POST-REMEDIAL CONSTRUCTION OPERATIONS, MAINTENANCE, AND MONITORING MANUAL FOR CHERRY FARM SITE (NYSDEC SITE NO. 9-15-063) RIVER ROAD SITE (NYSDEC SITE NO. 9-15-031)

Tonawanda, New York

SUBMITTED TO:

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION DIVISION OF HAZARDOUS WASTE REMEDIATION

SUBMITTED BY:

CHERRY FARM/RIVER ROAD SITE
Potentially Responsible Parties

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September 2006

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June 2017

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SECTION 1

INTRODUCTION

1.1 PURPOSE

In accordance with the New York State Department of Environmental Conservation (NYSDEC) Order on Consent (Index Nos. B9-0046-84-10 and B9-0047-91-02), the Potentially Responsible Parties (PRP) Group for the Cherry Farm Site (NYSDEC No. 9-15-063) and River Road Site (NYSDEC No. 9-15-031) has completed the required remediation of the combined sites. The key remedial action elements for the property included consolidation and capping of waste fill; regrading the Site for surface water management; and collection, treatment, and disposal of groundwater.

This document presents an operations, maintenance, and monitoring (OM&M) manual for post-remedial construction activities at the Cherry Farm/River Road Site (the Site), which complies with the requirements set forth under 6 NYCRR Part 360-2.15(i)(7). Ongoing OM&M will be conducted to ensure the effectiveness of the remedy, including the groundwater treatment system and surface water management program. Also, inspections and maintenance are required for the landfill cap, site security systems, runoff control structures, and access roads. This manual describes groundwater and surface water monitoring, cover and drainage system inspection, reporting requirements, emergency response procedures, and community involvement. It also includes Standard Operating Procedures (SOPs) for operation of the groundwater extraction and treatment system (Volume II of this manual). This manual was prepared by Parsons, Inc in accordance with guidance from NYSDEC Draft DER-10 (NYSDEC, 2002). Groundwater & Environmental Services, Inc. (GES) has been performing site operation and maintenance activities in accordance with the OM&M Manual since December 2007. At the request of the NYSDEC, GES prepared the June 2017 OM&M Manual, which includes updates and revisions that have been made to the monitoring and maintenance program since September 2006.

1.2 SITE HISTORY

The River Road Site and Cherry Farm Site are adjoining sites located in the Town of Tonawanda, Erie County, New York (see Figure 1.1). The River Road Site occupies approximately 23 acres, and is located along the Niagara River south of the Grand Island Bridge. The northern half of the River Road Site is owned by Mr. Matthew Duggan of Amherst, New York and the southern portion of the Site is owned by Niagara River World, Inc. and Clarence Material Corporation (Pineledge Holding Corporation). The Tonawanda Coke Corporation owned and operated two retention ponds located on property adjoining the Site's southwestern boundary. The ponds were closed during the winter of 1998 (prior to April 1998).

The Cherry Farm Site is a 56-acre parcel owned by Niagara Mohawk Power Corporation, and located immediately north of the River Road Site. These two sites were at one time a part of a larger property owned by Wickwire-Spencer Steel Company. Due to the common history,

former common ownership, and similar remedial programs, it was considered appropriate by the NYSDEC and PRPs to combine the remedial program at the two sites.

The Cherry Farm and River Road Sites were used for the disposal of waste from steel manufacturing processes from approximately 1908 to 1963, and were operated as a landfill for disposal of industrial wastes from facilities in the area from 1963 until about 1970. Flyash, bottom ash, slag, sludge, liquid boiler cleaning waste, concrete rubble, and miscellaneous wastefill were disposed.

1.3 GEOLOGY AND HYDROGEOLOGY

Detailed hydrogeologic investigations of the Site have been conducted and documented in previous reports: Cherry Farm Remedial Investigation Report, O'Brien & Gere, June 1989; River Road Phase I/Phase II Remedial Investigation Report, Dvirka & Bartilucci, September 1993. A summary of the Site geology and hydrogeology is provided below, based on the referenced investigations, and observations made during the installation of the recovery wells, monitoring wells, and observation wells in August and September, 1996.

Cherry Farm Site

From the surface to bedrock, the Cherry Farm/River Road Site consists of five major stratigraphic units as follows: fill; marsh deposits; fine alluvial sand sediments; gray clay and silt (till) above bedrock; and shale bedrock.

The thickness of the fill deposit ranges from 15 to 20 feet. The marsh deposits below the fill range in thickness to about five feet and grade to fine silts and sands at the eastern edge of the Site. With increasing depth below the marsh deposits, silty sands grade to relatively clean alluvial sands. The thickness of this alluvial sand unit is on the order of 30 feet close to the Niagara River. Above the bedrock and below the alluvial sands is what appears to be a few feet of silt and clay (till), which in some areas of the Site has been replaced by coarse alluvial sands and gravel. A shale bedrock completes the stratigraphic section of the subsurface materials at the Cherry Farm Site.

The groundwater system beneath the Cherry Farm/River Road Site can be divided into two primary hydrogeologic units: fill materials, and alluvial sands. These two units are separated over much of the Site by the finer-grained marsh deposits where they are present. Groundwater flow direction in both units, based on water level data and river elevations, appears to be primarily westerly, towards the river.

River Road Site

Some differences were observed between the Cherry Farm and River Road Site stratigraphy. At the River Road Site, the thickness of the fill is variable, reaching greater than 25 feet in some areas. Below the fill materials, marsh deposits were encountered, but appeared to be discontinuous. Alluvial/lacustrine sediments lie below the fill at the River Road Site. Only in some areas of the Site are the alluvial/lacustrine sediments separated from the fill by marsh

deposits. The alluvial/lacustrine sediments are described as gray-brown silt to clayey silt and gray-brown coarse to fine sand with lesser amounts of silt, clay and gravel. These deposits range in thickness from 15 to 35 feet. A till unit, with thicknesses of up to 16 feet in the eastern portion of the Site, lies below the alluvial/lacustrine sediments and on top of the bedrock.

Groundwater flow direction in both the fill materials, and the alluvial/lacustrine sediments, based on water level data and river elevations, appears to be primarily westerly, towards the river.

1.4 GOALS OF THE REMEDIAL ACTION

The objective of the remedial action is to provide a cost-effective corrective measure in conformance to accepted standards, reduce mobility of contaminants, limit potential pathways of contamination, and minimize long-term operation and maintenance costs. To the extent practicable, the remedial design for the Site was developed to reflect the proposed post-remedial development of a waterfront park and recreation area on the Cherry Farm Site by the Town of Tonawanda. Various redevelopment plans have been proposed over the years, but as of yet, no agreement has been reached between the Town and the Responsible Parties related to the redevelopment of the Site. Previouly, the remedial design consultant (Parsons) prepared a design that included grading of site soils to accommodate pathways, creation of a "hill" overlooking a proposed amphitheater, and installation of park utility corridors. These efforts were completed concurrently with the remedial action.

1.5 REMEDIAL ACTION SUMMARY

The remedial measures implemented for the Site were in accordance with the combined Record of Decision (NYSDEC, 1994). The Remedial Design for the combined properties included the following items:

- Consolidation of wastes and installation of permeable and impermeable barriers over the wastes;
- Stabilization and habitat enhancements of the shoreline along the Niagara River, including installation of wooded and wetland areas;
- Removal and consolidation of contaminated sediments located within onsite drainage ditches;
- Installation of soil covers to support vegetation;
- Installation and operation of groundwater extraction wells (deep/intermediate zone) and groundwater collection trenches (shallow zone);
- Collection and disposal of light non-aqueous phase liquids (LNAPL) present in groundwater on the River Road Site;
- Treatment of groundwater and subsequent discharge to the Town of Tonawanda Wastewater Treatment facility; and,

- Removal of river sediments impacted by the Site, and subsequent placement in an onsite sediment disposal area (SDA).

The final cover system consists of, from the top down, 6 inches of topsoil, 18 inches of protective cover soil, and an isolation geotextile layer on both the Cherry Farms and River Road Sites. Erosion control measures include vegetation for the capped area and riprap along the shoreline of the Niagara River. Habitat enhancements were integrated into the shoreline erosion protection design to provide additional wetland area onsite.

The groundwater treatment system includes oil/water separation, flow equalization, and pH adjustment. The groundwater treatment facility is located on the River Road portion of the Site. Public access to the portions of the Site where the treatment facility is located is restricted by a security fence.

The remediation was substantially completed by December 1998, with followup wetland plantings and final grading/seeding of the SDA in 1999.

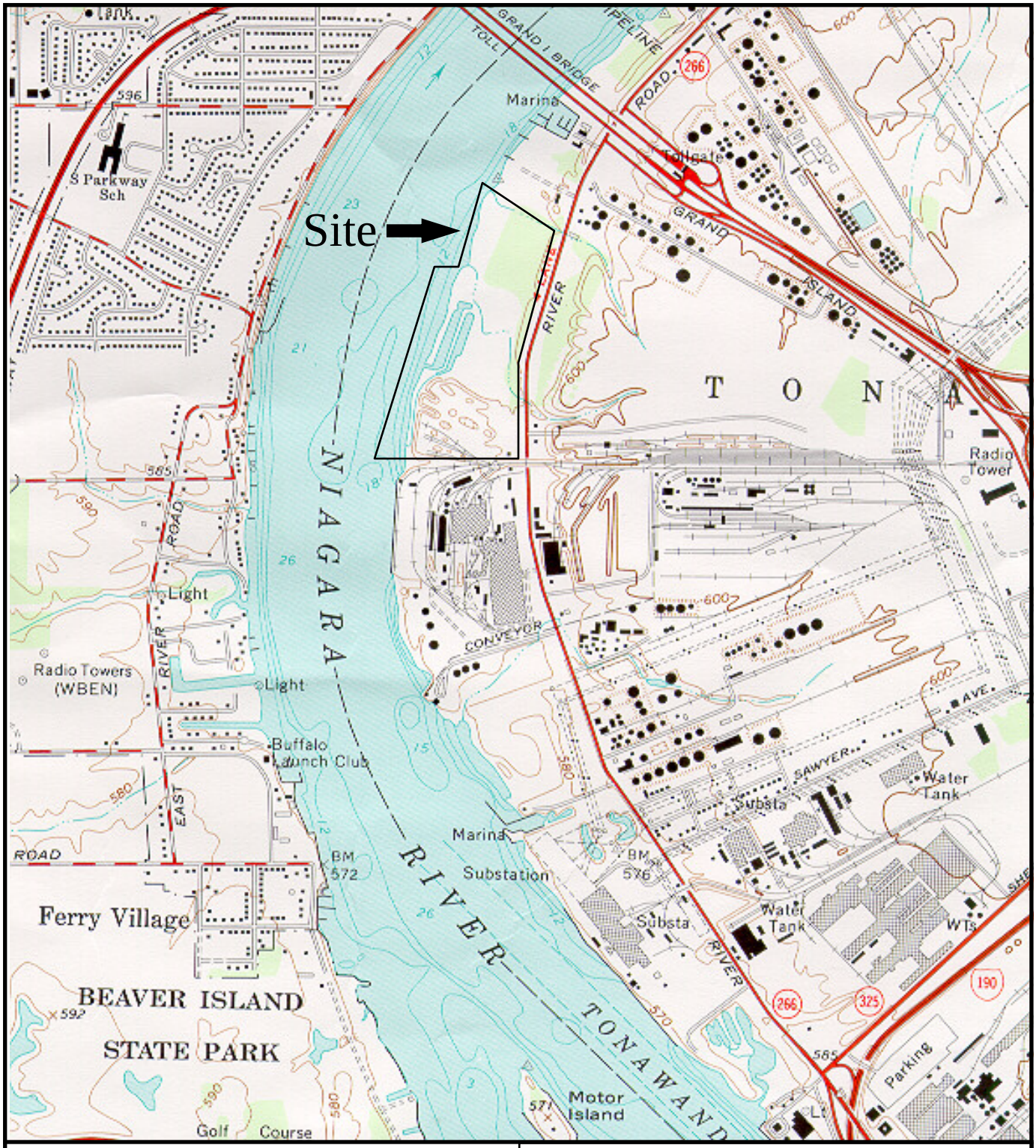
In October 2002, the intermediate/deep groundwater collection system was turned off as part of a groundwater upwelling study. Based on the results of the study, which showed no significant impacts to the Niagara River, NYSDEC approved permanently shutting down the intermediate/deep groundwater collection system in November 2004. Nine of the 11 intermediate/deep groundwater extraction wells were abandoned in July 2005. RW-4 and RW-5 were left in place as monitoring wells.

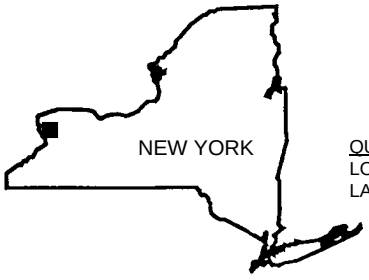
1.6 SUMMARY OF OM&M MODIFICATIONS

The following modifications were implemented as a result of the NYSDEC letters dated November 29, 2004, July 6, 2009, and March 20, 2017. The letters were in response to the recommendations outlined in the 2003 Annual and Five Year Review Report submitted by Parsons in April 2004, the 2008 Annual and Five Year Review Report submitted by GES in May 2009, and the 2016 Site Management Periodic Review Report submitted by GES in February 2017.

- The chemical analytical parameter list for the intermediate/deep groundwater samples was reduced by eliminating metals and pesticides. This change was enacted during the August 2005 groundwater sampling event.
- The groundwater sampling frequency was reduced from semi-annual to annual. This change was enacted in 2004.
- Groundwater level monitoring was reduced from monthly to quarterly, beginning in October 2004.
- Nine of the 11 intermediate/deep groundwater extraction wells were abandoned. This work was conducted in July 2005, and documented in a letter to NYSDEC dated August 26, 2005. Only extraction wells RW-4 and RW-5 were left in place, to be used as monitoring points.

