shall have the meanings indicated below, unless clearly indicated otherwise by the context of their use.

1. Contractor: The individual, partnership, company or corporation obligated to the Owner to perform the NAPL recovery well installation.
2. Tremie Method: The method of placing sand, gravel, bentonite pellets or other material at the bottom of a borehole by running water through a pipe and washing material out of the bottom of the pipe.

D. Supplied by Owner/Buyer

The Owner shall provide access to the Site and interface with all federal, state and local agencies. The Owner shall supply any available drawings showing known underground utilities. The Contractor shall verify actual locations before drilling.

1.2 References and Codes

The publications listed below form part of this Specification. Each publication shall be the latest revision and addendum in effect on the date this Specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, work covered by this Specification shall conform to the applicable provisions of these publications.

NAPL RECOVERY WELL INSTALLATION

A. ASTM (American Society for Testing and Materials) Standards

1. ASTM C150 Standard Specification for Portland Cement
2. ASTM D1586 Standard Method for Penetration Test and Split-Barrel Sampling of Soils
3. ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

B. The Owner shall obtain the necessary permits and certificates required for the execution of this Work. The Contractor shall provide any assistance and documentation that the Owner requires to obtain these permits and certificates.

C. Contractor shall comply with all federal, state or local laws, ordinances, or rules and regulations relating to the performance of the work of drilling and installing NAPL recovery wells and pumps.

1.3 Submittals

A. Draft Report

Contractor shall present the results of the NAPL recovery well installation in a written draft report in three (3) copies to Owner within four (4) weeks after completion of the recovery wells. This draft report shall be complete in itself and shall contain all pertinent data. It shall include, but not necessarily be limited to, the following information:

1. Final boring logs
2. As-built construction drawings
3. Groundwater/product level measurements
4. Air quality monitoring results
5. Well development results
6. All data and recommendations required by this Specification
7. Documentation of any deviations of the Work from these Specifications and evidence of Owner's approval.

B. Final Report

Contractor to submit five (5) bound copies and one (1) unbound reproducible copy of the final well installation report to Owner within two (2) weeks of the receipt of the review comments on the draft report.

NAPL RECOVERY WELL INSTALLATION

C. Data and Records

All data required to be recorded in accordance with ASTM or other standard test methods in this Specification shall be obtained and recorded by the Contractor and made available to the Owner.

D. Permits and Licenses

The Contractor shall furnish to the Owner three (3) copies of the following document:

- Drilling license and/or any other license required by federal, state, and/or local government agencies necessary to perform the Work of this Specification.

2.0 PRODUCTS AND MATERIALS

A. Water

Water used in the drilling process to prepare grout mixtures and to decontaminate the well screen and riser shall be potable.

B. Coarse Sand Pack

1. The coarse sand pack shall be installed in the annulus between the well screen and the borehole wall from the top of the gravel pack to one (1) foot above the piezometric water level.
2. The coarse sand pack shall consist of clean, well rounded silica sand free of loam, dust, and other foreign particles. The coarse sand pack gradation shall be No. "0" grade Morie Company sand or conforming to the following gradation:

<u>U.S. Standard Sieve Number</u>	<u>U.S. Standard Sieve Opening (Inches)</u>	<u>Cumulative Percent Retained (By Weight)</u>
16	0.047	0-2
20	0.033	40-60
25	0.028	70-90
30	0.023	90-97
35	0.020	98-100
40	0.016	99-100
50	0.012	100

C. Gravel Pack

Gravel pack shall be thoroughly washed, hard, well rounded basalt, or siliceous material. The gravel pack shall be free of loam, dust, calcareous material, organic material, and other foreign particles. The maximum particle size shall be 0.25 inch, and there shall be no material passing the No. 10 sieve. Gravel pack shall be installed above the six (6)-inch seal at the bottom of the well to one (1) foot above the top of the glaciolacustrine clay (Clay) and/or glacial till (Till).

NAPL RECOVERY WELL INSTALLATION

D. Well Screen

1. All well screen shall be new and constructed of twelve (12)-inch diameter continuous wrapped wire-wound No. 20 (0.020 inch slot) Type 316 stainless steel. The length of the well screen shall be 10 feet. The bottom of the well shall be fitted with a flat plate of the same material and shall be factory welded to the screen body. The top of the well screen shall be fitted with a weld ring fabricated of the same material and factory welded to the screen body.
2. Immediately prior to installation, the well screen shall be steam cleaned or high pressure water cleaned with clean, potable water, if not certified by the manufacturer, delivered to the Site in a factory sealed protective wrapping, and maintained clean at the Site.

E. Riser Casing

1. All well riser casing shall be new and constructed of twelve (12)-inch, Schedule 5, Type 304 stainless steel. The casing shall have a length equal to the distance from the top of the well screen to approximately two (2) feet above the final ground surface.
2. Immediately prior to installation, the riser casing shall be steam cleaned or high pressure water cleaned with clean, potable water, if not certified by the manufacturer, delivered to the Site in a factory sealed protective wrapping, and maintained clean at the Site.

F. Annular Sealants

1. Bentonite

The bentonite to be used for the six (6)-inch thick seal at the bottom of the wellbore and the two (2)-foot thick seal above the sand pack shall be pelletized and a minimum 0.25 inches in diameter. The pellets shall consist of sodium montmorillonite furnished in sacks or buckets from a commercial source and free of impurities which adversely impact the water quality in the well.

2. Cement-Bentonite Grout

The cement-bentonite grout to be used as backfill from the top of the bentonite pellet annular seal to the ground surface shall consist of about six (6) to seven (7) gallons of clean and potable water per ninety-four (94) pound bag of Type I Portland cement. Portland cement shall conform to ASTM C150, Type I. Ten (10) percent (by dry weight of cement) of unaltered bentonite powder shall be added after the initial mixing of cement and water to retard shrinkage and provide plasticity. The bentonite shall be added dry to the cement-water slurry without first mixing it with water.

G. Geomembrane Boot

The geomembrane boot which is to be used to seal the geomembrane landfill liner to the NAPL recovery wells shall be manufactured of the same material as the geomembrane liner and sealed to the liner following the manufacturer's recommended procedures. Details of the geomembrane boot installation are shown on the drawings.

NAPL RECOVERY WELL INSTALLATION

H. Concrete Well Pad

A concrete pad that will provide well protection shall be completed by constructing a six (6) inch thick concrete pad, slightly sloped, to provide water drainage away from the well. The concrete shall meet the requirements of Specification 02515: Portland Cement Concrete Pads. The concrete pad shall be eight (8)-feet by five (5)-feet and four (4)-inches in plan dimension. The concrete pad shall not be rigidly attached (cemented) to the well casing, to prevent cracking should subsidence occur. A rubber, plastic, or foam sleeve shall be utilized to prevent rigid attachment. Details of the concrete pad for NAPL recovery wells are found on the drawings.

3.0 EXECUTION

3.1 General

NAPL recovery wells shall be located as indicated on the drawings. Well locations may be relocated by the Owner after the award of contract but prior to installation. Contractor shall install the wells conforming to this Specification. Air monitoring of the breathing zone shall be performed by the Contractor in accordance with the requirements of Attachment A and B.

3.2 Equipment Mobilization/Demobilization

The Contractor shall furnish a truck and/or all terrain vehicle (ATV) mounted drill suitable for successfully completing the necessary boreholes, all necessary tools and equipment, drums or containers for waste material and drill spoils handling, decontamination equipment, labor, supplies, and miscellaneous materials required to complete the described program. This includes all work associated with moving equipment and supplies to the Site vicinity prior to beginning work, and moving equipment off site after the job has been completed.

3.3 Site Preparation

NAPL well installation will occur after placement of cap subbase material, prior to installation of the geomembrane liner, as shown on the drawings. The Contractor is responsible for providing access to all drilling locations during mobilization. All ruts and holes shall be restored to original grade.

3.4 Equipment Decontamination

Prior to mobilizing to the Site, the Contractor shall clean the drill rigs and drilling equipment. Each engine and power head shall be cleaned using a power washer, steam jenny, or, alternatively, it shall be hand washed with a brush using detergent to remove oil, grease and hydraulic fluid from the exterior of the rig. The drill rigs shall be inspected by the Owner when mobilized to determine that there are no fluid leaks. If necessary, down-hole drilling and sampling equipment shall be sandblasted to remove any paint, dried caked-on mud or heavy rust accumulation. Down hole equipment and items in the immediate vicinity of the boring shall be clean of oil and grime. Grease, oil, or other petroleum-based material shall not be applied to any threads.

The drill rig and drill tools shall be scraped and/or brushed to remove soil at the completion of each NAPL recovery well. All soils and drill cuttings shall be contained and disposed of

NAPL RECOVERY WELL INSTALLATION

in accordance with Section 3.9. The Contractor shall ensure that drill cuttings or spoils are not left in contact with the subbase materials of the landfill cap.

The drill rig(s) and drill tools shall be steam cleaned prior to leaving the Site. The Contractor shall utilize the temporary decontamination pad (Specification 01120: Decontamination). The drill rig(s) and drill tools shall be decontaminated using a powered steam system furnished by the Contractor. Detergent (Alconox™) solutions may be used as necessary to properly clean equipment. Decontamination water shall be pumped to the storage tank furnished by the Contractor. The Contractor shall be responsible for containerizing used protective clothing during decontamination procedures and disposing of these materials following the procedures of Section 3.9 of this Specification.

3.5 Pilot Hole Drilling

A truck mounted and/or ATV mounted hollow-stem auger drill rig shall be utilized to drill the pilot holes at the NAPL Recovery Well locations. Hollow-stem augers with 3.25-inch inner diameter shall be used to drill the pilot holes. During drilling operations, continuous split-spoon (2 inch O.D., 24 inch long) soil samples shall be collected according to the procedures of ASTM D1586 (Standard Method for Penetration Test and Split-Barrel Sampling of Soils) from a depth of fifteen (15) feet until at least penetrating 1.5 feet into the Clay/Till. Soil samples will be geologically logged according to the procedures of ASTM D2488 (Standard Practice for Description and Identification of Soils, Visual-Manual Procedure) by the Contractor. Samples shall be placed in clean jars furnished by the Contractor and held for secure storage.

The presence of NAPL will be determined by visual inspection of each soil sample as well as the inside and outside surfaces of the split spoon. All occurrences of NAPL shall be recorded. Evaluation of the presence of potentially recoverable NAPL and determination of NAPL recovery well location will be made by the Owner, with concurrence of the EPA's on-Site representative. Evaluation will be made considering the following factors:

- The presence of globules of NAPL within soil in the split-spoon or NAPL smeared on the surfaces of the split-spoon, indicating that NAPL is present and is not bound to the soil particles, or
- Recovery of NAPL from the hollow stem of the auger at the clay/till confining layer using a bottom-loading bailer.

If recoverable NAPL is not present, the drill rig will be relocated within the 30-foot radius of the well location and another pilot hole will be advanced. Determination of pilot hole locations will be made by the Owner. A maximum of three pilot holes will be advanced at a proposed NAPL well location.

The pilot hole(s) where recoverable NAPL is not present shall be grouted to existing grade on completion of drilling using a cement-bentonite grout tremied to the bottom of the borehole.

Drill spoils will be placed in drums or other watertight containers during the drilling operation and handled in accordance with Section 3.9 of this Specification.

AGGREGATE FOR LIGHT DUTY ACCESS ROADS AND BITUMINOUS PAVEMENT BASE

2.3 Additional Requirements

The aggregate shall have a percentage of wear not exceeding 45 percent when tested in accordance with ASTM C 131. That portion of the material passing the No. 40 sieve shall have a liquid limit of no more than 25 percent and a plasticity index of not more than 5 percent when tested in accordance with ASTM D 4318.

2.4 Woven Geotextile

The Woven Geotextile shall meet the requirements of Section 207 of NYDOT Specifications and as indicated on drawings. Use Mirafi 600 X or equivalent.

3.0 EXECUTION

3.1 Preparation

Before placing the graded aggregate base course or road mix, clean the top of the select cover fill of all foreign substances, shall be true to line and grade. Correct ruts and soft yielding spots that appear in the select cover fill, areas showing inadequate compaction, and excessive deviations in the surface.

3.2 Inspection

Examine the surface of the areas on which the graded aggregate base is to be placed. The surface shall be smooth, firm, clean, and frost free. Correct conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.3 Application

A. Limitations on Application

Do not construct graded aggregate base course when atmospheric temperature is below 35 degrees F, or when other weather conditions will detrimentally affect the quality of the base course.

B. Placing and Spreading

1. Prior to placement of the aggregate mixture, install the woven geotextile where shown on the drawings in accordance with Section 207 of NYDOT Specifications.
2. Place and spread the aggregate mixture in one layer of the thickness shown on Drawing 594000-10S-01. Maintain water content of the material during the placing period as required to obtain the compaction specified. Make adjustments, as required, in placing procedures or equipment to

AGGREGATE FOR LIGHT DUTY ACCESS ROADS AND BITUMINOUS PAVEMENT BASE

least 3 inches in diameter, through the base course. Where base course deficiency is more than 1/2 of an inch, correct by scarifying, adding mixture of proper gradation, reblading, and recompacting. Where the measured thickness is more than 1/2 of an inch thicker than specified, consider it as the specified thickness plus 1/2 of an inch for determining the average.

C. Compaction Test

Field density tests for compaction testing shall be as specified in Section 02006: Inspection and Testing Services.

3.5 Adjustment and Cleaning

A. Adjustment

When correcting deficiencies for smoothness and thickness, remove material in a manner that does not disturb or mix material from the underlying course into the layer. Feather edges of the new material so that the joint between new and original material is invisible.

B. Cleaning

Remove all debris, rubbish, and excess material from the jobsite.

3.6 Protection and Maintenance

After construction has been completed, protect and maintain the base course until final acceptance. Maintenance shall include drainage, rolling, shaping, and watering as necessary to maintain the course in proper condition. Areas of aggregate base course damaged by freezing, rainfall, or other weather conditions shall be corrected to meet the specified requirements.

END OF SPECIFICATION

EARTHWORK

moisture content. Top grade of the subbase material shall be two feet below the final grades, within a tolerance of 0.1 feet (plus or minus).

2. Cover Material

After installation of the drainage collection system, place cover material in a single 18 inch (compacted thickness) layer. Cover material shall be compacted to 80 percent of Proctor Density (ASTM D698), except under the site access roads where it shall be compacted in two separate lifts to be 90 percent of Proctor density.

3. Topsoil

Place topsoil to a uniform depth of six (6) inches. Finish grade to elevations shown on the drawings within a tolerance of 0.1 feet (plus or minus).

H. Permanent Erosion Control Measures

1. Location

Final cap drainage swales are located directly over the subdrains as shown on Drawing 594000-10S-02.

2. Erosion Control Netting

Prior to seeding operations, the drainage swales will be lined with erosion control netting per Section 2.1.M.3.

3. Stone Outlet Sediment Traps

Install the stone outlet sediment traps at the locations shown on Drawing 594000-10Q-02.

3.6 Temporary Access and Haul Roads

Vehicles hauling materials to the Cell shall travel on existing haul roads or new haul roads constructed by the Contractor for that purpose. The Contractor shall maintain haul roads in good working condition, and will apply suitable granular material to prevent rutting, as needed.

Haul roads shall be constructed at the Site to facilitate the movement of trucks and other equipment over the ground without coming into contact with existing fill soil materials. The haul roads shall be constructed as specified on the Drawings.

Vehicle speeds shall be limited to a maximum of 10 miles per hour.

EARTHWORK

OxyChem/Olin and the other contractor(s). Provide temporary measures such as erosion control netting to minimize potential erosion.

C. Embayment Sediment

1. Prior to offshore activities, a silt curtain as detailed on Drawing 594000-10Q-04 will be installed at the location shown on the drawings.
2. Install a temporary cofferdam constructed of either earth materials, sheet piling or geosynthetic structures. Design of the selected alternative must be submitted to the Owner for approval prior to installation. The crest must be at elevation 568 and the allowable seepage is 5,000 gallons per day.
3. Decant surface water to river based on turbidity (NTU > 17).
4. Provide and operate "mud" pumps to transfer free water draining from sediment to the onsite holding tank. Excavate trenches (if required) to facilitate drainage of the interstitial water from the sediment.
5. Sediment to be excavated varies between two and three feet deep. Excavation depths are shown on Drawings 594000-10Q-01 and 30K-05. Transport excavated material to Area 2 (refer to Drawing No. 59400-10U-06 for location of Area 2), spread in thin layers and blend with bulk fill or gypsum. The sediment, in the cell or stockpiled, must be covered with tarps or a minimum of 2 inches of cover soil at the end of each work day.
6. Backfill the two foot deep excavation areas with a minimum of one foot of backfill. Backfill the three foot deep excavation areas with a minimum of two feet of backfill. Backfill should be clean imported soil. At a minimum, the top six inches of the backfill shall be a silty sand. Earthen materials used in the cofferdam are not acceptable as backfill in the sediment excavation areas.
7. Remove the cofferdam after the sediments have been excavated and the bulkhead has been constructed. If an earthen or rock cofferdam is used, the imported materials used for the cofferdam must be excavated, placed, and compacted under the cap.

D. Foundations/Footings and Appurtenances

1. Excavate pits for constructing cast-in-place concrete foundations, footings, and other structures to permit the placement of each monolithic element of the structure to the full width and length required with a full horizontal bed. If the excavation sidewalls are to be used to form the sides of the structure, take special care during excavation to secure a true surface conforming to the lines and dimensions indicated on the plans for the structure. Corners and edges of the excavation shall be true and square, not rounded or undercut.

EARTHWORK

2. Do not excavate the final six (6) inches of material until just before the structure is to be placed. When the bottom of the excavation must be exposed for an extended period of time, during which time inclement weather may damage it, lower the bottom of the excavation approximately two (2) inches below the indicated bottom of the structure, and backfill the overexcavated area with lean concrete mud slab. If the bottom of the excavation is not firm and stable, notify Engineer immediately so that appropriate corrective measures may be developed and implemented.
3. Step excavation side slopes with each layer of backfill to avoid the development of unnecessary loads against the structure caused by backfill wedging between the structure and the excavation sidewalls.
4. Backfill of Structures

As soon as practical after completing construction of the related structure, including expiration of the specified minimum curing period for cast-in-place concrete, backfill the excavation to restore the required finished grade. Backfill by placing and compacting select granular backfill material in uniform horizontal layers of no greater than six (6) inches loose thickness. Thoroughly compact each layer to firm and stable condition with a vibrating plate type or vibrating roller type compactor, suitable for the material and lift thickness, and operated in accordance with the manufacturer's instructions for effective compaction. Thoroughly compact each layer before the placement of materials for the subsequent layer.

Insofar as possible, place and compact backfill symmetrically about the structure so as to avoid the development of unbalanced earth pressure loads on the structure.

Do not place backfill around new cast-in-place concrete structures until the concrete has cured for at least three (3) days; or, when the backfill will result in the development of unbalanced earth pressure loads on the structure, do not start backfilling until the concrete has cured for at least seven (7) days or compressive strength tests indicate that the concrete has achieved more than 80 percent of its specified compressive strength.

E. Trenching for Storm Drain/Utility Installation

1. Where the pipeline is to be installed in an area of fill or embankment, verify that such work has been completed to an elevation at least three (3) feet above the top of the pipeline to be installed prior to the installation of the pipe.
2. Carefully excavate trenches to the minimum depths and widths necessary for installing the storm drain/utility and associated appurtenances in accordance with the requirements of this specification, and the lines and grades indicated on the plans or elsewhere in the contract documents. In the embedment zone, the trench sidewalls shall be as nearly vertical as

EARTHWORK

practical. From the top of the embedment zone to the surface, the trench sidewalls shall be either sloped sufficiently to prevent sloughing or cave-in, or shall be properly supported.

3. Load, haul and place all material excavated by the trenching operations for installation of the storm drainage system and not suitable for backfill per City of Niagara Falls Standards in the designated area identified by OxyChem/Olin at the 102nd Street Landfill Site.

4. Unstable Subgrade

When soft, yielding, or otherwise unstable soil conditions are encountered at the required trench bottom elevation, overexcavated the trench to a depth of no less than 24 inches below the specified bedding as shown on the drawings, install 16 ounce geotextile fabric, and backfill with No. 2 stone. If conditions are so severe that overexcavating and backfilling will not achieve a stable condition, notify the engineer immediately so that appropriate corrective measures may be identified.

5. Unyielding Subgrade

If rock, stone, masonry, or other hard, unyielding material is encountered at or above the required trench bottom elevation, remove it to provide a clearance of no less than 6 inches below and on each side of pipes and associated fittings, valves, and other appurtenances. Backfill the overexcavated area with granular bedding material.

6. Backfill

Coordinate initial and final backfilling with the applicable piping system installation specification testing requirements to ensure that required visual examinations are accomplished before the pipeline is obscured by backfill.

Bedding and backfill shall be as shown on the drawings. Place and compact satisfactory backfill material in 8-inch maximum loose thickness lifts. Compact using vibratory or impact type compaction equipment suitable for use in confined areas.

Backfill within the R.O.W. shall be in accordance with the City of Niagara Falls Standard Specifications (No. 2 Crusher Run Stone, compacted in 8" lifts).

7. Pavement Restoration

Restore removed pavement to a condition equal or superior to that existing prior to its removal in accordance with the Standard Specifications of the City of Niagara Falls. Replace removed reinforcing steel with new material of a size, quality, and grade equal or superior to that which was removed. Install replacement steel with lap splices of no less than 36 bar diameters

EARTHWORK

or 12 inches for wire fabric. Concrete pavement is discussed in Specification 03300. Bituminous surfacing is discussed in Specification 02513.

8. Plastic Marking Tape

Place the appropriate colored tape a minimum of two feet above the underground conduit.

F. Fills and Embankments

1. Bulkhead

After the required excavation is completed, construct the first lift(s) by dumping successive loads of satisfactory materials in a uniformly distributed layer, of a thickness not greater than that necessary to support the hauling equipment while placing materials for the subsequent lift. Compact the top of this special first lift to a firm and stable condition; however, it need not be compacted to the specified density, provided it is overlaid by at least two (2) lifts that are placed and compacted as required. If the conditions are such that two (2) full lifts cannot be properly placed over the special lift, notify Owner so appropriate corrective measures may be developed and implemented.

After establishment of a stable work platform, continue filling in successive, horizontal lifts not exceeding 12 inches in compacted thickness and compact to 95 percent of Proctor Density (ASTM D698) within four (4) percentage points of optimum moisture content.

The bulkhead will be constructed in two phases. In the first phase, the bulkhead will be constructed to elevation 570 to form the work platform for the APL collection trench and slurry wall. After they are completed, the bulkhead will be finished to the final lines and grades shown on the drawings.

2. General Site Grading

Excavate or fill to achieve the desired subgrade for the capping system. All fill shall be placed in lifts not exceeding 12 inches in compacted thickness and compacted to 90 percent of Proctor Density (ASTM D698).

Where the existing ground surface on which the fill or embankment is to be constructed has a slope steeper than one (1) vertical to eight (8) horizontal, bench the surface so that each lift can be placed and compacted horizontally. Benching shall be of sufficient width to permit the safe and effective operation of placing and compacting equipment. Begin each horizontal cut at the intersection of the original ground surface and the vertical sides of the previous cut. Recompact material cut out for benching in conjunction with the compaction of the new fill material.

BITUMINOUS CONCRETE PAVING

previously placed pavement material drops below 140 degrees F before paving is resumed, give the exposed vertical face a thin coat of liquid asphalt just before paving is continued.

c. **Longitudinal Joints**

Coat longitudinal joints that are not completed before the previously laid mixture has cooled to a temperature below 140 degrees F, with liquid asphalt just before paving is continued.

3.4 Field Quality Control

A. Smoothness Test

Check the finished surface of the bituminous concrete mixture with a 10 foot straight edge as rolling progresses. Variations in the finished surface shall not exceed plus or minus 1/8 inch in 10 feet. Correct any portion of the pavement showing irregularities greater than the acceptable variation by removing materials, replacing with new materials, and reworking or recompacting as required. A tolerance that permits water to pond shall not be acceptable. Finished surfaces adjoining other pavements shall be even with finished surfaces of abutting pavements.

B. Thickness Test

The average thickness of the course, or of combined courses shall be within 1/4 inch of the indicated thickness. Where the deficiency is greater than the specified tolerance, remove the pavement and replace it with new pavement.

3.5 Adjustment and Cleaning

A. Adjustment

To correct deficiencies for smoothness and thickness, remove sufficient material to allow at least 1 inch of bituminous concrete to be placed. Skin patching for correcting low areas or planing for correcting high areas is not permitted. Edges of the fill shall be feathered so that the joint between fill and original surface is invisible.

B. Cleaning

Remove all debris, rubbish, and excess material from the job site.