- Cap inspections were reduced from quarterly to semi-annually. Routine inspections of the cap are conducted on a monthly basis, in conjunction with the routine site visits, and formal inspections with the NYSDEC are conducted on a semi-annual basis. Any minor deficiencies observed during the monthly inspections are documented and discussed with the NYSDEC during formal inspections semi-annually. This change was enacted following the 2009 third quarter cap inspection.
- The reduction of conveyance pipeline flushing. To alleviate the unnecessary system down-time and expense of conducting the flush, the conveyance pipeline are cleaned dependent upon influent flow. In order to maintain optimal system operation, flow rates from the sumps are monitored and a reduction in flow would predicate the need for flushing of the line. Pursuant to NYSDEC request, "as needed" is defined as the following: if a total flow rate of five gallons per minute (gpm) or less is sustained for a period of one month or more, and all other system checks relating to the flow rate have been completed (muriatic acid flush of sumps and lines, sump pump inspection/cleaning, and visual observation of interior influent piping), then the contractor will complete the flushing of the conveyance pipeline. This change was enacted in July 2009.
- Adjustment of the acidification set point from pH 2.0 to pH 2.5. The NYSDEC indicated that details of the plant operation to achieve the Town of Tonawanda discharge limits are up to the owner and the Town requirements. The remedial system has been operating and discharging within Town requirements since the pH of system had been modified. This change was enacted in 2009.
- The groundwater sampling frequency at wells MW-1, MW-2, MW-3, and MW-7 was reduced to once every two years. This change was enacted in 2017.
- The requirement for 5-year reports in addition to annual Periodic Review Reports was eliminated following approval of the NYSDEC in May 2017.





N

QUADRANGLE LOCATION
LONGITUDE: 78º 52' 30"
LATITUDE: 42º 52' 30"

SOURCE: U.S.G.S. 7.5 SERIES BUFFALO NW, New York-Ont (TOPOGRAPHIC), 1965

Figure 1.1

Cherry Farm/River Road Site PRP Group

Cherry Farm/River Road Site

SITE LOCATION MAP

GROUNDWATER & ENVIRONMENTAL SERVICES, INC.
495 AERO DRIVE, CHEEKTOWAGA, NEW YORK 14225

SECTION 2

SITE MONITORING

2.1 ENVIRONMENTAL MONITORING PLAN

Groundwater (shallow collection system sumps), surface water, and treatment plant influent and effluent monitoring will be a regular part of the post-closure activities at the Site. Collected and pre-treated groundwater is ultimately discharged to the Town of Tonawanda's Wastewater Treatment Facility under the provisions of an Industrial Discharge Permit (Volume II, Appendix A). The permit is renewed every three (3) years. The following subsections describe the monitoring points, procedures for sampling, analysis of samples, and the evaluation of sample results.

A series of groundwater monitoring wells and sumps were installed at upgradient and downgradient locations to provide adequate data to evaluate the effectiveness of the groundwater extraction system. The environmental monitoring system for groundwater and surface water includes the following:

- Seven intermediate/deep groundwater monitoring wells (two upgradient and five downgradient) to assess groundwater quality and efficiency of the groundwater extraction system;
- Nine observation wells to measure the hydraulic gradient of shallow groundwater as it enters the shallow interceptor trenches;
- Four sumps located in the shallow trenches to assess the shallow groundwater quality, and to collect LNAPL, if present; and
- Three surface water sampling points to assess surface water quality.

A description of the wells, piezometers, and sampling and analytical protocol is provided in the following sections. Also, a discussion regarding evaluation of the data is presented.

2.1.1 Groundwater Monitoring Plan

The groundwater monitoring wells to be monitored during post-closure operations are shown on Figure 2.1. These include two upgradient and seven downgradient monitoring wells (see Appendix A for well logs). Sampling and analysis of groundwater collected from the monitoring wells will be conducted annually with the exception of monitoring wells MW-1, MW-2, MW-3, and MW-7 which will be sampled once every two years beginning in 2017. Each year, the season during which samples are collected will be varied. The annual sampling events will be separated by a minimum of two quarters, and a maximum of four quarters. A sampling and analysis summary is provided in Table 2.1.

Upgradient:

MW-1; and MW-2.

Downgradient:

MW-3; MW-4; MW-5; MW-6; MW-7; RW-4; and RW-5.

2.1.2 Surface Water Monitoring Plan

Post-remedial construction surface water monitoring will be conducted at each of the three areas of shallow open channel flow (see Figure 2.1 for locations). Sampling and analysis of surface water monitoring points will be conducted annually, at the same time as the groundwater sampling. Note that a number of the surface water sampling points are often dry and therefore no samples are collected when that is the case.

2.1.3 Onsite Groundwater Treatment System Performance Monitoring

Total system flow is measured by an ISCO Ultrasonic Flow Meter, using a 22.5-degree V-notch weir in the equalization tank as the primary flow element. Sampling will be conducted in accordance with the industrial wastewater discharge permit issued by the Town of Tonawanda (Volume II, Appendix A). A summary of required analytical parameters and analyses for the treatment system is provided in Table 2.2 Samples are collected from the groundwater treatment system on the following schedule:

- Monthly: PCB arochlors and Oil & Grease from sampling location ML-1 and PCB arochlors, pH, and total petroleum hydrocarbons (TPH) from sampling location ML-2 for permitting purposes. PCB arochlors from the between carbon vessel sampling location are also analyzed monthly for monitoring purposes (see Volume II, Appendix C for treatment plant process and instrumentation diagram, showing sampling locations).

- Semi-annually: Total suspended solids (TSS), biological oxygen demand (BOD), total phosphorus, total arsenic, and total cyanide from sampling location ML-2.

A system process and instrumentation diagram (P&ID) detailing the system sampling locations in included on Figure 2.2.

2.2 SAMPLING PROCEDURES

2.2.1 Groundwater Sampling Procedures

The following is a step-by-step sampling procedure for the collection of groundwater samples from the monitoring wells. Well sampling procedures and data obtained will be recorded on the sampling forms in Appendix B (or similar). Copies of the forms will be maintained in the treatment system and at the office.

- The equipment will be assembled (see Table 2.3), inspected and calibrated to ensure it is in proper working order before mobilizing to the site.
- Upgradient well(s) will be selected as the initial sampling location(s). Wells will be measured or sampled generally in order of increasing contamination potential (upgradient to downgradient).

- Prior to any well evacuation or sampling at a well(s), the static water level will be measured. The well will also be examined for the presence of immiscible layers. An electronic water level indicator or interface probe (if immiscible layers are suspected) will be used to measure water levels or product levels. Use the surveyed well elevation reference point marked on the inner well casing when conducting the measurements. Measurement of water and floating liquids must be performed prior to measuring the levels of any sinking (dense) liquids in the monitoring well.
- Measured levels, obtained by lowering the probe(s) below the water surface, must be recorded on the well sampling record to the nearest 0.01 foot.
- The probe will be decontaminated (decontamination procedures are discussed in Section 2.2.3).
- If immiscible phases are detected, they must be collected (removed from the well) before any purging activities take place in a well. The floating immiscible layer will beremoved from the well using a bailer or a peristaltic pump.
- If no immiscible layers are detected or if the detected immiscible layers have been removed from the well, the well must be purged to ensure that any stagnant water is replaced by fresh formation water. Wells will be purged of a minimum of three well volumes whenever possible (high yield wells). If the well is purged to dryness (low yield well, recovery greater than 2 hours), the well will be sampled as soon as sufficient volume is available. Bailers, peristaltic pumps, or centrifugal pumps can be used to purge the wells.
- Former extraction wells, RW-4 and RW-5, now being utilized as monitoring wells, will be purged and sampled utilizing low-flow techniques. The wells will be sampled using peristaltic or submersible pumps and HDPE or similar tubing. The tubing will be securely fastened to the well casing during sampling to prevent movement and disturbance of any sediments in the well annulus. Pumps will be operated at 1,000 milliliters per minute or less during purging and sampling. The objective of the low-flow sampling technique is to minimize turbidity during sampling, thus more correctly approximating the actual groundwater concentrations.
- During purging, pH, temperature, conductance, and turbidity will be measured and recorded after each well volume is removed. The purge water will be contained and disposed of in the onsite groundwater treatment plant.
- Equipment used during purging will be decontaminated prior to its reuse. Decontamination should follow the procedures discussed in Section 2.2.3.
- Samples will be collected subsequent to purging, and after the well has recovered with enough volume to allow collection of a sample.
- If immiscible layers are detected in the well after purging, the layers must be sampled as if it were a groundwater sample. After sampling the immiscible layers in the well, they must be purged from the well and a groundwater sample obtained.

- Samples will be collected with disposable bailers or from a dedicated pump. Samples will be containerized and preserved in the order of volatilization sensitivity of the parameters (VOCs, SVOCs, metals/inorganics, etc.).
- Temperature, pH, and specific conductance will be measured in the field before and after sample collection.
- Measurements, observations, procedures, and time will be recorded on the sampling record sheet.
- Samples will be placed in laboratory coolers, on ice, and either dropped off at the lab the same day or will be picked up by the lab the following day. Chain-of-Custody procedures will be followed as outlined in Section 2.2.3.

2.2.2 Sump and Surface Water Sampling Procedures

Field procedures for sump and surface water sampling are described below.

- Surface water samples will be collected directly into the appropriate sample bottle. If the surface water flow is insufficient for direct filling of sample bottles, a decontaminated glass or stainless steel beaker may be used to collect the sample.
- Care will be exercised to ensure that the selected surface water sampling point is not in a visible area of stagnant water. Sampling of the sumps will take place prior to evacuation of water or LNAPL from the sump.
- Surface water samples will be collected while standing downstream from the sampling point, taking care not to disturb sediments near the sampling point.
- Sump samples will be collected with a disposable bailer from the top of the sump manhole, and decanted into the appropriate sample containers. No purging is necessary.
- For both surface water and sump samples, temperature, conductivity, and pH will be measured, and sample description and location will be noted. Surface water and sump sampling procedures and data obtained during sampling will be recorded on the forms included in Appendix B.
- Samples will be preserved and prepared for submittal to the contract laboratory.

2.2.3 Equipment Decontamination

Prior to using sampling equipment and between sampling points for groundwater and surface water, the non-dedicated, non-disposable equipment (meters, probes, glassware, and bailers) coming in contact with groundwater, LNAPL, or surface water will be decontaminated using the following procedure:

- The equipment will be thoroughly cleaned with a non-phosphate detergent/soap mixture if there is no visible LNAPL on the sampling equipment.
- If LNAPL is present (as measured with interface probe) and is visible on the sampling probe, the sampling equipment will be washed/rinsed with a pesticide-quality hexane after wiping the majority of the LNAPL off of the equipment. The equipment will then

be rinsed with potable water, washed with non-phosphate detergent and rinsed with distilled water.

- After cleaning sampling equipment (with or without LNAPL), the sampling equipment will be rinsed three times with potable or distilled water and then thoroughly dried using clean disposable towels.
- If sampling equipment is to be reused, it shall not be placed directly on the ground. Some equipment (bailers, glassware, etc.) will be wrapped in aluminum foil to protect it from becoming contaminated between use.
- Sample equipment will be decontaminated between use in different wells or sumps.
- Decontamination fluids will be contained and disposed of at the onsite groundwater treatment plant.

2.2.4 Field Sample Custody

A COC record (see Appendix B) will accompany the sample containers from selection and preparation at the laboratory, during shipment to the field for sample collection and preservation, and during return to the laboratory.

The COC identifies the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The COC also lists a unique description of the sample bottles in the set. If samples will be split and sent to different laboratories, a copy of the COC will be sent with each sample.

The "REMARKS" space is used to indicate if the sample is a matrix spike, matrix spike duplicate, or matrix duplicate. Since they are not specific to any one sample point, trip and field blanks are indicated on separate rows. Once the bottles are properly accounted for on the form, the sampler will write his or her name, and the date and time on the first "RELINQUISHED BY" space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper airbill number on the top of the COC, when applicable. Mistakes will be crossed out with a single line and initialed by the sampler. One copy of the COC will be retained by sampling personnel, and the other copy will be put into a sealable plastic bag and taped inside the lid of the shipping cooler.

If coolers are shipped to the laboratory, custody seals provided by the laboratory will be affixed to the latch and across the back and front lids of the cooler; and the person relinquishing the sample will place their signature across the seal. The COC seal must be placed so that the seal must be broken to open the container. The seal will be taped, and the cooler wrapped tightly with clear packing tape. The cooler will be relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier, or the cooler will be delivered by field personnel directly to the laboratory. Breakage of the seals before receipt at the laboratory may indicate tampering If tampering is apparent, the laboratory will contact the person designated on the COC, and the sample will not be analyzed.

2.3 SAMPLE ANALYSIS PROGRAM

2.3.1 Sample Analysis

Groundwater samples will be collected annually, and analyzed for the chemical parameters shown below, using NYSDEC Analytical Services Protocol (ASP) methods. Details of the sampling and analysis program, including required QA/QC samples, are provided in Table 2.1.

Collection Trench Sumps (shallow) and Surface Water	Monitoring and Extraction Wells (intermediate/deep)
TCL VOCs	TCL VOCs
TCL SVOCs	TCL SVOCs
TCL pesticides and PCBs	PCBs
TAL metals and cyanide	

TCL = Target Compound List; TAL = Target Analyte List

2.3.2 Data Quality Management

Groundwater and surface water samples will be analyzed in accordance with the NYSDEC Analytical Services Protocol by a laboratory which is approved by the New York State Department of Health Environmental Laboratory Approval Program (ELAP). For quality assurance/quality control purposes, trip blanks, matrix spike/matrix spike duplicates, and field duplicates will be collected as shown on Table 2.1.

The field and analytical equipment will be calibrated immediately prior to each day's activities. Calibration procedures will conform to the manufacturer's standard instructions and will include, but not be limited to, instrumentation necessary to measure water level, pH, conductivity, temperature, turbidity, and combustible gas. The calibration will confirm that the equipment is functioning within allowable tolerances, prior to field use. The calibration procedure and data will be noted on the field sheets.

The data quality management and quality assurance/quality control procedures described above pertain only to groundwater and surface water samples collected from the Site. Samples collected from the groundwater treatment system, as mentioned above, will be analyzed in accordance with the existing discharge permit.

2.4 WATER LEVEL MEASUREMENTS

Quarterly water level monitoring will be performed to evaluate hydraulic gradients. In addition to the water level measurements, the characteristics of LNAPL, if present, will be described, and the thickness measured. An interface probe will be used to measure levels, with an accuracy of approximately 0.01 feet.

Groundwater levels are measured at each of the following locations:

- Nine groundwater monitoring wells (MW-1 through MW-7, and RW-4, RW-5);
- Nine observations wells (OW-1 through OW-9); and,
- Four sumps (S-1 through S-4).

Niagara River water elevations will also be collected at the same frequency as the monitoring wells and piezometers are measured. The river elevations will be calculated from the staff gauge installed adjacent to a gabion wall near Sump 3 (see Figure 2.1).

2.5 EVALUATION OF MONITORING RESULTS

The chemical and hydraulic monitoring data collected during each year will be assembled and evaluated. The evaluation will consist of an evaluation of water quality and recovery system performance. An annual report incorporating the evaluations and data will be prepared in accordance with this OM&M Manual.

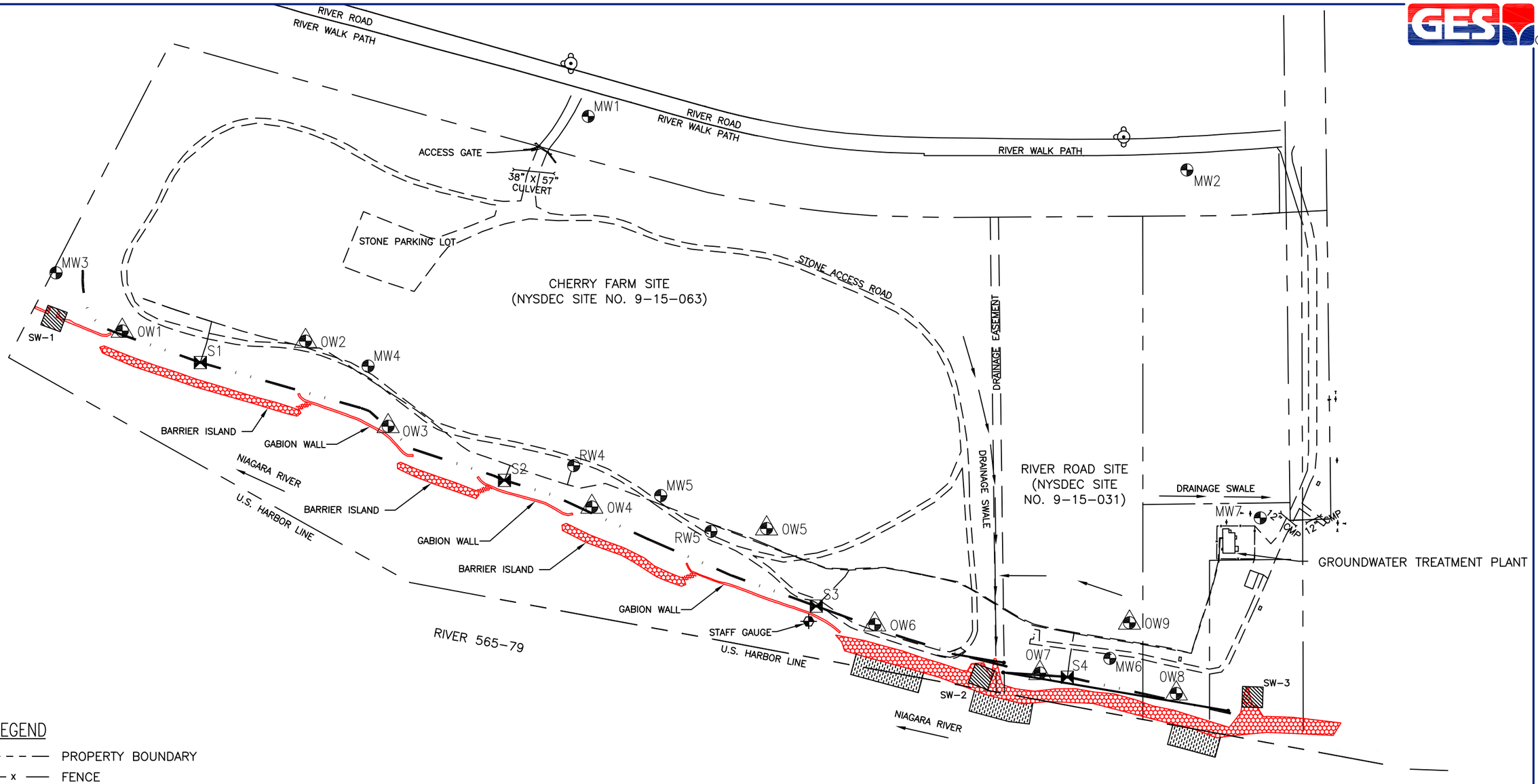
2.5.1 Water Quality Evaluation

An electronic water quality database will be developed and maintained, using data from the monitoring rounds. The database will facilitate production of the summary tables, and provide identification of results exceeding standards.

The annual evaluation of data will consider aspects of data quality relevant to the reporting of low and zero concentrations, missing data values, outliers, and the units of measure. The monitoring data will be compared to the NYSDEC groundwater or surface water quality standards and guidance values. The annual report will provide a summary of the groundwater, surface water, and treatment/recovery system monitoring performed during the entire year.

2.5.2 Reporting

An annual report will be prepared to summarize the water level and water quality results from the previous year. Groundwater contour maps showing hydraulic gradients and flow directions, hydrographs of monitoring wells and piezometers showing water level trends, and a brief discussion of the effectiveness of the shallow groundwater collection trench system will also be included. See Section 4 for additional discussion on reporting requirements.



LEGEND

- PROPERTY BOUNDARY
- FENCE
- TRENCH SUMP
- MONITORING WELL
- OBSERVATION WELL
- SHALLOW GROUNDWATER TRENCH
- GROUNDWATER CONVEYANCE PIPING

DRAFTED BY: W.G.S. (N.J.)	**SITE MAP**
CHECKED BY: J.K.C.	**CHERRY FARM (RIVER ROAD SITE) 4100 RIVER ROAD TONAWANDA, NEW YORK**
REVIEWED BY: G.B.	**Groundwater & Environmental Services, Inc.** 495 AERO DRIVE, SUITE 3, CHEEKTOWAGA, NEW YORK 14225
NORTH	SCALE IN FEET: 0 APPROXIMATE 250 / DATE: 6-1-15 / FIGURE: 2.1

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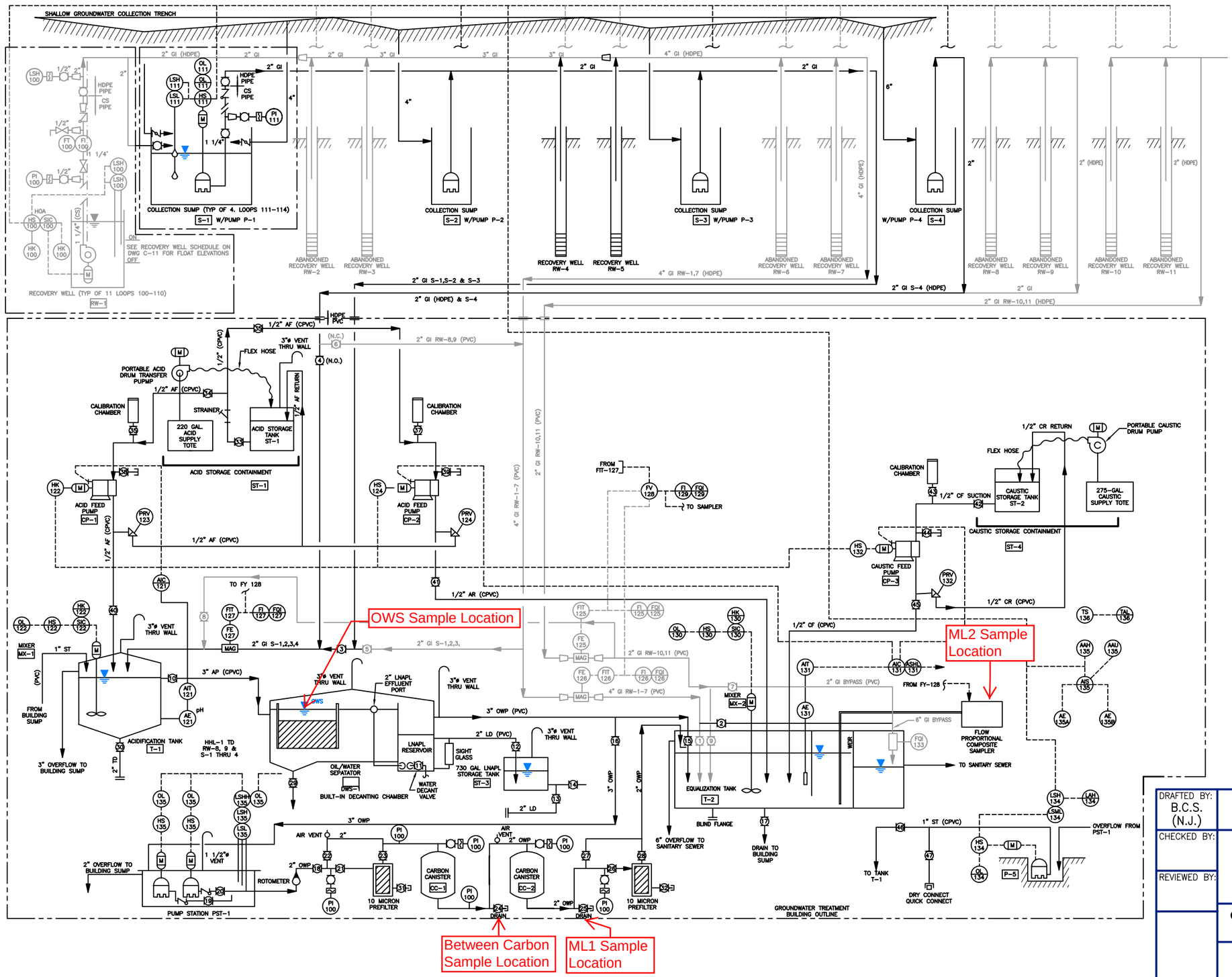

NOTES:

1. SHADE IS INACTIVE COMPONENTS OF GROUNDWATER EXTRACTION & GROUNDWATER TREATMENT SYSTEMS.

2. BOLD IS ACTIVE COMPONENTS OF GROUNDWATER EXTRACTION & GROUNDWATER TREATMENT SYSTEMS.

DRAFTED BY: B.C.S. (N.J.)	PROCESS & INSTRUMENTATION DIAGRAM
CHECKED BY:	CHERRY FARM (RIVER ROAD SITE) 4100 RIVER ROAD TONAWANDA, NEW YORK
REVIEWED BY:	Groundwater & Environmental Services, Inc. 158 SONWIL DRIVE, CHEEKTOWAGA, NEW YORK 14225
NOT TO SCALE	DATE 2-24-10 / FIGURE 2.2

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Table 2.1
Sampling and Analysis Summary
Annual Event
Cherry Farm/River Road Site

Matrix	Parameter	Field Samples					QC Samples		Total Samples
		Analytical Method(a)	Number of Samples	Field Duplicate	MS/MSD(b) (Total)	Sub-Total	Trip Blank	Field Blank	
Groundwater	TCL VOCs	ASP 95-1 (8260B)	9	1	1	12	2		14
MW-1 through MW-7 (c)	TCL SVOCs	ASP 95-2 (8270C)	9	1	1	12			12
RW-4, RW-5	TCL PCBs	ASP 95-3 (8082)	9	1	1	12			12
Extraction Trench Sumps	TCL VOCs	ASP 95-1 (8260B)	4			4			4
	TCL SVOCs	ASP 95-2 (8270C)	4			4			4
S-1 through S-4	TCL Pest/PCB	ASP 95-3 (8081A/8082)	4			4			4
	TAL Inorganics (d)	CLP-M (6010B)	4			4			4
Surface Water	TCL VOCs	ASP 95-1 (8260B)	3			3		1	4
SW-1 through SW-3	TCL SVOCs	ASP 95-2 (8270C)	3			3		1	4
	TCL Pest/PCB	ASP 95-3 (8081A/8082)	3			3		1	4
	TAL Inorganics (c)	CLP-M (6010B)	3			3		1	4

Notes:

(a) New York State Department of Environmental Conservation Analytical Services Protocol, 1995

(b) Matrix Spike/Matrix Spike Duplicate for organic analyses; matrix spike and laboratory duplicate for inorganic analyses.

(c) Monitoring wells MW-1, MW-2, MW-3, and MW-7 are only sampled once every two years.

(d) TAL Inorganics analysis includes cyanide.

Table 2.2
Sampling and Analysis Summary
Treatment Plant Groundwater Discharge Monitoring
Cherry Farm/River Road Site

Event	Location	Parameter	Analytical Method	Purpose
Monthly	ML-1 (influent)	PCBs	608	Compliance
		Oil & Grease	1664A	Compliance
	ML-2 (effluent)	PCBs	608	Compliance
		pH	SM 4500 H+	Compliance
		Total Petroleum Hydrocarbons	1664A	Compliance
	Between carbon	PCBs	608	Performance
Semi-annual	ML-2	TSS	2540D	Compliance
		BOD-5	5210B	Compliance
		Total Phosphorus	4500 P E	Compliance
		Total Arsenic	200.7	Compliance
		Total Cyanide	335.4	Compliance

TABLE 2.3

GROUNDWATER SAMPLING EQUIPMENT

Explosive gas meter	Personal safety equipment (hard hats, etc.)	Sample bottles
Interface probe (NAPL and water)	Deionized water	Alconox or equivalent detergent
Potable water	Disposable nitrile gloves	Disposable towels
pH meter, conductivity meter	Bailers or pumps	Pumps
Nylon rope	Shipping labels	Ice chests
Sampling records/forms	Chains-of-custody	Indelible ink pens

SECTION 3

POST-REMEDIAL CONSTRUCTION OPERATIONS & MAINTENANCE

3.1 INTRODUCTION

This section contains procedures for post-remedial construction operations and maintenance of the groundwater treatment system, landfill cover system, surface water drainage systems, and other site structures. For groundwater treatment system operating and maintenance procedures, see Volume II of this OM&M Manual. A summary of maintenance tasks, showing frequency of occurrence, is provided in Table 3.1.