3.6 Protection

Protect the pavement from traffic until it has cooled to atmospheric temperature, and does not pick up under foot or wheeled traffic.

END OF SPECIFICATION

GEOSYNTHETIC LINING SYSTEM

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the work necessary to furnish and install underground piping for the APL Collection System, Subdrain System and Storm Drainage System specified herein and as indicated on the Drawings.

B. Related Specifications

The following specifications prescribe items of related work:

02200	Earthwork
02013	APL Wet Well Installation
02902	APL Collection Trench

1.2 References

The following documents are a part of this section. Where this Specification section differs from these documents, the requirements of this section shall apply.

A. ASTM (American Society for Testing and Materials)

1. ASTM A746 Ductile Iron Pipe For Gravity Sewers
2. ASTM C76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
3. ASTM C443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
4. ASTM D1248 Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
5. ASTM D1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
6. ASTM D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
7. ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
8. ASTM F405 Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings
9. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

GEOSYNTHETIC LINING SYSTEM

- 10. ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) based On Outside Diameter
- 11. ASTM F894 Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
- 12. AWWA C600 Standard for Installation of Gray and Ductile Cast Iron Water Mains, American Water Works Association

2.0 PRODUCTS

2.1 APL Collection System

A. Single Wall Drain Pipe and Dual Wall Force Main

- 1. The pipe for single wall and dual wall pipe systems shall be extruded from a polyethylene compound and shall conform to the following requirements:
 - The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 355434C.
 - The polyethylene compound shall be suitable protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than 2 percent.
- 2. Drain pipe shall conform to ASTM F405 (corrugated). ADS N-12 LF perforated pipe as manufactured by Advanced Drainage Systems or approved equal.
- 3. Force main pipe shall conform to ASTM F714 (non-corrugated).
- 4. The carrier and container pipe shall conform to the following schedule:

CARRIER PIPE		CONTAINER PIPE	
Nominal Pipe Size-Inch	SDR	Nominal Pipe Size-Inch	SDR
1.5	11	3.5	11
2	11	4	15.5

- 5. Dual wall pipe shall be assembled into nominal 40-foot long sections. Carrier pipe shall be inserted into the container pipe.
- 6. Cleanout riser pipe shall be 6 inch diameter SDR 11 HDPE pipe. Refer to Specification 02902.

GEOSYNTHETIC LINING SYSTEM

7. The locations of the APL collection trench (drain pipe) and APL force main are shown on Drawing 594000-30K-01.

B. Fittings for APL Collection System Piping

1. Fittings shall be fabricated from polyethylene pipe and shall be SDR 11 or 15.5.
2. Carrier pipe joints shall be thermal butt-fusion welded. Container pipe joints may be thermal butt-fusion or extrusion-welded.
3. Provide polyethylene spacer on carrier pipe at all fitting outlets in dual wall pipe system.
4. Fittings connecting drain pipe to cleanout riser are detailed on Drawing 594000-30K-08.

C. Joints for APL Collection System Piping

Carrier pipe shall be jointed by thermal butt-fusion, except where connecting to flanged pipe or equipment. Container pipe joints shall be made with electrically activated Raychem Ultratape couplers. Coupler body thickness and grade of polyethylene shall match container pipe wall thickness and grade.

1. Flanges

ASTM A216, cast steel backing flanges with 150-pound, ANSI B16.1 Standard drilling. Flanges shall be complete with one-piece, molded polyethylene stub ends. Flanges shall be primed and coated as specified for buried steel piping.

2. Gaskets

Flat ring, 1/8 inch ethylene propylene rubber (EPR).

3. Bolting

Type 316 Stainless Steel, ASTM A193, Grade B8M hex head bolts; and ASTM A194, Grade 8M hex head nuts. Bolts shall be fabricated in accordance with, ANSI B18.2 and provided with washers of the same material as the bolts.

2.2 Storm Drainage System

A. Pipe

1. 48-inch High Density Polyethylene Pipe (HDPE Pipe) along the east side of the property as shown on Drawings 594000-30K-04C and 30K-05C.

The 48-inch HDPE pipe for the storm drainage system shall be as Spirolite, Class 40, corrugated wall HDPE pipe and shall conform to the following requirements:

GEOSYNTHETIC LINING SYSTEM

- ASTM D1248: Type III, Class C, Category 5, Grade P34.
- The polyethylene compound shall be suitable protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than 2 percent, as specified by ASTM D1248 for weather resistant (Class C) grades.
- Pipe shall conform to ASTM F894.

2. Temporary HDPE Storm Drain

The 48" diameter non-corrugated SDR 32.5 HDPE pipe extending from the headwall to past the cofferdam shall conform to the requirements of ASTM F714.

3. Reinforced Concrete Pipe (RCP)

The 12," 15," 18," and 54" diameter RCP for the storm drainage system along Buffalo Avenue as shown on Drawings 594000-30K-02C and 30K-04C shall be Class III and shall conform to the requirements of ASTM C76.

4. Ductile Iron Pipe (DISDP) for Storm Drains

The 8" diameter DISDP for the connections between the catch basins and the storm drain manholes along Buffalo Avenue shall be Class 50 pipe in accordance with ASTM A746, bituminous coated inside and out.

5. Polyvinyl Chloride (PVC)

Twelve inch diameter, Schedule 80 PVC pipe for the swale culvert piping shown on Drawings 594000-10U-04 and 10U-05 shall conform to the requirements of ASTM D1785.

B. HDPE Manhole (SDMH-2)

1. Riser shall be 60 inch diameter Corewall Class 160 per ASTM F894.
2. Base pipe shall be 48 inch diameter Corewall Class 160 per ASTM F894.
3. Detail for SDMH-2 is shown on Drawing 594000-30K-14.

C. Joints

1. Corrugated HDPE pipe shall be supplied with bell and spigot for push-on type joints in accordance with ASTM D3212 with viton gaskets conforming to ASTM F477.
2. RCP shall have standard bell and spigot with viton gaskets conforming to the requirements of ASTM C443. Cement mortar joints shall NOT be allowed.

GEOSYNTHETIC LINING SYSTEM

2.3 Subdrain System

A. Subdrain Collection Pipes

The four inch diameter pipe for the subdrain collection system as shown on Drawing 594000-10S-02 shall be extruded from a polyethylene compound and shall conform to the following requirements:

- The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 355434C.
- The polyethylene compound shall be suitable protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than 2 percent.
- The maximum allowable hoop stress shall be 800 psi at 73.4°F.
- Pipe sizes shall conform to ASTM F714, SDR 17.
- Pipe shall be perforated:
 - Two rows of perforations, 120 degrees apart
 - Perforations shall be 1/4-inch diameter, six inches on center

B. Subdrain Outfall Discharge

1. Pipe shall be six inch or four inch pipe as shown on Drawings 594000-10U-03 and 10U-05.
2. Comply with requirements of 2.3 A.

3.0 EXECUTION

3.1 Transportation

Care shall be taken during transportation of the pipe that it is not cut, kinked, or otherwise damaged.

3.2 Storage

Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of HDPE or PVC pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

GEOSYNTHETIC LINING SYSTEM

3.3 Handling HDPE Pipe

The handling of the joined HDPE pipeline shall be in strict accordance with the pipe manufacturer's written instructions and in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Slings for handling the pipeline shall not be positioned at pipe joints. Sections of the pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends of the pipeline rejoined.

3.4 Joining HDPE Pipe Section

- A.** Carrier pipes shall be joined to one another, to the polyethylene fittings, and to the flange connections by means of thermal butt-fusion. Polyethylene pipe lengths, fittings, and flanged connections to be joined by thermal butt-fusion shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.
- B.** Mechanical connections of the carrier pipe to flanged equipment and other piping systems shall be through flanged connections which shall consist of the following:
 - 1. A polyethylene "stub end" shall be thermally butt-fused to the ends of the pipe.
 - 2. Provide case steel backing flange.
 - 3. Bolts and nuts of sufficient length to show a minimum of three complete threads when the joint is made and tightened to the manufacturer's standard. Retorque the nuts after four hours.
 - 4. Gaskets as specified in section 2.1 of this specification.
- C. Butt-Fusion Joining HDPE Piping**

Butt-fusion of pipes and fittings shall be performed in accordance with the pipe manufacturer's recommendations as to equipment and technique. Depending on site conditions, butt-fusion joining shall be performed in or outside of the excavation at the Contractor's option.
- D.** HDPE Container pipes shall be joined by using electrically activated couplers. Prepare pipe ends by scraping to remove oxides and other contamination and install couplers in strict accordance with coupler manufacturer's written installation instructions.

3.5 Installation

- A.** All excavation and backfill shall conform to requirements specified in Specification 02200 - Earthwork and as shown on the drawings.

GEOSYNTHETIC LINING SYSTEM

- B.** The underground systems shall be installed at locations, line and grade, shown on the Drawings.
- C.** No piping (except the temporary 42" diameter HDPE pipe) shall be installed in water.

3.6 Hydrostatic Testing of APL Collection System Piping

1. Before pressure testing, remove or isolate all equipment that could be damaged by the hydrostatic test fluid or pressures used.
2. Backfill buried piping to a minimum depth of two feet above the top of the pipe before final testing. Temporary brace piping to prevent damage or movement during testing. The contractor may perform preliminary test at his own expense prior to backfilling, if desired.
3. Test pressure piping hydrostatically in accordance with AWWA C600 at 220 psi or the maximum allowable working pressure of the piping materials, whichever is smaller.
4. Pipe installation will not be accepted until the leakage for the section of line tested is less than the rate of leakage specified below:
 - Flanged, welded, screwed, and soldered: No measurable leakage for one hour.
 - Push-on, mechanical joints or caulked bell, and spigot piping: in accordance with AWWA C600.
5. Locate and repair defective joints and/or pipe until the leakage is within the specified allowance.
6. Retest the section of piping which required repairs.

END OF SPECIFICATION

GEOSYNTHETIC LINING SYSTEM

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the requirements for the work of supply and installation of the geosynthetic clay liner (GCL), very low density polyethylene (VLDPE) geomembrane, geonet, and geotextile layers for the capping system at the Owner's 102nd Street Landfill Site in Niagara Falls, New York. Details of the cap section are shown on Drawing 594000-10S-02.

B. Related Specifications

Coordinate Work prescribed by this specification with Work prescribed by Specification 02200 - Earthwork.

C. Terminology

Where used in this specification, the following terms shall have the meaning indicated below, unless clearly indicated otherwise by the context of their use.

1. **Geosynthetic Clay Liner:** A manufactured low hydraulic conductivity fabric consisting of a thin layer of bentonite secured between two layers of geotextile fabric.
2. **Geomembrane:** A flexible, synthetic polyethylene liner to be installed on a prepared surface to restrict the flow of surface water infiltration into the underlying landfill.
3. **Textured Geomembrane:** A geomembrane with a textured surface, used to provide a higher internal friction angle to resist sliding on steep slopes.
4. **Geonet:** A three-dimensional polyethylene material that allows surface water infiltration to flow horizontally within its structure.
5. **Geotextile:** A non-woven polyester or polypropylene fabric used for filtration, to keep the overlying select cover fill from entering the geonet.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, work included in this specification shall conform to the applicable provisions of these publications.

A. American Society for Testing and Materials (ASTM):

1. ASTM D638 Standard Test Method for Tensile Properties of Plastics

GEOSYNTHETIC LINING SYSTEM

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| 2. | ASTM D746 | Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impacts |
| 3. | ASTM D751 | Standard Test Method for Coated Fabrics |
| 4. | ASTM D792 | Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement |
| 5. | ASTM D1004 | Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting |
| 6. | ASTM D1204 | Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature |
| 7. | ASTM D1238 | Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer |
| 8. | ASTM D1505 | Test Method for Density of Plastics by the Density-Gradient Technique |
| 9. | ASTM D1621 | Standard Test Method for Compressive Properties of Rigid Cellular Plastics |
| 10. | ASTM D1693 | Test Method for Environmental Stress-Cracking of Ethylene Plastics |
| 11. | ASTM D3083 | Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal and Reservoir Lining |
| 12. | ASTM D3776 | Test Methods for Weight (Mass) per Unit Area of Woven Fabric |
| 13. | ASTM D3786 | Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method |
| 14. | ASTM D4437 | Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes |
| 15. | ASTM D4491 | Standard Test Methods for Water Permeability of Geotextiles by Permittivity |
| 16. | ASTM D4533 | Standard Test Method for Trapezoid Tearing Strength of Geotextiles |
| 17. | ASTM D4632 | Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method) |
| 18. | ASTM D4716 | Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products |
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GEOSYNTHETIC LINING SYSTEM

- 19. ASTM D4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile
- 20. ASTM D5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
- 21. ASTM E96 Test Method for Water Vapor Transmission of Materials

B. OSHA (Occupational Safety and Health Administration)

- 1. OSHA Construction Industry Standards, Title 29, Code of Federal Regulations, Part 1920.120, Construction Health and Safety Plan, and Construction Contingency Plan
- 2. OSHA Construction Industry Standards, Title 29, Code of Federal Regulations, Part 1926, Safety and Health Regulations for Construction.

1.3 Submittals

- A. The manufacturer shall submit a sample of each of the geosynthetic lining system materials and the minimum specifications of the materials. The specification shall fully cover the details of minimum physical properties and test methods used, methods to be used for making field seams, and certifications that the material complies with the minimum specifications.
- B. The Contractor shall submit a Quality Control and Field Testing Plan for approval by the Owner's Representative at least 30 days prior to the start of work under this section. The plan shall include a list of test methods and minimum standards with which to gauge the quality of work during construction.
- C. The geomembrane manufacturer shall also submit an approved list of licensed installers.
- D. Geomembrane installation Contractor shall submit complete written instructions and shop drawings covering the storage, handling, installation, and repair of the geomembrane. The shop drawings shall include layout of the geomembrane panels and details of all penetrations and special attachments such as junction with concrete surfaces.
- E. If changes to the final capping grades cause cap slopes to exceed 25 percent (4H:1V), then the Contractor shall submit the proposed cap system materials for direct shear testing as described on Drawing 594000-105-02. Changes to the final capping grades causing slopes to exceed 4H:1V may occur if the owner adds more general site fill than shown on the grading plans.

Note: the direct shear testing does not need to be performed with the site grades shown on Drawing 594000-100-01.

1.4 Product Delivery And Handling

The installation Contractor shall receive, inspect, and properly store all materials received on site until the installation of the liner. All such materials shall be inspected to verify their

GEOSYNTHETIC LINING SYSTEM

conformance to the requirements of this specification and to verify that they are free from defects. Any nonconforming or defective materials shall be clearly marked and promptly repaired using an approved repair procedure, or they shall be removed from the jobsite.

2.0 PRODUCTS

Materials shall be one of the following types unless otherwise shown on the drawings. If the material shown on the drawing is different from that covered in this specification, the manufacturer's literature and directions shall be used for the properties of material, types of field joints, inspection, and any other item required for satisfactory liner installation.

2.1 Geosynthetic Clay Liner

- A.** The GCL for slopes less than 10 percent shall be Claymax 200R or CETCO Bentomat CS, or approved equal. The GCL shall have a non-hydrated thickness of 0.125 to 0.20 inches and a maximum permeability of 1×10^{-9} cm/sec.
- B.** The GCL for slopes greater than 10 percent shall be Claymax Shear Pro 500SP or approved equal, meeting the requirements of Section 2.1.A.

2.2 Geomembrane

A. VLDPE Geomembrane

VLDPE geomembrane shall be manufactured from new, firm-quality VLDPE resin and shall meet the specification values according to the specification sheet for VLDPE. The liner material shall be free from holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. The lining material shall have no seams and shall be supplied in rolls. Each roll shall be labeled to identify thickness, length, and roll numbers. The material shall have a minimum thickness of 40 mils; Gundline VL, National Seal Company VLDPE, or approved equal.

B. Textured VLDPE Geomembrane

If textured VLDPE geomembrane is required (only if cap slopes are changed to be steeper than 4H:1V), it shall be a minimum of 40 mils thick, meeting the requirements of Section 2.2.A. The material shall be Gundline VLT; National Seal Company, Friction Seal; or approved equivalent.

2.3 Geonet

- A.** The geonet shall be manufactured by extruding two sets of HDPE strands to form a three-dimensional structure to provide planar water flow. Geonet shall be resistant to all forms of biological or chemical degradation normally encountered in a soil/landfill environment. Geonet shall contain stabilizers to prevent ultraviolet light degradation.
- B.** Geonet shall be Gundnet XL-14, National Seal Polynet 2000 or approved equal. The geonet shall have a minimum transmissivity of 0.21×10^{-3} square meters per second for each foot of width for all slopes.

GEOSYNTHETIC LINING SYSTEM

2.4 Geotextile

The geotextile shall be a non-woven, needle-punched continuous filament polyester or polypropylene fabric. Material shall be Trevira Spunbound 1125 or Polyfelt TS700 or approved equal.

3.0 EXECUTION

3.1 Surface Preparation

- A.** Installation of the geosynthetic lining system shall not begin until the cap subbase layer has been prepared to accept the system lining. Base material shall be free from angular rocks, roots, grass, and shall be filled and the surface made level or uniformly sloping as indicated on the drawings. The prepared surface shall be free from loose earth, rocks, rubble, and other foreign matter. The subgrade shall be uniformly compacted to ensure against settlement and shall be steel wheel rolled before liner installation.
- B.** Before starting installation of the lining system, Contractor shall inspect the subbase layer for suitability with the requirement of liner installation. Before commencing work, Contractor shall certify in writing that the surface on which the membrane is to be installed is acceptable. During the period of liner installation, the liner Contractor shall be responsible for protection and maintenance of the exposed subgrade until final acceptance of the finished work, including maintenance of the moisture content of the underlying soil.
- C.** The Owner will survey the top of the cap subbase layer to confirm the Contractor's earthwork grading. This survey will be completed prior to beginning installation of the geosynthetic lining system.

3.2 Material Placement and Seaming

Perform field seams work according to this specification and according to the manufacturer's recommendations.

A. Geosynthetic Clay Layer

Adjacent GCL panels shall be overlapped a minimum of six inches on each end. Panels must be placed down the slopes, perpendicular to the contour lines shown on the grading plan. Holes or tears in the fabric shall be repaired by overlapping a patch of additional material, overlapping the hole or tear by a minimum of six inches on all sides. Successive panels at the end of a roll shall be overlapped a minimum of two feet.

B. VLDPE Geomembrane

- 1. The installation of the VLDPE shall be done by Contractor using the manufacturer's extrusion or hot wedge welding equipment and installation methods. Lay out and overlap individual panels of liner material by a maximum of 4 inches for extrusion weld before welding or 5 inches for hot wedge weld

GEOSYNTHETIC LINING SYSTEM

before welding. Take extreme care in the preparation of the areas to be welded. Clean and prepare the area to be welded according to the procedures laid down by the material manufacturer.

2. Weld sheeting together by means of integration of the extrudate bead with the lining material. The composition of the extrudate shall be identical to the lining material, or all sheeting shall be welded together using the hot wedge welding system. The welding equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the lining material so as to ensure that changes in weather conditions will not affect the integrity of the weld.
3. No fish mouths shall be allowed within the seam area. Where fish mouths occur, cut and overlap the material; apply an overlap extrusion weld. Seal inlets, outlets, and other projections through the lining following the manufacturer's recommendation. HDPE boot details are shown on Drawings 594000-30K-06 and 30K-08.

C. Geonet

Adjacent panels shall be butted together or overlapped two to four inches and shall be joined with plastic ties. Place geonet perpendicular to the slope face. The geonet shall be rolled down the slopes in such a manner to keep the material in tension. Small tears in the fabric shall be repaired with plastic ties. Successive panels at the end of a roll (perpendicular to face) shall be overlapped a minimum of one foot and shall be tied at the top and bottom of the overlap.

D. Geotextile

The geonet surface to receive the geotextile shall be smooth and free of any foreign materials. Adjacent rolls shall be overlapped a minimum of one foot on each end, or sewed along the entire seam. Place geotextiles perpendicular to slope. Holes or tears shall be repaired by overlapping or sewing patch material a minimum of one foot in all directions. Successive panels at the end of a roll shall be overlapped a minimum of two feet.

3.3 Thermal Expansion/Contraction

During installation, take appropriate measures, as recommended by the geomembrane manufacturer, to provide sufficient slack in the VLDPE liner, to avoid excessive stresses being generated in the geomembrane due to temperature changes.

3.4 Field Quality Control

A. Prequalification Test Seams

1. Test seams shall be performed to verify that seaming conditions are adequate. Test seams shall be conducted at least two times each day (at the beginning of the morning and the beginning of the afternoon), for each piece of seaming equipment used that day. Also, each seamer shall perform at least one test

GEOSYNTHETIC LINING SYSTEM

seam each day. Test seaming shall be performed under the same conditions as production seaming. The test seam shall be at least two feet long.

2. Six specimens shall be cut from the test seam. These specimens shall be die cut one-inch wide. Specimens shall be tested by use of a field tensiometer in shear (3) and peel (3), and shall not fail in the joint. If a test seam fails, an additional test seam shall be immediately conducted. If the additional test seam fails, the seaming equipment or product shall be rejected and not used for production seaming until the deficiencies are corrected and a successful full test seam is produced.
3. The Inspection Agency Representative will observe test seams. A sample from each test seam shall be retained and labeled with the date, ambient temperature, number of seaming unit, seamer, and pass or fail description. One half of the sample shall be given to the Geomembrane Installer and the other half retained by the QA Engineer.
4. The criteria for determining a passing machine welded or hand welded seam in peel shall be:
 - a. Failure is by Film Tear Bond (FTB), National Sanitation Foundation (NSF), Standard 54, definition 2.16;
 - b. Yield strength for the seam is not less than 60 percent of the minimum tensile strength at yield for the parent material;
 - c. No greater than 10 percent or 1/8 inch of the seam width peels (separates) at any point.
5. The criteria for determining a passing machine welded or hand welded seam in shear (ASTM D3083) shall be:
 - a. Failure is by FTB;
 - b. Yield strength for the seam is not less than 90 percent of the minimum tensile strength at yield for the parent material;
 - c. Yield strain for the seam is at least 10 percent;
 - d. Break strain for the seam is at least 50 percent.

B. Non-Destructive Field Seam Testing

1. All field seams shall be non-destructively tested over their full length using a vacuum test unit, air pressure device, or other approved method. Each seam shall be numbered or otherwise designated. The location, date, test unit, name of tester, and outcome of all non-destructive testing shall be recorded by the Inspection Agency Representative.
 2. The Inspection Agency Representative will observe all testing. Testing shall be done as the seaming work progresses, not at the completion of all field seaming.
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GEOSYNTHETIC LINING SYSTEM

All defects found during testing shall be numbered and marked immediately after detection. All defects found shall be repaired, retested and remarked to indicate completion of the repair and acceptability. The test unit shall be a vacuum test unit.

3. The tests mentioned above shall be supplemented by a visual inspection. Any areas that appear suspect shall be probed utilizing a flat, thin, round edged metal probe to check the seams for continuity of the sheets and extruded bead.
4. The following procedures shall apply to locations where seams cannot be nondestructively tested:
 - a. All such seams shall be cap-stripped with the same geomembrane;
 - b. If the seam is accessible to testing equipment prior to final installation, the seam shall be nondestructively tested prior to final installation.
 - c. If the seam can not be tested prior to final installation, the seaming and cap-stripping operations shall be observed by the geosynthetic quality assurance technician for uniformity and completeness.
5. Vacuum Box Testing

The equipment shall be comprised of the following:

- a. A vacuum box assembly consisting of rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge;
- b. A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections;
- c. A rubber pressure/vacuum hose with fittings and connection;
- d. A bucket and wide paint brush, and a soapy solution.

The following procedures shall be followed:

- a. Energize the vacuum pump and reduce the tank pressure to approximately 10 inches of mercury, i.e., 5 psi gauge (35kPa).
- b. Wet a strip of geomembrane approximately 12 inches by 48 inches (0.3m by 1.2m) with the soapy solution.
- c. Place the box over the wetted area.
- d. Close bleed valve and open the vacuum valve.

Ensure that the leak tight seal is created.

EARTHWORK

the construction schedule, or damage to existing features or facilities in the vicinity of the work.

C. Infiltration (APL System, Utilities/Storm Drainage - Buffalo Avenue)

When the bottom of a trench must be carried to an elevation below the groundwater piezometric surface, or to such proximity to the piezometric surface that the excavation bottom will become soft due to its being saturated by groundwater, take measures to lower the piezometric surface sufficiently to maintain the stability of the excavation bottom. Design the groundwater control system using accepted professional methods of design and engineering consistent with the best modern practice. The system shall include such equipment and appurtenances necessary to achieve the groundwater control needs of the work. Carefully design and operate the system to avoid damage to existing structures and other facilities in the vicinity of the work.