3.2 DESCRIPTION OF SYSTEM COMPONENTS AND OPERATION

3.2.1 Groundwater Recovery

The system utilizes four (4) sumps located within the interceptor trench along the Niagara River, designated S-1, S-2, S-3, and S-4. The location of the interceptor trench and the sumps are shown on Figure 2.1. The interceptor trench collects shallow groundwater from the site as it flows towards the Niagara River and the four (4) submersible pumps located within each sump (P-1, P-2, P-3, and P-4, respectively) transfer water from the interceptor trench to the groundwater treatment system via two (2) conveyance pipelines. Sumps S-1, S-2, and S-3 all utilize one conveyance pipe, and sump S-4 is connected to a separate conveyance pipe. Each conveyance pipe is constructed of 2-inch diameter high density polyethylene (HDPE) pipe.

3.2.2 Treatment System Description

Groundwater from the conveyance pipes combines into one line and influent groundwater flow is monitored by a magnetic flow meter before entering the acidification tank (T-1). Sulfuric acid (93%) is added to the water in the acidification tank where it is continusly agitated (via mixer MX-1) to facilitate the removal of emulsified oil. The sulfuric acid addition to the tank is completed automatically and controlled by a pH controller which operates the chemical feed to maintain a pH of approximately 2.5 standard units in the acidification tank.

From the acidification tank, groundwater flows by gravity into an oil water separator (OWS-1) to separate out any light non-aqueous phase liquids (LNAPL). Any accumulated LNAPL is transferred manually to an LNAPL storage tank next to the OWS; however, no LNAPL has been recovered by the system since at least 2009. Water from the OWS flows into a clearwell equipped with two (2) submersible pumps (pump station PST-1), where it is them pumped through the remainder of the treatment train. Liquid level probes within the clearwell operate the two (2) submersible pumps based on influent flow rate and the liquid level probes also shut off the sump pumps (P-1 through P-4) if a high-high water level condition is reached in the pump station to prevent overflow of groundwater into the treatment system building.

From the pump station PST-1, water is pumped through a cartridge filter, through two liquid-phase activated carbon vessels (LGACs) plumbed in series (CC-1 and CC-2), through another cartridge filter and into the equalization tank (T-2). Caustic (50% sodium hydroxide) is automatically added to the equalization tank via a chemical feed pump and water in the tank is continuously agitated via mixer MX-2 to mix the caustic with the groundwater. The equalization tank, T-2, is equipped with pH probes which moniotor the pH of the water in tank T-2 and control the dosage of caustic into the equalization tank. The probes will also shut down the system if the pH in the equalization tank is not within the acceptable range of 5.75 to 9.0 standard units.

Effluent water from the equalization tank is discharge to the local sanitary sewer. Discharge is ultimately discharged to the Town of Tonawanda's Wastewater Treatment Facility under the provisions of an Industrial Discharge Permit (Volume II, Appendix A). Section 2.1.3 describes the required treatment system sampling requirements for compliance with the Industrial Discharge Permit.

3.2.3 System Controls and Monitoring

All pumps and mechanical elements of the treatment system are controlled by motor starters and control panels located within a separate electrical control room in the groundwater treatment system building. System interlocks including liquid level sensors, pressure transducers, and pH transducers send signals to the control panel which then adjusts operation of the system by adjusting pump operation.

The system is also equipped with a telemetry unit which will notify the system operator of various system shutdown conditions. The unit in place is a Sensaphone Skymetry unit. The Skymetry unit utilizes a T-Mobile 3G cellular service to provide wireless alarm notification. The unit will send phone calls, emails, and text messages in addition to storing all information in a web page interface. From the web page interface you can review historical alarm logs, current system status, and reprogram the notifications made by the Skymetry system. The system currently is set up to send notifications to the system operators upon any system shutdown condition, including shutdown due to power outages in addition to any system critical equipment alarm shutdown (including high liquid levels and pH out of range).

3.3 ROUTINE CAP INSPECTIONS

The Site will be inspected on a monthly basis, in conjunction with the routine site visits, and formal inspections with the NYSDEC will be conducted on a semi-annual basis throughout the post-remedial construction period. Any minor deficiencies observed during the monthly inspections would be documented and discussed with the NYSDEC during formal inspections semi-annually. A sample post-closure inspection checklist is provided in Appendix C. A site map (Figure 2.1) should also be used, when needed, to document problems and indicate areas that require attention. Specific maintenance activities are further discussed below.

The Site will be inspected for:

- Excessive debris, litter, and waste;

- Loss of vegetative cover;
- Integrity of drainage system including:
  - sediment buildup;
  - pooling or ponding;
  - slope integrity;
  - overall adequacy of surface runoff drainage system;
  - shoreline embankment protection along the Niagara River, including riprap, shoreline barrier islands, and gabion walls;
- Condition of access road, gates, and fencing;
- Integrity of groundwater monitoring and observation wells;
- Integrity of the cover system including:
  - erosion or settling of cap material;
  - slippage or slope failure, with particular attention to the area around the former SDA;
  - leachate breakthroughs;
  - animal burrows; and
  - woody, deep rooted vegetation.

The Site was inspected annually for five years for the establishment and growth of aquatic and woody vegetation in the emergent wetlands and wooded riparian wetland, respectively; and for utilization of these wetlands by fish and wildlife (per March 25, 1996 USACE permit). This requirement was completed in 2003.

3.4 MAINTENANCE

3.4.1 Cover System Maintenance

Inspection and maintenance of the landfill cover system will include the following:

- Landfill cover vegetation is fully established. Conduct annual ground inspections to determine the status of woody plant species on the Site, including surface and side slope areas.
- Mow the Site cover system surface once a year (after September 1 or per NYSDEC approval) to control woody vegetation and promote short grass species. In addition, paths will be mowed on an as-needed basis from the access road to each of the four extraction tench sumps.

Erosion of the cap or other site maintenance problems detected during routine site inspections or following particularly heavy storm events will be corrected. Repairs of eroded

areas will be made with materials and methods specified herein. If an eroded topsoil layer is encountered, the repair action may include, but is not limited to, the following:

- Covering repaired areas with topsoil, as specified in the Contract Documents, to minimum thickness (6-inches) and design grades; and
- Reseeding and fertilizing in accordance with materials and application rates specified in Section 02990 of the Contract Documents (Appendix D).

The need for cap repairs due to subsidence or settling will be based on whether the function of the cap in the affected area has been impaired. Repair actions may include, but are not limited to:

- Stripping and stockpiling topsoil from the affected area;
- Regrading the affected area in accordance with the grading plan shown on the record drawings; and
- Replacing topsoil, reseeding, and fertilizing to reestablish vegetative cover in accordance with Section 02990 (Appendix D) of the Contract Documents.

For animal control, the following procedures will be followed:

- Inspect for groundhog or other animal burrow or den entrances on the landfill. If den or burrow entrances are found, the entrances will be plugged with bentonite and the bare areas will be reseeded and fertilized, if necessary. Seed and fertilizer will be of the same type and quality as originally specified.
- If burrowing becomes persistent, an animal control specialist will be contacted to conduct trapping and removal of burrowing animals.

3.4.2 Maintenance of Site Structures

Drainage System

The elements of the drainage system, including the perimeter drainage swales, will be maintained throughout the post-closure period. These elements will be inspected in conjunction with routine site inspections to verify that the structures are intact and undisturbed, and that channels and discharge areas are free of obstructions which would impair the free flow of surface water run-off.

In the event any of the structures are found to be damaged or incapable of conveying the design flows, repairs will be made as soon as practical, as follows:

- Any obstructions found in swales will be removed.
- If any culverts are found to be damaged, such that their function is impaired, they will be repaired or replaced.
- Accumulated sediment will be removed from drainage swales and/or around outlet structures, as required, to maintain required capacity and proper operation.

- Riprap in drainage swales will be replaced or repaired, if needed.

Facility Access Control

Facility access control includes the following:

- Maintenance of fencing around the groundwater treatment plant, including gaps below fence, chain link fabric, and fence posts.
- Maintenance of gates and locks, to prevent unauthorized access;
- Maintenance of warning signs, to ensure visibility; and
- Maintenance of the access roads, including snow plowing, to allow easy access by authorized personnel.

Any repairs will be conducted on an as-needed basis.

3.4.3 Groundwater Monitoring Wells, Piezometers, and Sumps

General Inspection: Monitoring wells, piezometers, and sumps will be inspected for damage quarterly, as water level measurements are collected. If a well or piezometer is damaged such that representative water levels or groundwater samples cannot be obtained, or it is damaged beyond repair or rendered inoperative, a discussion will be held with NYSDEC to determine whether any action is necessary, such as repair or replacement.

Wells may need occasional cleaning as well screens may become encrusted with mineral deposits.

Sedimentation: Sedimentation in the monitoring wells, piezometers, and sumps will be evaluated by measuring the depth, and comparing to the constructed depth. Sediment will be removed if it is impacting the function of the well, piezometer, or sump.

LNAPL: The four extraction trench sumps will be monitored for LNAPL thickness and sedimentation. The thickness of LNAPL, if present, will be measured and recorded. If the measured thickness of LNAPL is ½-inch or greater, the LNAPL will be bailed from the sump (or pumped) and placed in the oil recovery tank in the treatment building. Any floating debris in the sumps will be immediately removed and disposed.

3.4.4 Treatment System

To ensure adequate system operation within normal operating parameters and to minimize any system non-operational time, the groundwater treatment system shall be visited by the system operator on a minimum schedule of once per week. System operational parameters including volumes of acid and caustic available onsite, pressures and flow rates throughout the system, and motor operational hours shall be documented on a weekly basis.

A list of routine maintenance tasks for the treatment system is included on Table 3.1. Detailed instructions for system operations are included in 13 standard operating procedures (SOPs), included in Volume II, SOPs. These SOPs include details about the following:

SOP-1 SYSTEM START-UP FROM A SHUT-DOWN MODE
SOP-2 FLOW METER OPERATION, FLOW BALANCING, AND FLOW ADJUSTMENT
SOP-3 ACIDIFICATION PRETREATMENT SYSTEM OPERATION
SOP-4 GRANULAR ACTIVATED CARBON SYSTEM OPERATION
SOP-5 EQUALIZATION TANK OPERATION
SOP-6 ACID AND CAUSTIC SYSTEM CALIBRATION AND CONTROL
SOP-7 COMPLIANCE SAMPLING FROM THE TREATMENT FACILITY EFFLUENT
SOP-8 SYSTEM SHUT-DOWN
SOP-9 ACCIDENTAL SPILL PREVENTION PLAN
SOP-10 ROUTINE OPERATION, MAINTENANCE, AND RECORDKEEPING
SOP-11 LOCKOUT / TAGOUT PROCEDURE
SOP-12 CONFINED SPACE ENTRY PROCEDURE
SOP-13 CONVEYANCE PIPELINE FLUSHING PROCEDURE

3.4.5 Conveyance Piping

To mitigate scaling, and provide adequate flow through the system, the groundwater conveyance pipelines may require flushing. If a total flow rate of five gallons per minute (gpm) or less is sustained for a period of one month or more, and all other system checks relating to the flow rate have been completed (muriatic acid flush of sumps/conveyance lines, sump pump inspection/cleaning, and visual observation of interior influent piping), a high-pressure flush will be used to remove sediment buildup and scaling. A high-volume pump will initially be attached to Sump 1, the most northerly collection trench sump. Water will be flushed through the discharge piping, collected at the treatment plant building, and run through the treatment system. The pump will then be moved downstream to Sump 2, Sump 3, and Sump 4, sequentially, and the process repeated.

Detailed instructions for conducting the line flushing, including equipment specifications, are included in Volume II, SOPs.

In addition to the pipeline flushing described above, pool-grade hydrochloric acid (muriatic acid) will be added to the sumps on an as needed basis Approximately two gallons of acid will be added to each sump (depending on individual flow rates) to help clear the lines back to the treatment building. When sump acid treatment does not sufficiently restore flow, the conveyance piping will be de-pressurized, opened at both ends and approximately 12 gallons of muriatic acid will be added to the line from the building and allowed to gravity drain back to the vault. Once the acid has worked through the line to the vault, potable water will be added to the line to flush loose material back to the vault. Acid cleaning of the sumps and lines will be performed using precautions contained in the Health and Safety Plan (Appendix E).

3.4.6 Shoreline Structures and Enhancements

Maintenance of other shoreline structures and enhancements, including riprap shoreline, barrier islands, gabion walls, and associated shoreline plantings may include the following:

- Replacement of riprap, cobbles, or other stone adjacent to the river, if shoreline inspections reveal substantial damage to the barrier islands, gabion walls, or riprap shoreline.
- Monitoring of shoreline vegetation and wetlands is no longer required, in accordance with the March 25, 1996 USACE permit. This 5-year monitoring program was completed in 2003.

3.4.7 Waste Disposal

Waste that accumulates in the treatment plant will require periodic disposal. Types of wastes expected, and storage/disposal guidelines, are listed below:

- Bag filters and personal protective equipment. Bag filters, PPE, and other waste are stored in 55-gallon drums within the treatment plant building
- Oil (LNAPL) containing PCBs. Oil is periodically skimmed from an oil/water separator within the treatment plant, and is placed in an LNAPL holding tank. Water from the bottom of the tank is periodically drained and run through the treatment plant. When the oil in this tank approaches capacity, it will be disposed.
- Spent carbon vessels (with carbon) and housings. Spent carbon will be disposed at the time a carbon changeout is required.
- Waste characterization will be conducted on the wastestreams identified above prior to arranging for disposal. Parameters to be analyzed will include PCBs and other parameters, as required by the disposal facility. Based on operations to date, and sampling and analysis conducted in 2016, it is assumed that the spent carbon will be non-hazardous. The oil from the holding tank is assumed to be hazardous due to PCB content.