D. Disposal of Removed Water

Refer to the Water Management Plan included as an attachment to Specification 11231. The Contractor shall review design and operation of all systems with Owner prior to use.

E. System Removal

After completing construction operations needing water control, remove materials, equipment, and other facilities used for that purpose, and clean up and restore affected areas as required.

3.5 Excavation and Backfill

A. General

1. Stockpiling

Stockpile excavated materials within the limits of the landfill in an orderly manner at a distance from the banks of the excavation sufficient to avoid overloading the bank. Arrange stockpiles so as not to obstruct drainage or other construction operations in the vicinity of excavation.

Stockpiling of excavated materials shall not be allowed outside of the limits of the slurry wall alignment.

2. Moisture Control

Compact backfill material at a moisture content suitable for that material using the compaction equipment employed. Compact cohesive materials at a moisture content within plus or minus four (4) percent of optimum.

EARTHWORK

When water must be added, distribute it uniformly over the surface of the layer, and thoroughly incorporate it into the soil by manipulation (plowing, discing, raking, or blading) to achieve a uniform distribution of moisture throughout the material. When the moisture content is excessive, defer compaction until the material has dried to a suitable moisture content. Natural drying may be accelerated by manipulation to increase the rate of evaporation, or by blending in a dry material. If drying is accomplished by blending in a dry material, take care not to exceed the specified maximum layer thickness for compaction. Remove any excess material from the layer before compaction.

B. Off-site Perimeter Soils

1. Excavate the area(s) indicated on the Drawings to the depth required (including sod or other existing cover). Background information can be found in the Perimeter Soils Verification Sampling Data Summary Report. The area being excavated (and not backfilled) shall be limited to that area which can be backfilled in one day. Remove all materials encountered within the indicated depth of removal including stumps and root systems. Carefully load, to avoid fugitive emissions, into lined trucks. Transport excavated materials to Area 2 as shown in Drawing 594000-10U-06, spread, compact and provide daily cover.
2. Some of the perimeter soils along Buffalo Avenue contain dioxin. These soils will be consolidated into the Dioxin-Containing Soil Placement Cell as shown on Drawing 594000-30K-02. The soil will be covered with a geotextile fabric per Section 2.1.M.2. Construction of the cell is discussed in Section 3.7.
3. Excavation shall be suspended during wet weather. In the event of rain, excavated areas shall be covered with 6-mil polyethylene sheets and tarps to prevent intrusion of rainwater. The tarps shall be elevated in the center on drums or appropriate framework such that rainwater is diverted to undisturbed areas.
4. After the cleanup objectives are achieved and the excavation has been taken to the appropriate depth, the Contractor shall backfill the excavation to the pre-excavation grades with pre-approved fill in horizontal lifts not exceeding 8 inches loose thickness. Compact to no less than 90 percent of Standard Proctor Density (ASTM D698). Place a minimum of six (6) inches of topsoil over the compacted fill and lightly tamp, taking precautions not to over compact or create a hard crust on top. Finish grade to the elevations shown on the Drawings, within a tolerance of 0.1 feet (plus or minus).
5. Coordinate backfilling operation with the installation of storm drainage. Placement of topsoil may also be delayed due to work in the area under separate contracts. Coordinate the placement of the topsoil with

EARTHWORK

OxyChem/Olin and the other contractor(s). Provide temporary measures such as erosion control netting to minimize potential erosion.

C. Embayment Sediment

1. Prior to offshore activities, a silt curtain as detailed on Drawing 594000-10Q-04 will be installed at the location shown on the drawings.
2. Install a temporary cofferdam constructed of either earth materials, sheet piling or geosynthetic structures. Design of the selected alternative must be submitted to the Owner for approval prior to installation. The crest must be at elevation 568 and the allowable seepage is 5,000 gallons per day.
3. Decant surface water to river based on turbidity (NTU > 17).
4. Provide and operate "mud" pumps to transfer free water draining from sediment to the onsite holding tank. Excavate trenches (if required) to facilitate drainage of the interstitial water from the sediment.
5. Sediment to be excavated varies between two and three feet deep. Excavation depths are shown on Drawings 594000-10Q-01 and 30K-05. Transport excavated material to Area 2 (refer to Drawing No. 59400-10U-06 for location of Area 2), spread in thin layers and blend with bulk fill or gypsum. The sediment, in the cell or stockpiled, must be covered with tarps or a minimum of 2 inches of cover soil at the end of each work day.
6. Backfill the two foot deep excavation areas with a minimum of one foot of backfill. Backfill the three foot deep excavation areas with a minimum of two feet of backfill. Backfill should be clean imported soil. At a minimum, the top six inches of the backfill shall be a silty sand. Earthen materials used in the cofferdam are not acceptable as backfill in the sediment excavation areas.
7. Remove the cofferdam after the sediments have been excavated and the bulkhead has been constructed. If an earthen or rock cofferdam is used, the imported materials used for the cofferdam must be excavated, placed, and compacted under the cap.

D. Foundations/Footings and Appurtenances

1. Excavate pits for constructing cast-in-place concrete foundations, footings, and other structures to permit the placement of each monolithic element of the structure to the full width and length required with a full horizontal bed. If the excavation sidewalls are to be used to form the sides of the structure, take special care during excavation to secure a true surface conforming to the lines and dimensions indicated on the plans for the structure. Corners and edges of the excavation shall be true and square, not rounded or undercut.

EARTHWORK

2. Do not excavate the final six (6) inches of material until just before the structure is to be placed. When the bottom of the excavation must be exposed for an extended period of time, during which time inclement weather may damage it, lower the bottom of the excavation approximately two (2) inches below the indicated bottom of the structure, and backfill the overexcavated area with lean concrete mud slab. If the bottom of the excavation is not firm and stable, notify Engineer immediately so that appropriate corrective measures may be developed and implemented.
3. Step excavation side slopes with each layer of backfill to avoid the development of unnecessary loads against the structure caused by backfill wedging between the structure and the excavation sidewalls.
4. Backfill of Structures

As soon as practical after completing construction of the related structure, including expiration of the specified minimum curing period for cast-in-place concrete, backfill the excavation to restore the required finished grade. Backfill by placing and compacting select granular backfill material in uniform horizontal layers of no greater than six (6) inches loose thickness. Thoroughly compact each layer to firm and stable condition with a vibrating plate type or vibrating roller type compactor, suitable for the material and lift thickness, and operated in accordance with the manufacturer's instructions for effective compaction. Thoroughly compact each layer before the placement of materials for the subsequent layer.

Insofar as possible, place and compact backfill symmetrically about the structure so as to avoid the development of unbalanced earth pressure loads on the structure.

Do not place backfill around new cast-in-place concrete structures until the concrete has cured for at least three (3) days; or, when the backfill will result in the development of unbalanced earth pressure loads on the structure, do not start backfilling until the concrete has cured for at least seven (7) days or compressive strength tests indicate that the concrete has achieved more than 80 percent of its specified compressive strength.

E. Trenching for Storm Drain/Utility Installation

1. Where the pipeline is to be installed in an area of fill or embankment, verify that such work has been completed to an elevation at least three (3) feet above the top of the pipeline to be installed prior to the installation of the pipe.
2. Carefully excavate trenches to the minimum depths and widths necessary for installing the storm drain/utility and associated appurtenances in accordance with the requirements of this specification, and the lines and grades indicated on the plans or elsewhere in the contract documents. In the embedment zone, the trench sidewalls shall be as nearly vertical as

EARTHWORK

practical. From the top of the embedment zone to the surface, the trench sidewalls shall be either sloped sufficiently to prevent sloughing or cave-in, or shall be properly supported.

3. Load, haul and place all material excavated by the trenching operations for installation of the storm drainage system and not suitable for backfill per City of Niagara Falls Standards in the designated area identified by OxyChem/Olin at the 102nd Street Landfill Site.

4. Unstable Subgrade

When soft, yielding, or otherwise unstable soil conditions are encountered at the required trench bottom elevation, overexcavated the trench to a depth of no less than 24 inches below the specified bedding as shown on the drawings, install 16 ounce geotextile fabric, and backfill with No. 2 stone. If conditions are so severe that overexcavating and backfilling will not achieve a stable condition, notify the engineer immediately so that appropriate corrective measures may be identified.

5. Unyielding Subgrade

If rock, stone, masonry, or other hard, unyielding material is encountered at or above the required trench bottom elevation, remove it to provide a clearance of no less than 6 inches below and on each side of pipes and associated fittings, valves, and other appurtenances. Backfill the overexcavated area with granular bedding material.

6. Backfill

Coordinate initial and final backfilling with the applicable piping system installation specification testing requirements to ensure that required visual examinations are accomplished before the pipeline is obscured by backfill.

Bedding and backfill shall be as shown on the drawings. Place and compact satisfactory backfill material in 8-inch maximum loose thickness lifts. Compact using vibratory or impact type compaction equipment suitable for use in confined areas.

Backfill within the R.O.W. shall be in accordance with the City of Niagara Falls Standard Specifications (No. 2 Crusher Run Stone, compacted in 8" lifts).

7. Pavement Restoration

Restore removed pavement to a condition equal or superior to that existing prior to its removal in accordance with the Standard Specifications of the City of Niagara Falls. Replace removed reinforcing steel with new material of a size, quality, and grade equal or superior to that which was removed. Install replacement steel with lap splices of no less than 36 bar diameters

EARTHWORK

or 12 inches for wire fabric. Concrete pavement is discussed in Specification 03300. Bituminous surfacing is discussed in Specification 02513.

8. **Plastic Marking Tape**

Place the appropriate colored tape a minimum of two feet above the underground conduit.

F. Fills and Embankments

1. **Bulkhead**

After the required excavation is completed, construct the first lift(s) by dumping successive loads of satisfactory materials in a uniformly distributed layer, of a thickness not greater than that necessary to support the hauling equipment while placing materials for the subsequent lift. Compact the top of this special first lift to a firm and stable condition; however, it need not be compacted to the specified density, provided it is overlaid by at least two (2) lifts that are placed and compacted as required. If the conditions are such that two (2) full lifts cannot be properly placed over the special lift, notify Owner so appropriate corrective measures may be developed and implemented.

After establishment of a stable work platform, continue filling in successive, horizontal lifts not exceeding 12 inches in compacted thickness and compact to 95 percent of Proctor Density (ASTM D698) within four (4) percentage points of optimum moisture content.

The bulkhead will be constructed in two phases. In the first phase, the bulkhead will be constructed to elevation 570 to form the work platform for the APL collection trench and slurry wall. After they are completed, the bulkhead will be finished to the final lines and grades shown on the drawings.

2. **General Site Grading**

Excavate or fill to achieve the desired subgrade for the capping system. All fill shall be placed in lifts not exceeding 12 inches in compacted thickness and compacted to 90 percent of Proctor Density (ASTM D698).

Where the existing ground surface on which the fill or embankment is to be constructed has a slope steeper than one (1) vertical to eight (8) horizontal, bench the surface so that each lift can be placed and compacted horizontally. Benching shall be of sufficient width to permit the safe and effective operation of placing and compacting equipment. Begin each horizontal cut at the intersection of the original ground surface and the vertical sides of the previous cut. Recompact material cut out for benching in conjunction with the compaction of the new fill material.

EARTHWORK

As soon as the fill is brought up to subgrade in Area 2, as shown on Drawing 594000-10U-06, install a silt fence along the bulkhead.

3. Slope Protection/Riprap
 - a. Prepare the subgrade of areas to receive riprap to the lines, grades, and cross sections shown on the drawings. Compact subgrade before placement of the geotextile fabric.
 - b. Place geotextile fabric, on prepared subgrade unless otherwise noted on the drawings.
 - c. Place the bedding material and riprap to conform to the class, layer thicknesses, slopes, lines, and grades shown on the drawings. Stone may be placed by mechanical methods, augmented by hand placing where necessary, provided that when the riprap is completed it forms a properly graded, dense, neat layer of stone. At locations where riprap is required for channel changes and drainage ditches, it shall be placed prior to diverting the water into the channel changes and drainage ditches.
 - d. At locations where riprap is required at the outlets of pipe culverts or storm drains, place the riprap immediately after completing their installation.
 - e. Place riprap from the bottom of a slope upward, with the larger stones being placed in the lower courses. Fill open joints with spalls, and thoroughly ram them into place. The variation between the tops of adjacent stones shall be no greater than 3 inches.