3.5 HEALTH AND SAFETY REQUIREMENTS

A site-specific Post-Remedial-Construction Health and Safety Plan has been prepared for the Cherry Farm/River Road Site, specifically for conducting OM&M activities, and is included as Appendix E. The plan was prepared in accordance with the Occupational, Health and Safety Administration's regulations in 29 CFR 1910.120, and the appropriate state and local regulations. The plan contains the following, in addition to other required information:

- Organization and responsibilities of the project/health and safety team;
- Characterization of the chemical and physical hazards present at the Site;
- A description of the medical program required for OM&M personnel;
- A summary of the air monitoring program to be conducted during OM&M activities;

- Instruction on selection and use of personal protective equipment (PPE), and action levels for upgrading or downgrading PPE;
- Proper delineation of work zones and equipment personal decontamination; and
- An accident prevention and contingency plan (evacuation, first aid, emergency response team notification, routes to the hospital, etc.)

Table 3.1
Cherry Farm/River Road Site
Task Frequency Table

Task	Frequency	Comments	Target Date	Related SOP
Treatment System Compliance Tasks				
Treatment plant sampling for PCBs, TPH, oil and grease	Monthly	Samples are delivered to the laboratory the same day as sample collection.	First week of month	SOP-7
Treatment plant sampling for BOD, TSS, arsenic, phosphorus, and cyanide	Semi-annual	Samples are delivered to the laboratory the same day as sample collection.	June and December	SOP-7
Self monitoring (discharge) report to Town of Tonawanda	Monthly	Self-monitoring report by 25th of each month for previous month's activity. Include sample results, flow data, email to Town of Tonawanda.	25th of each month	SOP-7
Monthly flow e-mailed to the Town of Tonawanda	Monthly	E- mail flow data to Paul Morrow at pmorrow@tonawnda.ny.us.	10th of each month	SOP-7
Treatment System Maintenance				
Backflow valve test	Annual following reminder letter	Requires licensed Town of Tonawanda plumber. Town sends reminder letter with list of approved plumbers.	March 31	
Acid-clean pH probe sensor	Weekly	To maintain accurate readings between calibrations.		SOP-3,5,6
Equalization tank pH probe calibration	Weekly	Change calibration solutions out after every few uses to ensure accurate calibration.		SOP-3,5,6
Acidification tank pH probe calibration	Once/two weeks	Change calibration solutions out after every few uses to ensure accurate calibration.		SOP-3,5,6
Change out calibration solutions	As needed	Record in log book and mark on bottles with initials.		SOP-3,5,6
Chemical transfer	As needed	Store empty totes inside the plant during the colder months for pick-up. Totes can be stored outside when temperatures are above 55^{o}F. Start keeping inside in October.		SOP-3,5

Table 3.1
Cherry Farm/River Road Site
Task Frequency Table

Task	Frequency	Comments	Target Date	Related SOP
Chemical order/delivery	As needed	Order when 1/2 of a tote of each chemical is remaining.		SOP-3,5
Acid clean sumps	Monthly/as needed	Use muriatic acid from chemical supplier (two gallons per sump), usually treat when the flow into the plant drops below 5 gpm.		SOP-10
Remove LNAPL from Sump 1	Quarterly/as needed	Use duct tape to hold control switch over from automatic to manual in control box next to sump, pump water level to bottom to remove oil.		SOP-10
Line flushing	As needed	Line flushing will be performed if/ when acid line rinsing is no longer effective.		SOP-13
Check emergency eye wash and shower	Weekly	Mark in the log book when it was checked and whether it passed.		
Check first aid kit	Monthly	No permanent first aid kit on-site, contractor maintains first aid kit in company vehicle.		
PPE/waste drum pick-up	As needed	After a drum is full, disposal is required within 180 days. Disposal regulations may apply.		
Empty chemical tote pick-up	As needed	Riverside Chemical takes empty totes when they deliver chemicals		SOP-3,5
Landfill Maintenance				
Site inspections	Semi-annual	NYSDEC requires advance notice of inspection so they can be present.		
Garbage and litter pick-up	As needed	Shoreline litter and trash can be disposed of in a dumpster.		
Snow plowing	As needed	Keep access road to treatment plant plowed.		
Landfill cap mowing	Annual	Entire cap area, after bird nesting season is complete.	September	

This list is complementary to the OM&M manual and SOPs. Ensure all OM&M SOPs are followed.

SECTION 4

REPORTS

4.1 INTRODUCTION

This section describes the reporting and recordkeeping requirements for the post-remedial construction period. The primary reporting element is an annual summary report, submitted to NYSDEC, NYSDOH, and the public repository, as shown below:

Mr. Brian Sadowski (1 hard copy, 1 CD) NYSDEC 270 Michigan Avenue Buffalo, New York 14203-2999 Ph: 716-851-7220	Ms. Julia M Kenney (1 hard copy) NYSDOH Corning Tower, Room 1787 Albany, New York 12237 Ph: 518-402-7860
City of Tonawanda Public Library (1 hard copy) 333 Main Street City of Tonawanda, New York 14150 Ph: 716-693-5043	

4.2 ANNUAL REPORT

An annual report will be prepared to summarize the water level and water quality results from the gauging and sampling events conducted in the last calendar year and present the results of a statistical evaluation via trend graphs of at least the last eight sampling rounds. Groundwater contour maps showing hydraulic gradients and flow directions, hydrographs of monitoring wells and piezometers showing water level trends, and a brief discussion of the effectiveness of the shallow groundwater collection trench system will also be included. The annual report will also summarize the inspection and maintenance activities on the cap, treatment plant, groundwater collection trench system, and site structures. The annual report will also provide recommendations for continued OM&M, and, where appropriate, modifications to various components of the OM&M Manual. NYSDEC approved discontinuation of the requirement for a 5 year review in May 2017 (via electronic mail).

4.3 MONITORING RECORDS

The environmental monitoring records that will be maintained include the following:

- A field information log, which contains well purge information, sampling information, field analytical data, instrument calibration check data, and general information such as weather conditions, observation, etc.;

- Chain-of-custody forms for the environmental and LNAPL samples;
- Records of data, drawings, and calculations of data evaluation;
- Electronic and hard copy records of the environmental chemical analyses, such as chemical analytical results from groundwater sampling events (see Section 4.7 for details); and,
- Photographs (taken during semi-annual inspections, or other field activities, such as the line-flushing event).

4.4 INSPECTIONS/MAINTENANCE RECORDS

A log book will be maintained onsite to track daily maintenance activities conducted. Also, routine inspections will be conducted on a monthly basis. A site inspection form is presented in Appendix C and will be filled out minimally during the semi-annual inspections. The site plan included in Section 2 should also be utilized, where appropriate, to document results of the inspections.

4.5 GROUNDWATER DISPOSAL RECORDS

Pre-treated groundwater will be disposed via discharge to the Town of Tonawanda's sanitary sewer system for subsequent final treatment at the Town's Wastewater Treatment Facility. Discharge monitoring records will be submitted in accordance with the industrial wastewater discharge permit issued by the Town (Volume II, Appendix A), and electronic copies will be maintained by treatment operator.

4.6 SITE PLANS AND DRAWINGS

A site plan showing locations of monitoring points, final grade contours, locations of barrier islands, riprap shoreline, gabion walls, and in-river sediment caps is provided in Section 2, Figure 2.1. The other site plans and construction details, including record drawings of final grading and subgrade plans, cover system details, interceptor trench sumps, location of utilities and piping, etc., can be found in:

- Appendix J of the June 1995 Design Report, Cherry Farm Site, River Road Site;
- Appendix A of the May 1998 Final Remedial Design Report, Sediment Removal at Cherry Farm Site, River Road Site; and
- October 1999 Final Construction Certification Report, Cherry Farm Site, River Road Site.

Copies of these reports are maintained at:

NYSDEC Region 9 Office
270 Michigan Avenue
Buffalo, New York, 14203
(716) 851-7220

SECTION 5

PERSONNEL AND CITIZEN PARTICIPATION

5.1 INTRODUCTION

The goal of the citizen participation program is to increase public understanding of the remediation and OM&M process. To keep the public informed about activities at the Site, the PRP group will maintain a local document repository at the City of Tonawanda Public Library, which will contain the pertinent documents relating to the Site investigation and remediation.

5.2 ORGANIZATION

The principal parties involved in implementation of the OM&M program at the Cherry Farm/River Road Site are: the NYSDEC; the Cherry Farm/River Road Site PRP Group; the OM&M Project Manager; OM&M field personnel; and an analytical laboratory. Responsibilities, qualifications, and training requirements for the OM&M personnel are described in the following paragraphs.

5.3 RESPONSIBILITIES AND DUTIES

Implementation of the Cherry Farm/River Road OM&M will require onsite personnel. Personnel will conduct routine inspections, sampling, and maintenance, as well as operate and maintain the groundwater collection system. Additionally, a Project Manager will be required to organize and oversee field and reporting activities on behalf of the PRP Group.

5.3.1 PRP Group

The PRP Group will perform or contract for the services of a Project Manager, operation and maintenance field personnel, and an analytical laboratory.

5.3.2 OM&M Personnel

The OM&M Project Manager will have the following responsibilities:

- Schedule and coordinate the monitoring activities, as described in Section 2;
- Evaluate the environmental monitoring data to determine if reportable exceedances occur, and to determine if any health or environmental hazards are present;
- Oversee inspection of the Site to ensure adequate maintenance is being conducted as described in Section 3;
- Maintain and submit the required documentation and records of OM&M activities as described in Sections 4;
- Oversee the activities conducted by the OM&M field personnel;

- Be available to respond in an emergency situation in accordance with the Contingency Plan (Appendix E);
- Serve as the primary interface between the NYSDEC and PRP Group; and,
- Maintain records of the OM&M costs for the Site.

The onsite OM&M field personnel will have the following responsibilities:

- Obtain environmental samples, as described in Section 2 of this manual, including completion of chain-of-custody forms and field notes;
- Conduct the site inspection and maintenance activities, as described in Section 3 of this manual;
- Carry out the operations associated with the onsite groundwater treatment plant, including proper recording of data and ordering chemicals;
- Conduct regular calibration of site sampling and monitoring equipment and maintain calibration records;
- Adhere to the requirements of the OM&M Health and Safety Plan (see Appendix E); and,
- Promptly inform the OM&M Project Manager of any problems associated with the landfill cap system, groundwater monitoring system, groundwater collection system and treatment plant, or site security system.

5.3.3 Subcontracted Analytical Laboratory

The subcontracted analytical laboratory will have the following responsibilities:

- Coordinate the analytical testing with the Project Manager;
- Schedule, analyze, and maintain quality assurance of the analytical work; and,
- Provide timely reports to the OM&M Project Manager, summarizing the analytical results.

5.4 QUALIFICATIONS AND TRAINING

The OM&M onsite field personnel must each have a high school diploma or equivalent (as a minimum), secondary education in environmental science, and receive the following training:

- OSHA 40-hour hazardous waste site worker training (29 CFR 1910.120) (only required for personnel performing groundwater sampling, liner repairs, or other activities which could result in exposure to waste materials);
- Site specific health and safety and contingency plan implementation and training;
- Training regarding Site specific O&M procedures described in Sections 2 and 3 of this manual; and,
- Training regarding site-specific OM&M procedures related to the treatment plant, as described in Volume II of this manual.

In addition, the O&M personnel must be familiar with the Site's engineering drawings, relevant specifications, sampling and analysis protocols, environmental monitoring, and reporting requirements.

5.5 CITIZEN PARTICIPATION PROGRAM

The goal of the citizen participation program is to increase public understanding of the remediation process at this Site.

- A local Document Repository has been established, which will contain the pertinent documents relating to the investigation and remediation of the Site, including the O&M reports discussed in Section 4 at the following address:

  Public Repository
  City of Tonawanda Public Library
  333 Main Street
  City of Tonawanda, New York 14150
  Ph: 716-693-5043

- On an as-needed basis in the future, NYSDEC will prepare Fact Sheets, and the PRP Group will be responsible for distributing the Fact Sheets in accordance with a contact list. The intent of the Fact Sheets is to inform the public about pertinent OM&M activities that will be conducted at the Site.

Key Contacts

The PRP Group representatives are:

David Flynn (for Honeywell) Phillips Lytle, LLP One Canalside 125 Main Street Buffalo, NY 14203-2887 Phone: 716-847-5473	**Mark Sweitzer** Honeywell International, Inc. 6100 Philadelphia Pike Claymont, DE 19703 Phone: 215-807-8453
Jeffrey Davis (for National Grid) Barclay Damon, LLP One Park Place 300 South State Street Syracuse, NY 13202 Phone: 315-703-6233	**Brian Stearns** Niagara Mohawk Power Corp. d/b/a National Grid 300 Erie Boulevard West Syracuse, NY 13202 Phone: 315-428-5731

Key New York State Department of Environmental Conservation contacts are:

Mr. Michael Hinton
270 Michigan Ave.
Buffalo, NY 14203
Phone: (716) 851-7220

Mr. Brian Sadowski
270 Michigan Ave.
Buffalo, NY 14203
Phone: (716) 851-7220

SECTION 6

REFERENCES

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APPENDIX A

MONITORING WELL AND RECOVERY WELL CONSTRUCTION AND BORING LOGS

Cherry Farm/River Road
Recovery Well Construction Data

Asbuilt Elevations

Recovery Well	Ground Surface at Drill	Depth Drilled (ft)	Well Bottom Depth (ft)	Length of Riser + Sump Installed	Length of Screen Installed	Total Length (ft)	Cut to fit Vault	Well Total Depth at Riser	Top of Riser Elevation	Elevation Well Bottom	Screen (from top of riser in vault) (1)				Filter Pack (bgs during drill) (2)				Bentonite Seal (bgs during drill) (2)			
											Bottom		Top		Bottom		Top		Bottom		Top	
											Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth
RW-1	581.47	49	46.5	34.95	15	49.95	2.1	47.85	581.82	533.97	538.97	42.85	553.97	27.85	532.47	49.35	558.97	22.5	558.97	22.5	563.97	17.5
RW-2	581.22	52	51.9	35	20.1	55.1	2.3	52.8	581.82	529.02	534.02	47.8	554.12	27.7	529.22	52.6	558.72	22.5	558.72	22.5	563.92	17.3
RW-3	581.67	52	52.85	35.1	20.15	55.25	1.3	53.95	582.30	528.35	533.35	48.95	553.5	28.8	529.67	52.63	557.82	23.85	557.82	23.85	563.97	17.7
RW-4	580.61	51.8	51.3	35	20.1	55.1	2.8	52.3	581.83	529.53	534.53	47.3	554.63	27.2	528.81	53.02	558.31	22.3	558.31	22.3	562.91	17.7
RW-5	580.56	54	51	35	20	55	2.3	52.7	582.05	529.35	534.35	47.7	554.35	27.7	526.56	55.49	558.56	22	558.56	22	562.86	17.7
RW-6	570.4	39.5	38.5	25	15.1	40.1	0.8	39.3	570.76	531.46	536.46	34.3	551.56	19.2	530.9	39.86	555 9	14.5	555.9	14.5	558.9	11.5
RW-7	570.1	39.2	38.9	25	15.1	40.1	0.7	39.4	570.67	531.27	536.27	34.4	551.37	19.3	530.9	39.77	555.2	14.9	555.2	14.9	559.1	11
RW-8	582.79	50	48.37	45.17	10.1	55.27	5.8	49.47	583.83	534.36	539.36	44.47	549.46	34.37	532.79	51.04	553.42	29.37	553.42	29.37	557.79	25
RW-9	582.82	50	47.9	40.9	10	50.9	1.75	49.15	583.86	534.71	539.71	44.15	549.71	34.15	532.82	51.04	553.92	28.9	553.92	28.9	558.82	24
RW-10	582.8	45	41.5	35	10.1	45.1	3.7	41.4	583.28	541.88	546.88	36.4	556.98	26.3	537.8	45.48	560.3	22.5	560.3	22 5	565.3	17.5
RW-11	581.9	45	42	35	10.1	45.1	3.8	41.3	581.22	539.92	544.92	36.3	555.02	26.2	536.9	44.32	559	22.9	559	22.9	564.4	17.5

(1) Screen depths and elevations were determined from the length of the well screen and riser and the as-built elevation of the top of the riser as-built in the well vault.
(2) Filter pack and bentonite seal depths and elevations were determined during well installation, measuring from a ground surface reference point of known elevation.