4. Other Fill

Transport excavated slurry trench spoils, APL collection trench spoils, APL force main spoils, storm drain trench spoils, excess slurry, well cuttings, and the removed temporary cofferdam to Area 2 as shown on Drawing 594000-10U-06. Spread in thin layers and blend with bulkfill. Compact to 90% of Standard Proctor density.

Distribute used PPE throughout Area 2. Manually spread out material so there are no concentrations of PPE that could cause localized settlement of the final cap.

G. Capping System

1. Subbase Material

After grading to the required subgrade (Owner supplied general site fill), place and compact in a single 12 inch thick lift to 90 percent of Proctor density (ASTM D698) within four (4) percentage points of optimum

EARTHWORK

moisture content. Top grade of the subbase material shall be two feet below the final grades, within a tolerance of 0.1 feet (plus or minus).

2. **Cover Material**

After installation of the drainage collection system, place cover material in a single 18 inch (compacted thickness) layer. Cover material shall be compacted to 80 percent of Proctor Density (ASTM D698), except under the site access roads where it shall be compacted in two separate lifts to be 90 percent of Proctor density.

3. **Topsoil**

Place topsoil to a uniform depth of six (6) inches. Finish grade to elevations shown on the drawings within a tolerance of 0.1 feet (plus or minus).

H. Permanent Erosion Control Measures

1. **Location**

Final cap drainage swales are located directly over the subdrains as shown on Drawing 594000-10S-02.

2. **Erosion Control Netting**

Prior to seeding operations, the drainage swales will be lined with erosion control netting per Section 2.1.M.3.

3. **Stone Outlet Sediment Traps**

Install the stone outlet sediment traps at the locations shown on Drawing 594000-10Q-02.

3.6 Temporary Access and Haul Roads

Vehicles hauling materials to the Cell shall travel on existing haul roads or new haul roads constructed by the Contractor for that purpose. The Contractor shall maintain haul roads in good working condition, and will apply suitable granular material to prevent rutting, as needed.

Haul roads shall be constructed at the Site to facilitate the movement of trucks and other equipment over the ground without coming into contact with existing fill soil materials. The haul roads shall be constructed as specified on the Drawings.

Vehicle speeds shall be limited to a maximum of 10 miles per hour.

EARTHWORK

3.7 Dioxin-Containing Soil Placement Cell

Construct Dioxin-Containing Soil Placement Cell in accordance with the details and location presented on the drawings. After preparation of the subgrade, place fill in lifts not exceeding 12 inches in compacted thickness and compact to 90 percent of Proctor Density (ASTM D698) within four (4) percentage points of optimum moisture content.

3.8 Dust Control

Contractor shall make every effort to control dust for the duration of the Work. This effort shall include minimizing the area of disturbed soil exposed at any one time, and installing temporary or permanent surface stabilization measures immediately after completing a land grading unit of the overall Work. For disturbed areas not subject to traffic, temporary or permanent vegetation shall be installed according to the drawings. For other areas subject to traffic, dust control measures shall include mulching, sprinkling water, spraying adhesive or calcium chloride, and surface roughening by tillage. The measures implemented shall be maintained until all disturbed areas have been stabilized with vegetation.

3.9 Field Quality Control

Contractor shall be responsible for ensuring that earthwork materials and execution meet the requirements of this specification. The Contractor is responsible for providing material testing submittals. An Independent Inspection and Testing agency will be engaged by the Owner for the purpose of inspecting and testing placed materials in the field.

Quality Control requirements are discussed in Specification 02006 - Inspection and Testing Services.

END OF SPECIFICATION

EARTHWORK

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the requirements for excavation and fill associated with the following:

1. Installation of sediment and erosion control features.
 2. Construction of Dioxin-Containing Soil Placement Cell for off-site perimeter soils containing dioxin.
 3. Excavation of soils and other material within the area delineated on the Drawings for removal of off-site perimeter soils to the minimum depth indicated by the sampling and testing program.
 4. Layout and excavation of storm drains and appurtenances.
 5. Construction of temporary access roads on existing cap.
 6. Construction of diversion berms, swales, and sedimentation pond.
 7. Transportation and placement of excavated off-site perimeter soils/materials containing dioxin in the designated Dioxin-Containing Soil Placement Cell at the Site.
 8. Transportation and placement of excavated off-site perimeter soils not containing dioxin to a designated location under the cap.
 9. Transportation and placement of excavated storm drain soil not suitable for reuse as backfill to a designated location under the cap.
 10. Installation of silt curtain and cofferdam in Niagara River.
 11. Backfill of excavation for perimeter soils and storm drain, grading and seeding.
 12. Excavation of embayment sediments.
 13. Construction of bulkhead.
 14. Grading/shaping of existing landfill and Owner imported general site fill.
 15. Transportation, placement, and mixing of excavated sediments under the cap.
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EARTHWORK

16. Transportation and placement of excavated slurry wall trench spoils, APL collection trench spoils, APL force main trench spoils, and well cuttings under the cap.
17. Placement of capping system including seeding.
18. Placement of riprap on bulkhead.
19. Excavation and backfill for installation of footings/foundation/slabs for loadout facility, APL wet wells and NAPL recovery wells.
20. Trenching and backfill for installation of underground piping, conduit, cable and appurtenances.
21. Install permanent erosion control features.
22. Quality Control Requirements.

B. Attachments

The following Attachments prescribe Work related procedures, protocols and requirements:

- Attachment A: Owner's Site Specific Health and Safety Plan (SSHSP)
- Attachment B: Health and Safety Plan (HASP) Addendum and Appendices

Coordinate Work prescribed by this specification with Work and requirements prescribed by the above listed specifications and attachments.

C. Terminology

The following terms are defined as stated, unless otherwise indicated:

1. *Soil Classification Symbols:* Symbols based on the Unified Soil Classification System as determined per ASTM D2487 or ASTM D2488 (such as GW, SW, and CH).
2. *Cohesive Materials:* Soils classified per ASTM D2487 or ASTM D2488 as GC, SC, ML, CL, MH, CH, or materials classified as GM or SM when their fine fraction (material passing a No. 40 sieve) has a plasticity index of 4 or greater.
3. *Cohesionless Materials:* Soils classified per ASTM D2487 or ASTM D2488 as GW, GP, SW, SP, and materials classified as GM or SM when their fine fraction (material passing a No. 40 sieve) is non-plastic or has a plasticity index less than 4.

EARTHWORK

4. *Proctor Density*: The maximum dry density achieved per ASTM D698 when testing a sample of material representative of that to be compacted in the field.
5. *Optimum Moisture Content*: The moisture content at which the Proctor Density is achieved.
6. *Inspection and Testing Agency*: The company, partnership, or corporation retained by OxyChem/Olin to perform the inspections and tests required to determine and verify compliance of the work with the requirements of this specification.
7. *Unyielding Subgrade*: Rock or soil containing large stones (over 3 inches in any dimension) that if allowed to remain at the trench bottom, would likely cause uneven or point loading on the pipe.
8. *Unstable Subgrade*: Material in the trench bottom that lacks sufficient firmness to maintain the alignment of the pipe, or to prevent joints in the pipe from separating during backfilling. This may be material that is otherwise satisfactory but has been disturbed or is saturated with water.
9. *Pipe Embedment Zone*: The area of the trench in the immediate vicinity of the installed pipe, including special foundations when required (see pipe bedding details on the drawings), where special materials and construction techniques are required by this specification to ensure proper installation of the pipeline.
10. *Load-bearing Subgrade*: The soil lying beneath and up to 5 feet outside of the edge of pavements and structures (either existing or to be constructed), and the soil lying within such other limits of load-bearing subgrade as may be indicated on the drawings or elsewhere in the contract documents.
11. *Personal Protective Equipment (PPE)*: Disposable outer coveralls, gloves, boots, etc. as required by the SSHSP and the HASP.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, Work included in this specification shall conform to the applicable provisions of these publications.

A. *Applicable Codes*

1. American Society for Testing and Materials (ASTM)
 - a. ASTM C33 Standard Specification for Concrete Aggregate

EARTHWORK

As soon as the fill is brought up to subgrade in Area 2, as shown on Drawing 594000-10U-06, install a silt fence along the bulkhead.

3. Slope Protection/Riprap
 - a. Prepare the subgrade of areas to receive riprap to the lines, grades, and cross sections shown on the drawings. Compact subgrade before placement of the geotextile fabric.
 - b. Place geotextile fabric, on prepared subgrade unless otherwise noted on the drawings.
 - c. Place the bedding material and riprap to conform to the class, layer thicknesses, slopes, lines, and grades shown on the drawings. Stone may be placed by mechanical methods, augmented by hand placing where necessary, provided that when the riprap is completed it forms a properly graded, dense, neat layer of stone. At locations where riprap is required for channel changes and drainage ditches, it shall be placed prior to diverting the water into the channel changes and drainage ditches.
 - d. At locations where riprap is required at the outlets of pipe culverts or storm drains, place the riprap immediately after completing their installation.
 - e. Place riprap from the bottom of a slope upward, with the larger stones being placed in the lower courses. Fill open joints with spalls, and thoroughly ram them into place. The variation between the tops of adjacent stones shall be no greater than 3 inches.

4. Other Fill

Transport excavated slurry trench spoils, APL collection trench spoils, APL force main spoils, storm drain trench spoils, excess slurry, well cuttings, and the removed temporary cofferdam to Area 2 as shown on Drawing 594000-10U-06. Spread in thin layers and blend with bulkfill. Compact to 90% of Standard Proctor density.

Distribute used PPE throughout Area 2. Manually spread out material so there are no concentrations of PPE that could cause localized settlement of the final cap.

G. Capping System

1. Subbase Material

After grading to the required subgrade (Owner supplied general site fill), place and compact in a single 12 inch thick lift to 90 percent of Proctor density (ASTM D698) within four (4) percentage points of optimum

AGGREGATE FOR LIGHT DUTY ACCESS ROADS AND BITUMINOUS PAVEMENT BASE

obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course.

C. Compaction and Finishing

1. Compact each layer of base course to a dry density of not less than 95 percent of maximum dry density determined by ASTM D 698 in accordance with Section 203 of NYDOT specifications. If testing cannot be performed using ASTM 2922 due to the size of the aggregate, compaction can be approved by the inspection and testing agency based on visual observation of the compaction and the absence of rutting in the final surface.
2. Roll the material with a self-propelled, three-wheel roller weighing no less than 10 tons, or with approved vibratory equipment. Begin the rolling at the edges of the layers. When the sides have been rolled, the rolling shall progress gradually toward the center, parallel with the centerline of the roadway, uniformly lapping each preceding track at least 18 inches and covering thoroughly the entire surface with the rear wheel. Continue rolling until the required density is achieved and the entire surface is well keyed and does not creep or wave ahead of the roller.
3. Compact inaccessible areas with smaller mechanical equipment or hand tampers. If the mixture is excessively moistened by rain, aerate it by means of blade graders, or other approved equipment, until the moisture content of the mixture is satisfactory. Finish the surface of the layer by blading or rolling with a smooth roller or a combination thereof. The completed surface shall be firm, even, and true to line and grade.

3.4 Field Quality Control

A. Smoothness Test

The surface of the completed aggregate base shall not deviate more than 1/2 of an inch from the specified cross section at any point and 3/8 of an inch in 10 feet from the specified longitudinal grade at any location. Correct deviations by loosening, adding, or removing material; reshaping; watering; and compacting. The smoothness requirements specified above apply only to the top layer.

B. Thickness Test

The average thickness of the base course, determined by computing the average of the depth measurement, shall not underrun the specified thickness by more than 1/4 inch. Measure the thickness of the base course at intervals such that there will be a depth measurement for at least each 500 square yards of complete base course. Take depth measurements by making test holes, at

BITUMINOUS CONCRETE PAVING

- B.** Correct the deficiencies where the subgrade or previously constructed pavement courses are loose, rutted, or otherwise defective prior to placing materials for a subsequent pavement course.
- C.** Cover the surfaces of curbs, gutters, manholes, and other structures that bituminous concrete mixture will be placed against with a thin, uniform coat of asphalt emulsion tack coat. Where the bituminous concrete mixture will be placed against the vertical face of an existing pavement, clean the vertical face to remove foreign substances and apply a coating of asphalt emulsion tack coat at a rate of approximately 0.25 gallons per square yard.