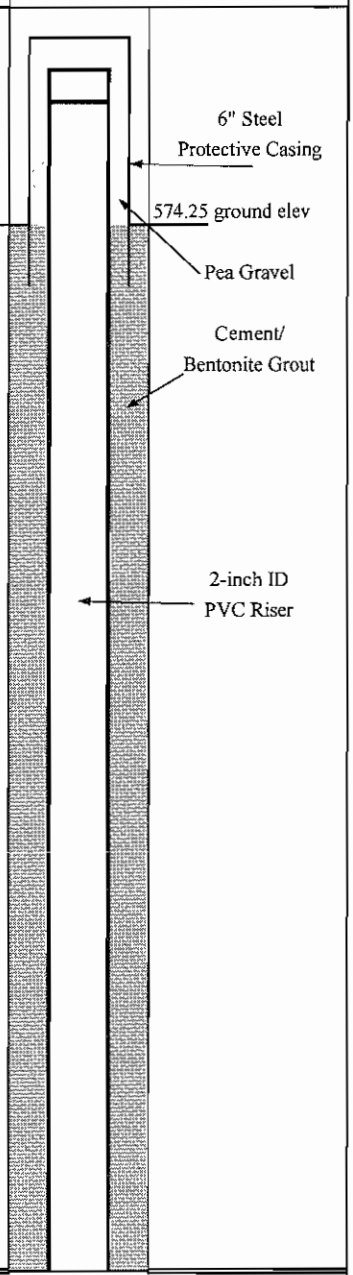
Asbuilt Elevations

WELL	Top of Riser Elevation	Elevation Well Bottom	Screen (from top of riser in vault) (1) Bottom Elevation	Bottom Depth	Top Elevation	Top Depth	Designed Top Screen Elevation	Diff in Top of Scr	Designed Inlet Elev.	ASBUILT Inlet Elev.	Inlet Depth from Top of Riser	Lower Sensor Elevation	Upper Sensor Elevation	Depth to Sensor from Top of Riser Lower	Upper
RW-1	581.82	533.97	538.97	42.85	553.97	27.85	555	1.03	547.5	546.47	35.35	560	561	21.82	20.82
RW-2	581.82	529.02	534.02	47.8	554.12	27.7	555	0.88	545	544.12	37.7	560	561	21.82	20.82
RW-3	582.30	528.35	533.35	48.95	553.5	28.8	555	1.5	545	543.5	38.8	560	561	22.3	21.3
RW-4	581.83	529.53	534.53	47.3	554.63	27.2	555	0.37	545	544.63	37.2	560	561	21.83	20.83
RW-5	582.05	529.35	534.35	47.7	554.35	27.7	555	0.65	545	544.35	37.7	560	561	22.05	21.05
RW-6	570.76	531.46	536.46	34.3	551.56	19.2	555	3.44	547.5	544.06	26.7	560	561	10.76	9.76
RW-7	570.67	531.27	536.27	34.4	551.37	19.3	555	3.63	547.5	543.87	26.8	560	561	10.67	9.67
RW-8	583.83	534.36	539.36	44.47	549.46	34.37	550	0.54	545	544.46	39.37	560	561	23.83	22.83
RW-9	583.86	534.71	539.71	44.15	549.71	34.15	550	0.29	545	544.71	39.15	560	561	23.86	22.86
RW-10	583.28	541.88	546.88	36.4	556.98	26.3	550	-6.98	545	551.98	31.3	560	561	23.28	22.28
RW-11	581.22	539.92	544.92	36.3	555.02	26.2	550	-5.02	545	550.02	31.2	560	561	21.22	20.22

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO. MW-1
Driller:	SJB VARIES					
Inspector:	DANIEL LIPP and GENE MELNYK				PROJECT NAME Cherry Farm/River Road	Sheet 1 of 3
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location: Along River Road near entrance to
Method:	VARIED					Cherry Farm
					Weather sunny 40	
GROUNDWATER	OBSERVATIONS					
Date					Date/Time Start 10/25/96 1100	
From						
DTW					Date/Time Finish 10/28/96 1400	

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				3	
	SS-1	1	4	4	Brown topsoil and roots, wet
				5	
		2		4	
				2	
	SS-2	3	15	3	Black medium to fine sand, some brown elay,moist
				2	
		4		4	
				2	
	SS-3	5	12	2	Brown clay, some course gravel, trace brown medium to fine
				4	sand moist
		6		6	
				1	
	SS-4	7	15	2	Brown clay, some course gravel, moist
				4	
		8		3	
				woh	
	SS-5	9	3	1	Brown clay, moist
				3	
		10		2	
				woh	
	SS-6	11	6	2	Brown silty clay, trace (-) fine gravel, moist, stiff
				2	
		12		2	
				woh	
	SS-7	13	4	2	Stiff brown clay
				3	
		14		3	
				1	
	SS-8	15	12	1	Upper 6" stiff brown clay, lower 6" black moist
				2	foundry sand, petroleum odor
		16		4	
				woh	
	SS-9	17	18	woh	Gray silt/sand-wet stiff brown clay with foundry sand

WELL CONSTRUCTION

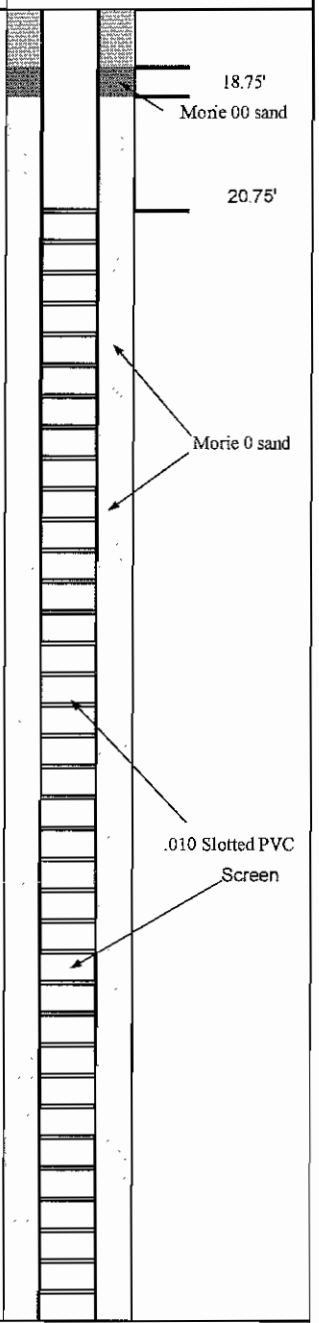


STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations noted on the log are from the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO.	MW-1
Driller:	SJB VARIES						
Inspector:	DANIEL LIPP and GENE MELNYK				PROJECT NAME Cherry Farm/River Road	Sheet 2 of 3	
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location:	
Method:	VARIED						
					Weather sunny 40		
GROUNDWATER	OBSERVATIONS						
Date					Date/Time Start 10/25/96 1100		
From							
DTW					Date/Time Finish 10/28/96 1400		

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				woh	
		18		1	
				woh	
	SS-10	19	15	woh	Gray silt, some clay, wet dilatent, soft
				2	
		20		1	
				woh	
	SS-11	21	24	woh	Gray silty clay with silt layer, wet, dilatent
				woh	
		22		woh	
				woh	
	SS-12	23	12	woh	Gray silty clay with layers of very fine sand, wet
				woh	
		24		woh	
				wor	
	SS-13	25	14	wor	Same as above
				2	
		26		1	
				wor	
	SS-14	27	12	1	Gray silty clay with dilatent fine sand layers, wet
				1	
		28		2	
				4	
	SS-15	29	8	3	Gray sandy clay with layers of sand, wet
				2	
		30		3	
				4	
	SS-16	31	24	1	
				2	
		32		6	
				2	
	SS-17	33	24	2	Gray fine sand and silt, trace (-) clay, wet
				4	
		34		3	
				3	
	SS-18	35	24	3	Gray fine sand and silt, trace (-) clay, wet dilatent
				4	
		36		5	
				5	
	SS-19	37	24	4	Gray silt, trace (+) fine sand,trace clay, wet dilatent
				3	
		38		4	
				4	



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations were determined at the time the borehole was drilled.

Contractor:	SJB SERVICES	PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO. MW-1
Driller:	SJB VARIES		
Inspector:	DANIEL LIPP and GENE MELNYK	PROJECT NAME Cherry Farm/River Road	Sheet 3 of 3
Rig Type:	CME 75/85 TRAC	PROJECT NUMBER 726673.41	Location:
Method:	VARIED		

GROUNDWATER	OBSERVATIONS			
Date				
From				
DTW				

Weather: sunny 40

Date/Time Start: 10/25/96 1100

Date/Time Finish: 10/28/96 1400

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	WELL CONSTRUCTION
	SS-20	39	14	4	Gray silt, some fine sand, trace (-) clay, wet, dilatent	
				3		
		40		7		
				woh		40.75'
	SS-21	41	16	5	Gray silt and very fine sand, trace(-) fine gravel, wet, dilatent	
				7		
		42		6		42'

STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations were determined at the time the borehole was drilled.

PARSONS ENGINEERING SCIENCE

DRILLING RECORD

BORING NO. MW-2

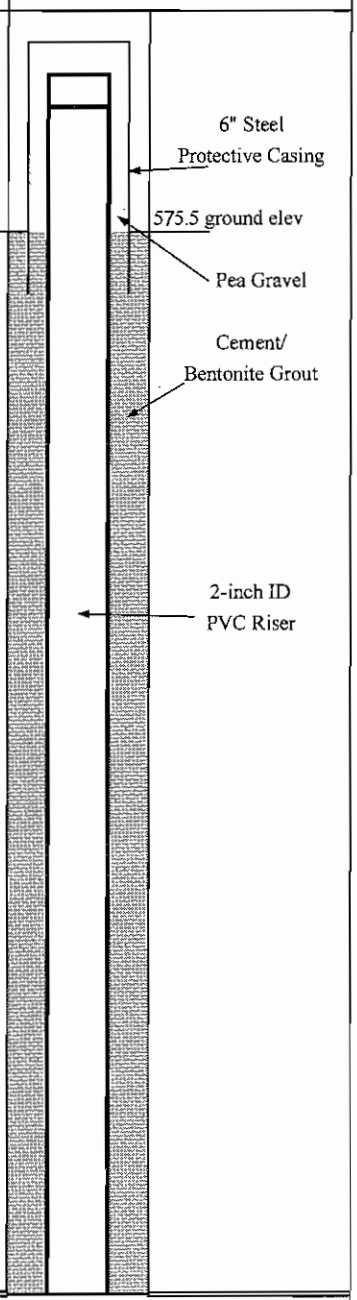
Sheet 1 of 3

Contractor:	SJB SERVICES
Driller:	SJB VARIES
Inspector:	DANIEL LIPP and GENE MELNYK
Rig Type:	CME 75/85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	Along River Road infront of Pine Hill Cement
Weather	sunny 40
Date/Time Start	10/21/96 1530
Date/Time Finish	10/23/96 1700

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				1	
	SS-1	1	18	20	Topsoil 0-6", concrete fill 6-17", gray silt and fill 17-18"
				10	
		2		10	
				2	
	SS-2	3	0	4	Metal debris, trace gray fill
				3	
		4		1	
				woh	
	SS-3	5	14	1	Gray /brown silt and clay
				1	
		6		3	
				woh	
	SS-4	7	12	1	Black sand 0-2', then gray silt and clay
				1	
		8		2	
				woh	
	SS-5	9	10	woh	Gray silt/clay and black sand
				4	
		10		2	
				4	
	SS-6	11	24	9	Gray silt/elay, fill (concrete rubble), wet
				6	
		12		2	
				1	
	SS-7	13	24	12	Gray silt and sand 0-12', gray silty clay 12-24"
				1	
		14		1	
	SS-8	15			**Drill casing to 22' and then washed-out casing**
		16			Top of marsh deposit at 16'
	SS-9	17	0.20		



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations noted at the time the borehole was drilled.