3.3 Application

A. Limitations on Application

1. Do not begin placing bituminous concrete mixture if air temperature is below 40 degrees F, if there is evidence of the aggregate base being frozen, or if there is fog, rain, or other unsuitable conditions.
2. Do not place bituminous concrete mixture when the wind is blowing at such a rate that proper compaction cannot be attained due to cooling of the mixture; or when sand, dust, or other debris is being deposited on the underlying surface to such an extent that proper bonding cannot be achieved.
3. The temperature of the bituminous concrete mixture shall be 290 degrees F minimum and 320 degrees F maximum leaving the mix plant, and 280 degrees F minimum at time of placing.
4. Do not incorporate into the work bituminous concrete mixture that is discolored, indicating the bitumen has been overheated.
5. Do not spread any mixture that cannot be finished and compacted during daylight hours.

B. Prime Coat

1. Apply prime coat to the surface of the existing aggregate base at least 24 hours in advance of the placement of new bituminous paving course.
2. Apply prime coat with a pressure distributor designed, equipped, maintained, and operated so the rate of application shall be between 0.25 and 0.50 gallons per square yard.
3. Use sufficient bitumen to seal the voids, but not more than can be readily absorbed. Cover any excess bitumen that does not penetrate the aggregate base with sand.
4. Keep prime coat surface free from traffic until placement of bituminous paving course.

BITUMINOUS CONCRETE PAVING

C. Tack Coat

1. Apply tack coat to the surface of concrete pavements and to previously placed bituminous pavement courses just before placing new bituminous paving course, in accordance with NYDOT Section 407.
2. Apply tack coat with a pressure distributor designed, equipped, maintained, and operated so the rate of application is between 0.03 and 2.0 gallons per square yard.
3. Apply tack coat sufficiently in advance of the spreading operation of the bituminous concrete mixture to permit volatiles to evaporate from the asphalt cement, but not so far in advance that the tack coat becomes covered with dust or other foreign substances.
4. Keep tack coat surface free from traffic, except asphalt trucks required to feed the paving, until the subsequent paving course is spread.

D. Bituminous Concrete Courses

1. Spread and finish in accordance with NYDOT Section 401.
 - a. Spread the bituminous concrete mixture using a self-propelled paver capable of spreading and finishing the mixture to the required width and thickness; true to line, grade, and cross section; and with a smoothly struck finish, uniform density, and texture, without the need for an undue amount of back dressing to correct irregularities.
 - b. Coordinate the spreading operation with the rate of production and delivery and with the rate of compaction to attain the most uniform and continuous progress possible.
 - c. Where the thickness of finished paving will be 3 inches or less, spread in one layer.
2. Compact in accordance with NYDOT Section 401.
 - a. General
 - (1) Start compacting the bituminous concrete mixture as soon as the mixture will bear a roller without undue displacement. Operate rollers at a slow and uniform speed not exceeding 300 feet per minute. Correct at once any displacement resulting from reversing the direction of a roller, or from other causes, by raking and adding fresh mixture as required.
 - (2) Keep the wheels of the rollers moistened with water to prevent the mixture from adhering to the wheels. Compact the areas inaccessible to rollers with hot mechanical hand tampers. Protect the surface of the pavement from drippings of oil, kerosene, or other materials used in paving and cleaning operations. If the bituminous

BITUMINOUS CONCRETE PAVING

concrete mixture becomes loose and broken, mixed with dirt, or defective in any other way, remove the unsatisfactory mixture and replace it with fresh, hot bituminous concrete mixture. Complete rolling before the temperature of the bituminous mixture drops below 140 degrees F.

b. Initial Rolling

Perform initial rolling of each course using a self-propelled, steel wheel roller weighing 8 to 12 tons. Begin each course at edges and work toward the center. During initial rolling, the entire pavement surface shall receive at least 2 passes of the roller in an overlapping pattern (1/2 the width of the roller on adjacent passes).

c. Intermediate Rolling

Perform intermediate rolling using a self-propelled, pneumatic tire roller weighing 6 to 10 tons and equipped with at least 7 smooth tread, low pressure tires inflated at 50 to 55 pounds per square inch. Intermediate rolling shall consist of no less than 5 passes of the roller over the entire area of the pavement.

d. Final Rolling

Perform final rolling using a self-propelled, steel wheel roller weighing 8 to 12 tons. Continue final rolling until all roller marks are eliminated.

3. Joints

a. General

(1) Place each bituminous paving layer as continuous as possible to keep the number of joints to a minimum. Create joints between old and new pavements, between successive days' work, or where the mixture has become cold (less than 140 degrees F). Make these joints in such a manner as to create a continuous bond between the old and new pavement construction courses.

(2) When the pavement construction involves 2 or more courses, offset successive courses by at least 6 inches.

b. Transverse Joints

If placing of material is discontinued or if material in place becomes cold, make a joint running perpendicular to the direction traveled by the paver. Before placement continues, trim the edge of the previously placed pavement to a straight line perpendicular to the paver and cut back to expose an even vertical surface for the full thickness of the course. When placement continues, position the paver on the transverse joint so that sufficient hot mixture will be spread in order to create a joint after rolling that conforms to the required smoothness. If the temperature of the

NAPL RECOVERY WELL INSTALLATION

3.6 NAPL Recovery Well Installation

NAPL recovery wells will be installed at the location of pilot holes that encountered recoverable NAPL. Boreholes for NAPL recovery wells shall be installed using rotary, bucket auger or other drilling technique approved by the Owner. The Contractor shall install any temporary casing necessary to maintain borehole stability. Type and size of the temporary casing shall be determined by the driller based on the drilling technique and depth of borehole. A biodegradable drilling mud, such as Revert™, may be used to maintain the stability of the borehole during drilling.

The borehole shall be terminated 18 inches into the glaciolacustrine clay (Clay) and/or glacial till (Till) with a borehole diameter of 24 to 30 inches at the bottom. A six (6) inch thick bentonite seal shall be tremied to the bottom of the borehole. The well screen shall be installed in the boring at the top of the six (6)-inch bentonite seal. Centralizers will be placed at the bottom of well screen and at each screen/casing joint. The annular space surrounding the well screen to one (1) foot above the top of the Clay/Till shall be filled with gravel pack material by the tremie method or as approved by the Owner. Coarse sand pack shall be installed in the annular space surrounding the well screen from top of gravel pack to approximately one (1) foot above the water table. Coarse sand pack shall be placed by the tremie method or as approved by the Owner. Any temporary casing shall be withdrawn while backfilling the annulus of the boring around the well screen or riser casing.

A bentonite pellet plug at least two (2) feet thick shall be placed above the coarse sand pack and hydrated. The plug shall be placed by the tremie method or as approved by the Owner.

The borehole shall be completed to existing ground surface by pumping cement-bentonite grout through a tremie pipe to the top of the bentonite pellet seal.

The geomembrane boot shall be attached to the NAPL recovery well and welded or glued to the liner as shown on the drawings and in accordance with the manufacturer's recommended procedures.

The concrete pad will be installed after completion of the landfill cap to final grade. Construction details are provided on the drawings.

Drill spoils will be placed in drums or other watertight containers during the drilling operation and handled in accordance with Section 3.9 of this Specification.

3.7 Well Development

Upon completion of the NAPL recovery well installation, each well shall be developed by jetting and pumping. The potable water jet shall be introduced to the well through a system consisting of drill string a four-nozzle jetting tool or equivalent attached to the base of the drill string. The jetting tool shall be constructed such that nozzle outlets are spaced equally around the circumference of the tool to hydraulically balance it during operation. The nozzles shall be configured to produce water jets in a direction perpendicular to the orientation of the drill stem, nozzle outlets are no less than one (1) inch from the inside of the screen, and produce a jet velocity between 100 and 300 feet per second. Recommended nozzle orifice size is 3/16 inch or less and pump should be able to produce a pressure of 260 psi or more.

The jetting tool shall be placed at the bottom of the well screen and rotated slowly while being pulled at 10 to 15 minutes per foot of screen. Several passes shall be made until the

NAPL RECOVERY WELL INSTALLATION

amount of additional material removed from the formation becomes negligible and water pumped from the well is visibly free of fines or until approved by Owner. This shall allow the proper set-up of the sand pack and the free flow of NAPL into the well.

Development water and decontamination rinsate shall be handled according to Section 3.9 of this Specification.

3.8 NAPL Well Pump Installation

The NAPL well pump and NAPL probe shall be installed in the well. Details of the NAPL well installation are shown on the drawings. The NAPL pump intake should be no more than three (3) inches above the bottom of the well. The mobile trailer shown on Drawing 594000-25J-01 is not part of this Contract.

3.9 Procedures for Handling Program-Derived Wastes

All solid wastes and drill cuttings derived from the NAPL well installation shall be containerized in drums or watertight containers furnished by the Contractor for transportation to a designated section of the landfill for disposal. Solid waste and soils shall be placed in the landfill and the drums or containers re-used until completion of the program.

The solid waste, soils and drill cuttings shall have free-water decanted from them to the extent that is practical. The material shall then be stabilized as necessary by the addition of Portland Cement or blending with other soils that are available. The stabilized soils shall be placed in the portion of the landfill designated by the Owner and compacted as required to meet the provisions of Specification 02200: Earthwork.

Liquid wastes shall be stored in the tank furnished by the Contractor and transported by the Contractor, or his licensed hauler, to the Owner's designated Niagara Falls plant for treatment and disposal. Liquid wastes shall include decontamination fluids collected from the decontamination pad.

END OF SPECIFICATION

APL WET WELL INSTALLATION

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes requirements for the installation of aqueous phase liquid (APL) wet wells at the Owner's 102nd Street Landfill Site (Site) in Niagara Falls, New York. The Work shall be complete and shall include the mobilization of equipment and materials, the preparation of excavations, completion of the wells, the installation of geomembrane boots, and the installation of pre-cast concrete, pumps and sensors. The Contractor shall furnish all materials, labor, tools, supervision and equipment necessary to complete the Work of this Specification.

B. Attachments

The following Attachments prescribe Work related procedures, protocols and requirements:

Attachment A: Owner's Site Specific Health and Safety Plan (SSHSP)
Attachment B: Health and Safety Plan (HASP) Addendum and Appendices

Coordinate Work prescribed by this specification with Work and requirements prescribed by the above listed specifications and attachments.

C. Terminology

Where used in this specification, the following term shall have the meaning indicated below, unless clearly indicated otherwise by the context of its use.

1. Contractor: The individual, partnership, company or corporation obligated to the Owner to perform the APL wet well installation.

D. Supplied by Owner/Buyer

The Owner shall provide access to the Site and interface with all federal, state and local agencies. The Owner shall supply any available drawings showing known underground utilities. The Contractor shall verify actual locations before excavation.

1.2 References and Codes

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, work covered by this specification shall conform to the applicable provisions of these publications.

- A. The Owner shall obtain the necessary permits and certificates required for the execution of this work. The Contractor shall provide any assistance and documentation that the Owner requires to obtain these permits and certificates.
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APL WET WELL INSTALLATION

- B.** Contractor shall comply with all federal, state or local laws, ordinances, or rules and regulations relating to the performance of the work of excavation and installing APL wet wells and pumps.

1.3 Submittals

A. Draft Report

Contractor shall present the results of the APL wet well installation in a written draft report in three (3) copies to Owner within four (4) weeks after completion of the APL wet wells. This draft report shall be complete in itself and shall contain all pertinent data. It shall include, but not necessarily be limited to, the following information:

1. As-built construction drawings
2. Groundwater/product level measurements (if applicable)
3. Air quality monitoring results
4. All data and recommendations required by this specification
5. Documentation of any deviations of the Work from these specifications and evidence of Owner's approval.

B. Final Report

Contractor to submit five (5) bound copies and one (1) unbound reproducible copy of the final wet well installation report to Owner within two (2) weeks of the receipt of the review comments on the draft report.

C. Data and Records

All data required to be recorded in accordance with standard test methods in this specification shall be obtained and recorded by the Contractor and made available to the Owner.

D. Permits and Licenses

The Contractor shall furnish to the Owner three copies of the following document:

- Licenses required by federal, state, and/or local government agencies necessary to perform the Work of this specification.

2.0 PRODUCTS AND MATERIALS

A. Water

Water used to prepare grout mixtures and to decontaminate the equipment shall be potable.

APL WET WELL INSTALLATION

B. Geomembrane Boot

The geomembrane boot which is to be used to seal the geomembrane landfill liner to the APL wet well pre-cast concrete manhole shall be manufactured of the same material as the geomembrane liner and sealed to the liner following the manufacturer's recommended procedures. Details of the geomembrane boot installation are shown on Drawing 594000-30K-08.