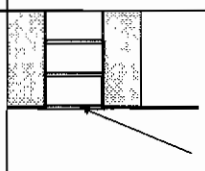
Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO. MW-2
Driller:	SJB VARIES					
Inspector:	DANIEL LIPP and GENE MELNYK				PROJECT NAME Cherry Farm/River Road	Sheet 2 of 3
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location:
Method:	VARIED					
					Weather sunny 40	
GROUNDWATER	OBSERVATIONS					
Date					Date/Time Start 10/21/96 1530	
From						
DTW					Date/Time Finish 10/23/96 1700	

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	COMMENTS
		18				
						18.50
	SS-10	19				Morie 00 sand
		20				
				2		20.5'
	SS-11	21	24	4	Gray/brown clay and silt, some medium to fine sand, wet	
				2		
		22		1		
				woh		
	SS-12	23	10	1	Same as above	
				3		
		24		4		
				woh		
	SS-13	25	10	3	Brown medium to fine sand, some silt, wet	Morie 0 sand
				6		
		26		4		
				woh		
	SS-14	27	15	8	Brown medium to fine sand, some silt some course	
				14	gravel, wet	
		28		16		
				2		
	SS-15	29	18	5	Brown silt, medium to fine sand, some fine gravel, wet	
				4		
		30		2		
				woh		
	SS-16	31	24	3	Brown silt and clay, trace medium to fine sand, wet	.010 Slotted PVC
				3		screen
		32		2		
				1		
	SS-17	33	24	2	Same as above	
				2		
		34		1		
				7		
	SS-18	35	18	8	Same as above	
				5		
		36		6		
				14		
	SS-19	37	10	3	Same as above	
				2		
		38		2		
				12		

STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations noted from the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO. MW-2
Driller:	SJB VARIES					
Inspector:	DANIEL LIPP and GENE MELNYK				PROJECT NAME Cherry Farm/River Road	Sheet 3 of 3
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location:
Method:	VARIED					
					Weather sunny 40	
GROUNDWATER	OBSERVATIONS					
Date					Date/Time Start 10/21/96 1530	
From						
DTW					Date/Time Finish 10/23/96 1700	

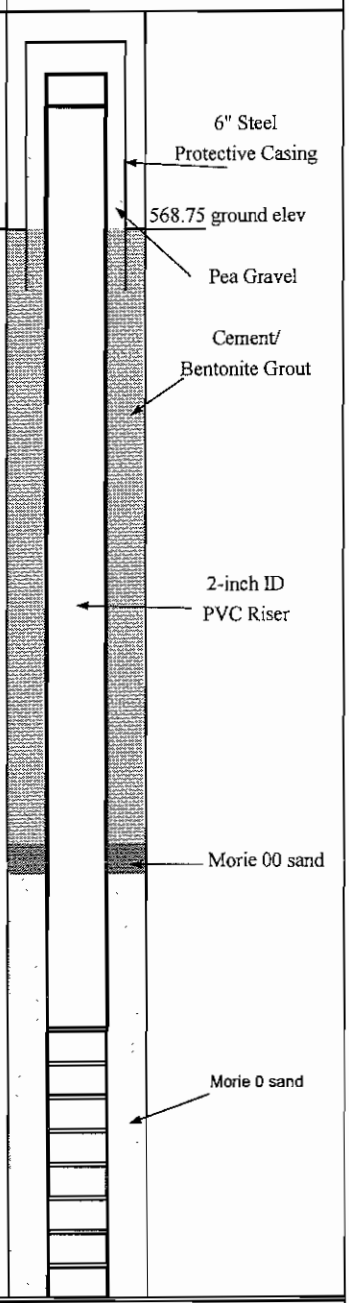
Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	COMMENTS
	SS-20	39	12	14	Brown silt and clay, some course gravel, trace fine gravel, wet	 40.2' 40.5'
				8		
		40		9		

STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations noted at the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO. MW-3
Driller:	SJB VARIES					
Inspector:	GEORGE HERMANCE				PROJECT NAME Cherry Farm/River Road	Sheet 1 of 2
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location: Northwest corner of Cherry Farm
Method:	VARIED					
					Weather sunny 55	
GROUNDWATER	OBSERVATIONS					
Date					Date/Time Start 9/23/96 1300	
From						
DTW					Date/Time Finish 9/24/96 1420	

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				woh	
	SS-1	1	12	1	Dark brown then brown clayey silt, some (-) fine sand
				1	
		2		1	
				woh	
	SS-2	3	8	woh	Brown clayey silt, then black fine sand and silt, moist soft, roots
				woh	
		4		1	
				woh	
	SS-3	5	18	1	Black clayey silt, trace (+) fine sand, roots to 5.5' then gray silty
				1	fine sand, mois, trace (+) roots
		6		2	
				2	
	SS-4	7	16	1	Gray fine sand, some (+) silt, trace (+) roots to 7.5' then wet
				2	dilatent sand
		8		1	
				1	
	SS-5	9	24	1	Gray fine sand, some (+) roots, wet dilatent
				1	
		10		2	
				1	
	SS-6	11	20	2	Gray medium to fine sand, little silt, traee (-) very fine gravel
				2	wet dilatent
		12		2	
				1	
	SS-7	13	14	1	Gray medium to fine sand, little (+) silt, traee (-) very fine
				1	gravel wet dilatent
		14		1	
				3	
	SS-8	15	18	2	Gray medium to fine sand, little silt (in layers), wet dilatent
				2	
		16		3	
				2	
	SS-9	17	12	4	Gray medium to fine sand, little silt, wet, dilatent

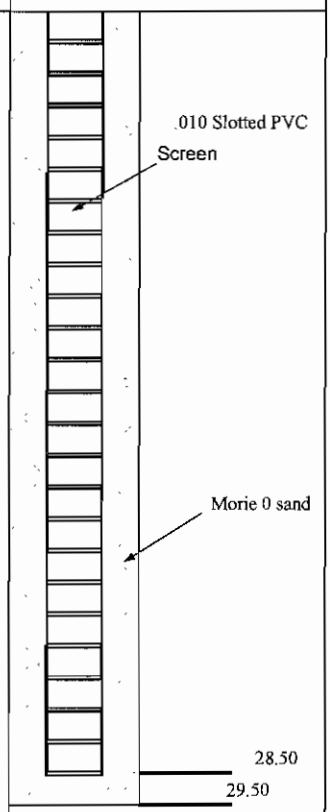


STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE	BORING NO.	MW-3
Driller:	SJB VARIES				DRILLING RECORD		
Inspector:	GEORGE HERMANCE				PROJECT NAME Cherry Farm/River Road	Sheet 2 of 2	
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location:	
Method:	VARIED						
					Weather sunny 55		
GROUNDWATER	OBSERVATIONS						
Date					Date/Time Start 9/23/96 1300		
From							
DTW					Date/Time Finish 9/24/96 1420		

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				4	
		18		9	
				5	
	SS-10	19	24	6	Same as above 15-17, trace (-) roots
				6	
		20		7	
				4	
	SS-11	21	15	5	Gray medium to fine sand, silt, wet, dilatent
				6	
		22		7	
				6	
	SS-12	23	20	7	Gray fine sand and silt, wet, dilatent
				7	
		24		8	
				2	
	SS-13	25	6	4	Gray fine sand, trace (+) silt,wet, dilatent
				4	
		26		7	
				2	
	SS-14	27	18	4	Alternating layers of medium to fine sand and tan clayey
				1	silt to 28'
		28		1	
				2	
	SS-15	29	18	1	Alternating layers of medium to fine sand and tan clayey
				3	silt , wet
		30		2	



WELL CONSTRUCTION

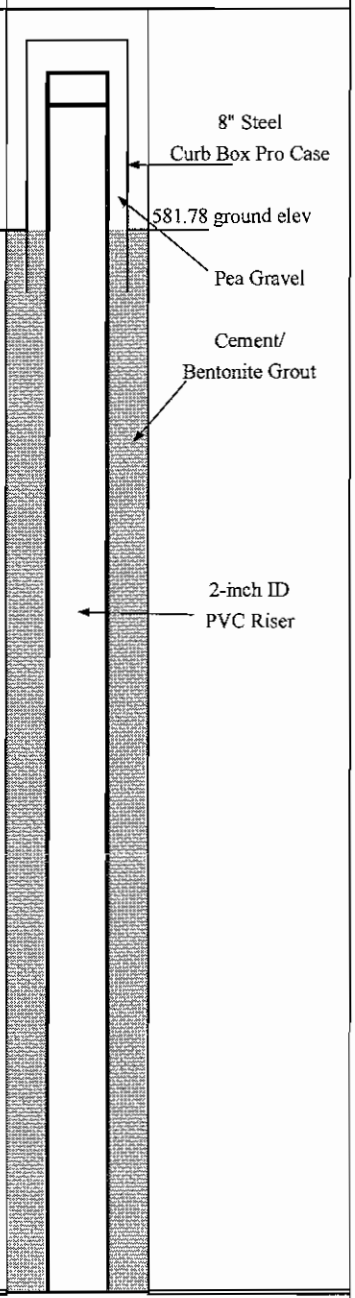
STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO. MW-4
Driller:	SJB VARIES					
Inspector:	DANIEL LIPP				PROJECT NAME Cherry Farm/River Road	Sheet 1 of 3
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location: near river middle of Cherry Farm
Method:	VARIED					
					Weather sunny 55	
GROUNDWATER	OBSERVATIONS					
Date					Date/Time Start 10/2/96 1400	
From						
DTW					Date/Time Finish 10/4/96 0840	

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				7	
	SS-1	1	12	6	Black medium fine sand, traee gravel, moist, fill
				18	
		2		20	
				22	
	SS-2	3	12	8	Same as above with trace of tan fine sand
				11	
		4		20	
				14	
	SS-3	5	20	28	Black medium fine sand, moist, fill
				28	
		6		25	
				19	
	SS-4	7	22	18	Black and tan medium fine sand, moist,fill
				15	
		8		13	
				4	
	SS-5	9	0	3	No recovery
				3	
		10		2	
				2	
	SS-6	11	10	2	Blaek medium fine sand, moist, fill
				2	
		12		2	
				1	
	SS-7	13	18	1	Blaek medium fine sand, trace tan fine sand, wet, fill
				1	
		14		1	
				WOH	
	SS-8	15	15		Black medium fine sand, wet, fill (water at 14')
		16			
				woh/.1	
	SS-9	17	24	2	Black medium to fine sand, 17.7 top of marsh deposit

WELL CONSTRUCTION



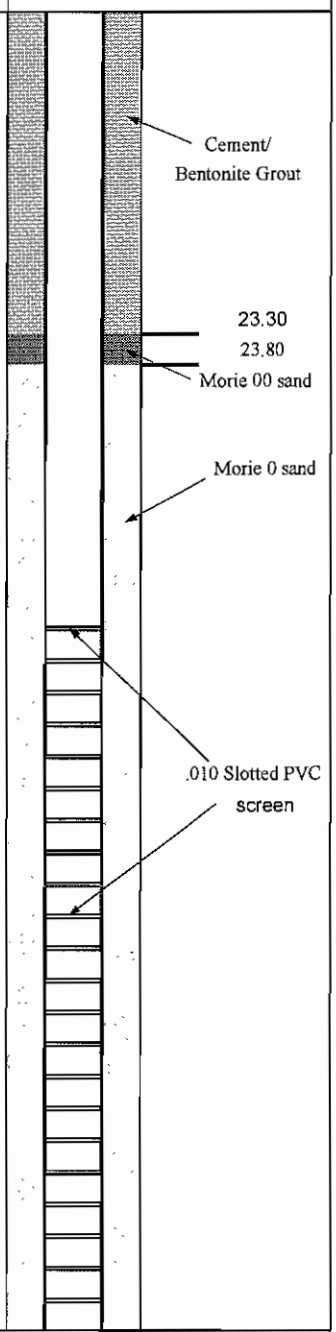
STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO.	MW-4
Driller:	SJB VARIES						
Inspector:	DANIEL LIPP				PROJECT NAME Cherry Farm/River Road	Sheet 2 of 3	
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location:	
Method:	VARIED						
					Weather sunny 55		
GROUNDWATER	OBSERVATIONS						
Date					Date/Time Start 10/2/96 1400		
From							
DTW					Date/Time Finish 10/4/96 0840		

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				3	
		18			
				1	
	SS-10	19	12	1	Gray and brown sandy silt
				2	
		20		3	
				3	
	SS-11	21	18	1	Gray and brown sandy silt
				2	
		22		2	
				1	
	SS-12	23	20	2	Gray medium to fine sand, some silt, wet
				2	
		24		4	
				8	
	SS-13	25	15	3	Gray medium to fine sand, trace silt, moist
				3	
		26		5	
				4	
	SS-14	27	12	4	Gray medium to fine sand, some fine gravel, moist
				5	
		28		5	
				12	
	SS-15	29	15	5	Gray medium to fine sand, trace fine gravel, moist
				4	
		30		7	
				2	
	SS-16	31	8	5	same as above
				5	
		32		5	
				4	
	SS-17	33	10	4	Gray medium to fine sand, wet
				7	
		34		7	
				3	
	SS-18	35	10	3	Gray medium to fine sand, trace fine gravel, moist
				3	
		36		6	
				7	
	SS-19	37	12	4	same as above
				3	
		38		3	
				4	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

PARSONS ENGINEERING SCIENCE

DRILLING RECORD

BORING NO. MW-4

Sheet 3 of 3

Contractor: SJB SERVICES
Driller: SJB VARIES
Inspector: DANIEL LIPP
Rig Type: CME 75/85 TRAC
Method: VARIED

PROJECT NAME Cherry Farm/River Road
PROJECT NUMBER 726673.41

Location: near river middle of Cherry Farm

Weather sunny 55

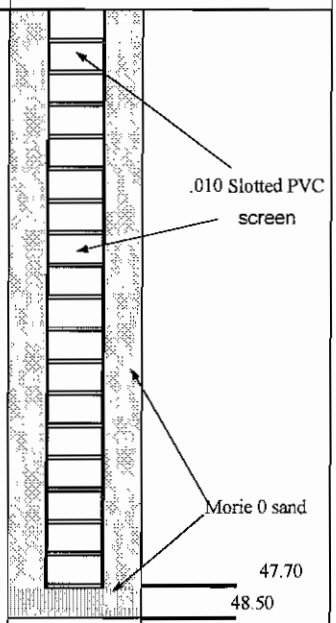
Date/Time Start 10/2/96 1400

Date/Time Finish 10/4/96 0840

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	18	2	Brown and gray medium to fine sand, some fine gravel, some
				2	silt, moist
		40		3	
				1	
	SS-21	41	15	1	Brown and gray medium to fine sand, trace silt, trace fine
				4	gravel, moist
		42		4	
				2	
	SS-22	43	24	1	Brown silt, some gray medium to fine sand, (+) clay,moist
				2	
		44		3	
				1	
	SS-23	45	18	1	Brown silt and clay, some gray medium to fine sand
				2	
		46		2	
				woh	
	SS-24	47	24	1	Brown and gray clay, some silt, trace gray medium to fine sand
				1	
		48		1	