C. Pre-Cast Concrete Manhole

A pre-cast concrete manhole that will provide well, pump, and piping protection shall be provided by the Contractor. The manhole shall conform to Specification 03400. Details of the pre-cast concrete manhole for APL wet wells are found on Drawing 594000-30K-06.

3.0 EXECUTION

3.1 General

Aqueous phase liquid wet wells shall be located as indicated on the drawings. Well locations may be relocated by the Owner after the award of contract but prior to installation. Contractor shall install the four (4) wells conforming to this specification. Air monitoring of the breathing zone shall be performed by the Contractor in accordance with the requirements of Attachment A and B.

3.2 Equipment Mobilization/Demobilization

The Contractor shall furnish excavating equipment suitable for successfully completing the necessary wet well installations, all necessary tools and equipment, trucks, drums or containers for waste material and spoils handling, decontamination equipment, labor, supplies, and miscellaneous materials required to complete the described program. This includes all work associated with moving equipment and supplies to the site vicinity prior to beginning work, and moving equipment off site after the job has been completed.

3.3 Site Preparation

The APL wet well installation will occur after placement of cap subbase material and the installation of the APL collection trench, but prior to installation of the geomembrane liner, as shown on the drawings. The Contractor is responsible for providing access to all excavation locations during mobilization. All ruts and holes shall be restored to original grade.

3.4 Equipment Decontamination

Prior to mobilizing to the Site, the Contractor shall clean the equipment. The excavating equipment shall be cleaned using a power washer, steam jenny, or, alternatively, it shall be hand washed with a brush using detergent to remove oil, grease and hydraulic fluid from the exterior. The excavating equipment shall be inspected by the Owner when mobilized to determine that there are no fluid leaks.

The bucket and boom of the excavating equipment and tools shall be scraped and/or brushed to remove soil/debris at the completion of each APL wet well. All soils can be

BITUMINOUS CONCRETE PAVING

1.0 GENERAL

1.1 Summary

A. Scope of Specification

This specification prescribes the requirements for the construction of plant-mixed, hot-laid bituminous concrete binder course and top wearing surface course on a prepared aggregate base or concrete pavement base at the locations and to the lines, grades, thicknesses, and other dimensions shown on the drawings.

Bituminous paving will also be required to replace the Buffalo Avenue pavement that will be removed to install the storm sewer in the locations shown on Drawing 594000-30K-04C. The trench backfill detail showing the replacement paving is shown on Drawing 594000-30K-13.

B. Related Specification

Coordinate Work in this specification with Specification 02234: Light Duty Access Road and Bituminous Pavement Base Aggregate Mixes.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, all Work included in this specification shall conform to the applicable provisions of these publications.

A. ASTM (American Society for Testing and Materials)

1. ASTM D242 Standard Specification for Mineral Filler for Bituminous Paving Mixtures
2. ASTM D692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures
3. ASTM D1073 Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
4. ASTM D2172 Standard Test Methods for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
5. ASTM D3381 Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction

B. NYDOT, State of New York, Department of Transportation Standard Specifications for Construction and Materials

1. Section 401 Plant Mix Pavements - General

BITUMINOUS CONCRETE PAVING

2. Section 403 Hot Mix Asphalt Concrete Pavement
3. Section 407 Tack Coat
4. Section 702 Bituminous Materials
5. Section 703 Aggregates

1.3 Submittals

A. Product Data

Submit the following to Owner for approval prior to beginning asphalt placement:

- Aggregate and mineral filler gradations
- Certificate of compliance for each asphalt product
- Bituminous concrete mix design

B. Test Results

Submit results of the tests required during the performance of the work.

1.4 Quality Assurance

Services of an inspection and testing agency to perform inspections and tests necessary to ensure that the work complies with requirements of the specifications will be retained by the Contractor.

2.0 PRODUCTS

2.1 Materials

- A. Fine aggregate shall be natural or manufactured sand conforming to ASTM D1073.
- B. Coarse aggregate shall be crushed stone, crushed slag, or crushed gravel conforming to ASTM D692. That portion of the coarse aggregate material retained on the Number 4 sieve shall contain not less than 50 percent by weight of crushed pieces having at least 1 fractured face.
- C. Mineral filler shall be limestone dust, dolomite dust, or portland cement conforming to ASTM D242.
- D. Asphalt cement for bituminous concrete shall be viscosity grade AC 15 conforming to NYDOT Section 702.
- E. Liquid asphalt for prime coat shall be MC-30 conforming to NYDOT Table 702-4.
- F. Asphalt emulsion tack coat shall meet the requirements of NYDOT Table 702-9.

BITUMINOUS CONCRETE PAVING

- G. Binder Coarse shall be NYDOT Type 3.
- H. Wearing Coarse shall be NYDOT Type 6F.

2.2 Mixes

A. Job Mixes

1. Bituminous concrete for base, binder, and surface courses shall be a mixture of asphalt cement, coarse aggregate, fine aggregate, and, if required, mineral filler. Job mix formula shall be established using the Marshall mix design method based on the following parameters:

Stability	1,500 lbs. (min.)
Flow	0.08 to 0.18 inches
Voids in mineral aggregate Type 6F	15.5% (min.)
Air voids	2.0 - 4.0 percent

2. Type 3 mix shall have an asphalt content between 4.5 and 6.5 percent as measured by ASTM D2172. Type 6F mix shall have an asphalt content between 5.8 and 7.0 percent as measured by ASTM D2172. Owner to submit a minimum of one sample per 100 tons per mix type.

B. State Approved Mixes

In lieu of performing new tests to certify materials and mix designs, materials and mixes certified for use by NYDOT may be furnished provided all requirements of this specification are met and complete certified documentation of such compliance is submitted and approved.

3.0 EXECUTION

3.1 Examination

Examine the surface of the area to be paved before placing the bituminous concrete mixture to ensure that it is properly prepared, intact, firm, cured, and dry. Correct conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 Preparation

- A. Clean surface of the area to be paved before placing the bituminous concrete mixture, and keep the surface from accumulating materials that would contaminate the mixture, prevent bonding, or interfere with spreading operations.

AGGREGATE FOR LIGHT DUTY ACCESS ROADS AND BITUMINOUS PAVEMENT BASE

1.0 GENERAL

1.1 Summary

This specification prescribes the requirements for the aggregate material and the construction of the light duty access roads and the aggregate base for the bituminous pavement. Construct to the lines, grades, thicknesses, and cross sections shown on the drawings.

These dense aggregate layers are above the select cover fill, and form part of the final cap surface. The locations of the light duty access roads are shown on Drawing 594000-10U-01. The limits of the bituminous pavement are shown on Drawings 594000-10-U-04 and 594000-10U-05.

1.2 References

The publications listed below form part of this specification. Each publication shall be the latest revision and addendum in effect on the date this specification is issued for construction unless noted otherwise. Except as modified by the requirements specified herein or the details of the drawings, Work included in these specifications shall conform to the applicable provisions of these publications.

A. ASTM (American Society for Testing and Materials)

1. ASTM C 117 Standard Test Method for Materials Finer than Number 200 Sieve in Mineral Aggregates by Washing
2. ASTM C 131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
3. ASTM C 136 Standard Method for Sieve Analysis of Fine and Coarse Aggregates
4. ASTM D 698 Standard Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures using 5.5 pound Rammer and 12 inch Drop
5. ASTM D 2922 Standard Test Methods for Density of Soil and Soil-Aggregates by Nuclear Methods (Shallow Depth)
6. ASTM D 4318 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
7. ASTM E 329 Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as used in Construction

EARTHWORK

3.7 Dioxin-Containing Soil Placement Cell

Construct Dioxin-Containing Soil Placement Cell in accordance with the details and location presented on the drawings. After preparation of the subgrade, place fill in lifts not exceeding 12 inches in compacted thickness and compact to 90 percent of Proctor Density (ASTM D698) within four (4) percentage points of optimum moisture content.

3.8 Dust Control

Contractor shall make every effort to control dust for the duration of the Work. This effort shall include minimizing the area of disturbed soil exposed at any one time, and installing temporary or permanent surface stabilization measures immediately after completing a land grading unit of the overall Work. For disturbed areas not subject to traffic, temporary or permanent vegetation shall be installed according to the drawings. For other areas subject to traffic, dust control measures shall include mulching, sprinkling water, spraying adhesive or calcium chloride, and surface roughening by tillage. The measures implemented shall be maintained until all disturbed areas have been stabilized with vegetation.

3.9 Field Quality Control

Contractor shall be responsible for ensuring that earthwork materials and execution meet the requirements of this specification. The Contractor is responsible for providing material testing submittals. An Independent Inspection and Testing agency will be engaged by the Owner for the purpose of inspecting and testing placed materials in the field.

Quality Control requirements are discussed in Specification 02006 - Inspection and Testing Services.

END OF SPECIFICATION

EARTHWORK

the construction schedule, or damage to existing features or facilities in the vicinity of the work.

C. Infiltration (APL System, Utilities/Storm Drainage - Buffalo Avenue)

When the bottom of a trench must be carried to an elevation below the groundwater piezometric surface, or to such proximity to the piezometric surface that the excavation bottom will become soft due to its being saturated by groundwater, take measures to lower the piezometric surface sufficiently to maintain the stability of the excavation bottom. Design the groundwater control system using accepted professional methods of design and engineering consistent with the best modern practice. The system shall include such equipment and appurtenances necessary to achieve the groundwater control needs of the work. Carefully design and operate the system to avoid damage to existing structures and other facilities in the vicinity of the work.

D. Disposal of Removed Water

Refer to the Water Management Plan included as an attachment to Specification 11231. The Contractor shall review design and operation of all systems with Owner prior to use.

E. System Removal

After completing construction operations needing water control, remove materials, equipment, and other facilities used for that purpose, and clean up and restore affected areas as required.

3.5 Excavation and Backfill

A. General

1. Stockpiling

Stockpile excavated materials within the limits of the landfill in an orderly manner at a distance from the banks of the excavation sufficient to avoid overloading the bank. Arrange stockpiles so as not to obstruct drainage or other construction operations in the vicinity of excavation.

Stockpiling of excavated materials shall not be allowed outside of the limits of the slurry wall alignment.

2. Moisture Control

Compact backfill material at a moisture content suitable for that material using the compaction equipment employed. Compact cohesive materials at a moisture content within plus or minus four (4) percent of optimum.

EARTHWORK

When water must be added, distribute it uniformly over the surface of the layer, and thoroughly incorporate it into the soil by manipulation (plowing, discing, raking, or blading) to achieve a uniform distribution of moisture throughout the material. When the moisture content is excessive, defer compaction until the material has dried to a suitable moisture content. Natural drying may be accelerated by manipulation to increase the rate of evaporation, or by blending in a dry material. If drying is accomplished by blending in a dry material, take care not to exceed the specified maximum layer thickness for compaction. Remove any excess material from the layer before compaction.

B. Off-site Perimeter Soils

1. Excavate the area(s) indicated on the Drawings to the depth required (including sod or other existing cover). Background information can be found in the Perimeter Soils Verification Sampling Data Summary Report. The area being excavated (and not backfilled) shall be limited to that area which can be backfilled in one day. Remove all materials encountered within the indicated depth of removal including stumps and root systems. Carefully load, to avoid fugitive emissions, into lined trucks. Transport excavated materials to Area 2 as shown in Drawing 594000-10U-06, spread, compact and provide daily cover.
2. Some of the perimeter soils along Buffalo Avenue contain dioxin. These soils will be consolidated into the Dioxin-Containing Soil Placement Cell as shown on Drawing 594000-30K-02. The soil will be covered with a geotextile fabric per Section 2.1.M.2. Construction of the cell is discussed in Section 3.7.
3. Excavation shall be suspended during wet weather. In the event of rain, excavated areas shall be covered with 6-mil polyethylene sheets and tarps to prevent intrusion of rainwater. The tarps shall be elevated in the center on drums or appropriate framework such that rainwater is diverted to undisturbed areas.
4. After the cleanup objectives are achieved and the excavation has been taken to the appropriate depth, the Contractor shall backfill the excavation to the pre-excavation grades with pre-approved fill in horizontal lifts not exceeding 8 inches loose thickness. Compact to no less than 90 percent of Standard Proctor Density (ASTM D698). Place a minimum of six (6) inches of topsoil over the compacted fill and lightly tamp, taking precautions not to over compact or create a hard crust on top. Finish grade to the elevations shown on the Drawings, within a tolerance of 0.1 feet (plus or minus).
5. Coordinate backfilling operation with the installation of storm drainage. Placement of topsoil may also be delayed due to work in the area under separate contracts. Coordinate the placement of the topsoil with