WELL CONSTRUCTION



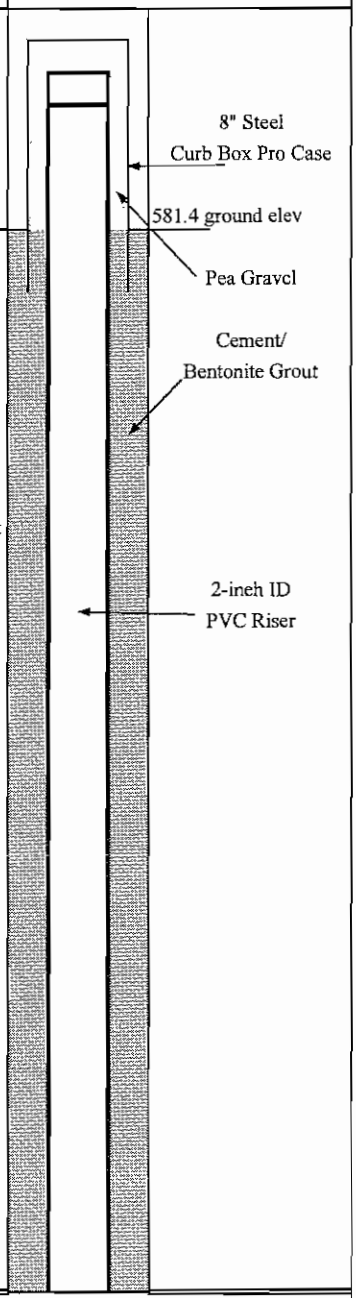
STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determine at the time the borehole was drilled.

Contractor:	SJB SERVICES		PARSONS ENGINEERING SCIENCE DRILLING RECORD		BORING NO.	MW-5
Driller:	SJB VARIES					
Inspector:	DANIEL LIPP		PROJECT NAME	Cherry Farm/River Road	Sheet	1 of 3
Rig Type:	CME 75/85 TRAC		PROJECT NUMBER	726673.41	Location:	near river, southwest end of Cherry Farm
Method:	VARIED					
			Weather	sunny 45		
GROUNDWATER	OBSERVATIONS					
Date			Date/Time Start	10/7/96 1000		
From						
DTW			Date/Time Finish	10/8/96 1750		

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				5	
	SS-1	1	18	6	Black medium to finc sand, trace gravel, trace red brick, moist
				5	fill
		2		8	
				9	
	SS-2	3	18	5	Black medium to fine sand, some wood, moist fill
				20	
		4		20	
				6	
	SS-3	5	8	7	Black medium to fine sand, some tan medium to fine sand, moist
				11	fill
		6		8	
				6	
	SS-4	7	24	7	Same as above
				5	
		8		4	
				1	
	SS-5	9	15	2	Same as above
				2	
		10		2	
				1	
	SS-6	11	8	2	Same as above
				2	
		12		2	
				7	
	SS-7	13	12	8	Same as above
				14	
		14		16	
				6	
	SS-8	15	10	5	Black mcdium to fine sand, trace tan fine sand, traee white fine
				16	gravel, wet fill
		16		8	
				2	
	SS-9	17	18	2	Black medium to fine sand, wet fill

WELL CONSTRUCTION

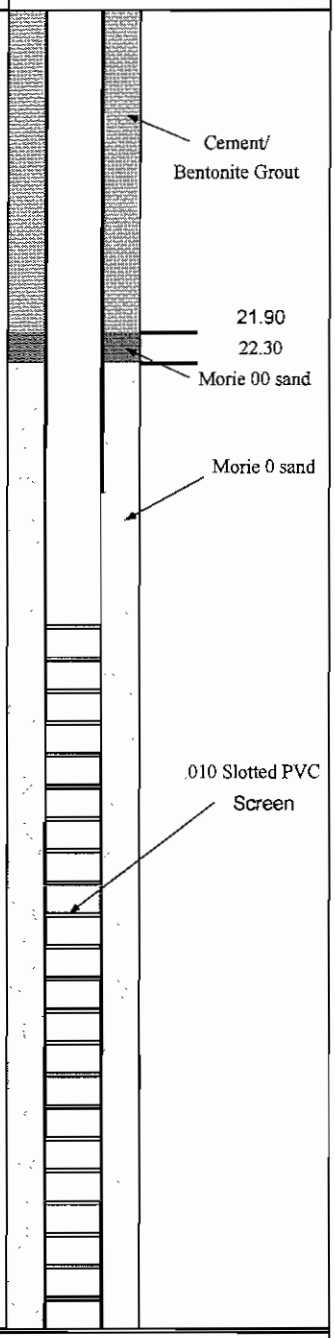


STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO.	MW-5
Driller:	SJB VARIES						
Inspector:	DANIEL LIPP				PROJECT NAME Cherry Farm/River Road	Sheet 2 of 3	
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location:	
Method:	VARIED						
					Weather sunny 45		
GROUNDWATER	OBSERVATIONS						
Date					Date/Time Start 10/7/96 1000		
From							
DTW					Date/Time Finish 10/8/96 1750		

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				2	
		18		4	
				1	
	SS-10	19	24	woh	Brown silt sand, trace black medium to fine sand,Marsh
				1	deposit at 19', wet, casing at 20'
		20		woh	
				woh	
	SS-11	21	0	woh	No recovery
				woh	
		22		woh	
				woh	
	SS-12	23	24	woh	Black and brown silt and medium to fine sand, trace
				woh	clay, wet
		24		woh	
				woh	
	SS-13	25	24	woh	Same as above
				woh	
		26		woh	
				woh	
	SS-14	27		5	Brown medium to fine sand, some black silt,wet
				5	
		28		5	
				6	
	SS-15	29	18	3	Brown and gray medium to fine sand, wet
				6	
		30		12	
				10	
	SS-16	31	10	11	Gray medium to fine sand, some fine gravel,wet
				10	
		32		10	
				7	
	SS-17	33		9	Same as above
				10	
		34		7	
				11	
	SS-18	35	12	9	Gray medium to fine sand, wet
				10	
		36		11	
				4	
	SS-19	37	10	7	Same as above
				5	
		38		7	
				5	



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

PARSONS ENGINEERING SCIENCE

DRILLING RECORD

BORING NO. MW-5

Sheet 3 of 3

Contractor: SJB SERVICES
Driller: SJB VARIES
Inspector: DANIEL LIPP
Rig Type: CME 75/85 TRAC
Method: VARIED

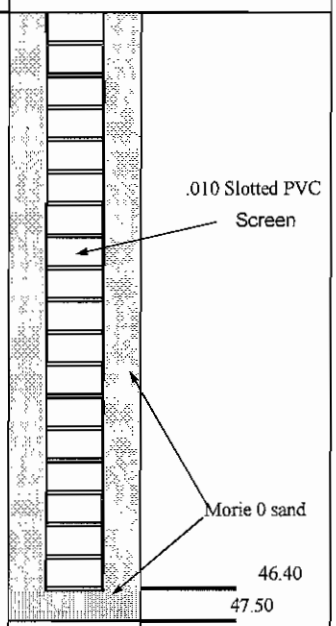
PROJECT NAME: Cherry Farm/River Road
PROJECT NUMBER: 726673.41
Location:

Weather: sunny 45
Date/Time Start: 10/7/96 1000
Date/Time Finish: 10/8/96 1750

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	10	5	Gray medium to fine sand, trace fine gravel
				3	
		40		2	
				3	
	SS-21	41	15	4	Gray and brown medium to fine sand, some brown clay
				22	
		42		0	
				5	
	SS-22	43	18	4	Same as above
				5	
		44		7	
				6	
	SS-23	45	15	3	Same as above
				3	
		46		2	
				woh	
	SS-24	47	24	woh	Same as above
		48			

WELL CONSTRUCTION



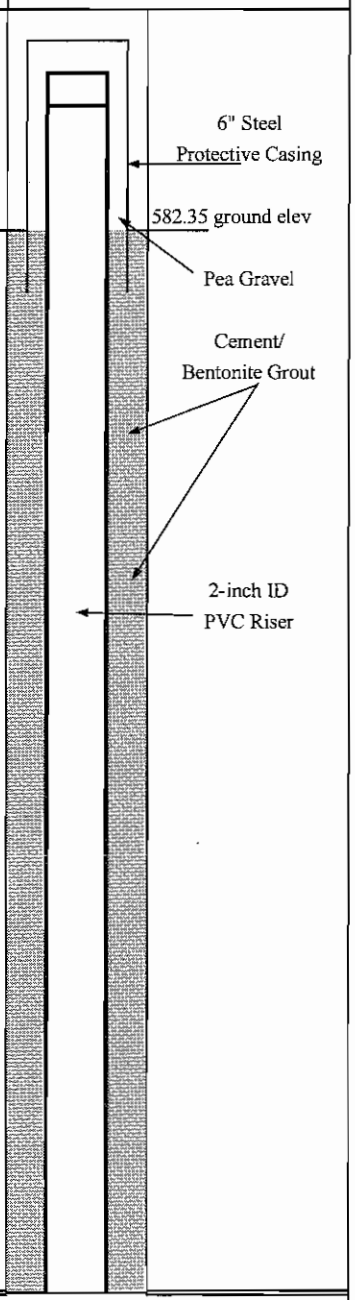
STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO. MW-6
Driller:	SJB VARIES					
Inspector:	DANIEL LIPP				PROJECT NAME Cherry Farm/River Road	Sheet 1 of 3
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location: Near river, middle of River Road Site
Method:	VARIED					
					Weather sunny 40	
GROUNDWATER	OBSERVATIONS					
Date					Date/Time Start 10/11/96 0900	
From						
DTW					Date/Time Finish 10/15/96 0900	

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				3	
	SS-1	1	24	6	Black medium to fine sand, trace tan fine sand, moist fill
				13	
		2		11	
				9	
	SS-2	3	24	7	Black medium to fine sand, trace tan fine sand, traee red fine
				13	sand, moist fill
		4		60	
				32	
	SS-3	5	5	32	Black medium to fine sand, some slag, some course gravel
				84	moist fill
		6		0	
				50/.4	
	SS-4	7	0		No recovery
		8			
				34	
	SS-5	9	8	26	Brown medium to fine sand, trace brick
				7	
		10		5	
				2	
	SS-6	11	15	2	Red and brown brick, slag, sand, moist
				4	
		12		4	
				5	
	SS-7	13	16	4	Red and brown briek, sand, slag, black slag with NAPL @ 13.8'
				2	
		14		4	
				2	
	SS-8	15	12	1	Black sand and slag, wet, NAPL odor
				2	
		16		13	
				8	
	SS-9	17		19	Same as above, top of marsh deposit at 19'

WELL CONSTRUCTION



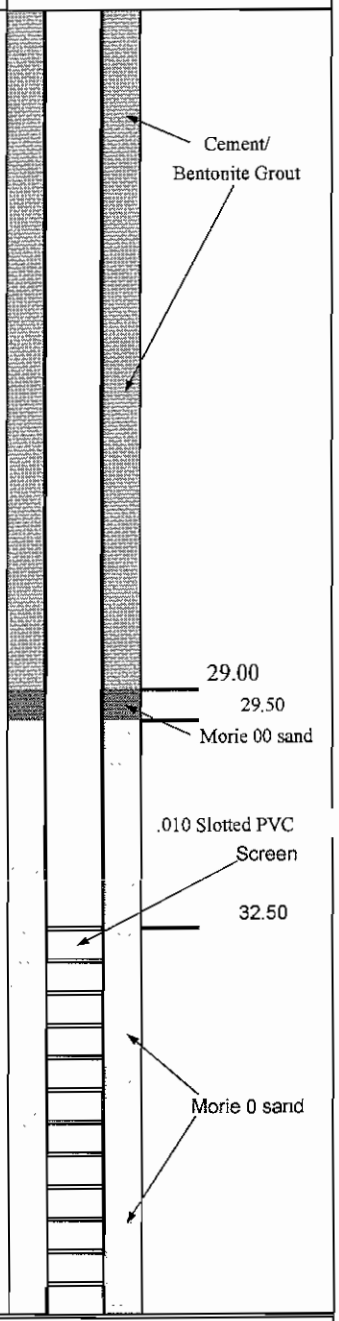
STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borhole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO.	MW-6
Driller:	SJB VARIES						
Inspector:	DANIEL LIPP				PROJECT NAME Cherry Farm/River Road	Sheet 2 of 3	
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location:	
Method:	VARIED						
					Weather sunny 40		
GROUNDWATER	OBSERVATIONS						
Date					Date/Time Start 10/11/96 0900		
From							
DTW					Date/Time Finish 10/15/96 0900		

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				4	
		18		1	
				3	
	SS-10	19	24	2	Black course gravel and slag, some marsh deposit
				5	
		20		2	
				2	
	SS-11	21	18	4	Gray medium to fine sand, some silt, wet
				2	
		22		2	
				3	
	SS-12	23	18	2	Same as above, wet
				2	
		24		5	
				4	
	SS-13	25	18	3	Same as above, wet
				3	
		26		4	
				3	
	SS-14	27	10	2	Gray medium to fine sand, wet
				6	
		28		7	
				11	
	SS-15	29	15	9	Same as above
				7	
		30		8	
				4	
	SS-16	31	8	6	Same as above
				7	
		32		8	
				3	
	SS-17	33	8	5	Same as above
				8	
		34		15	
				12	
	SS-18	35	12	16	Same as above
				19	
		36		12	
				3	
	SS-19	37	8	6	Same as above
				8	
		38		10	
				3	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. MW-6

Sheet 3 of 3

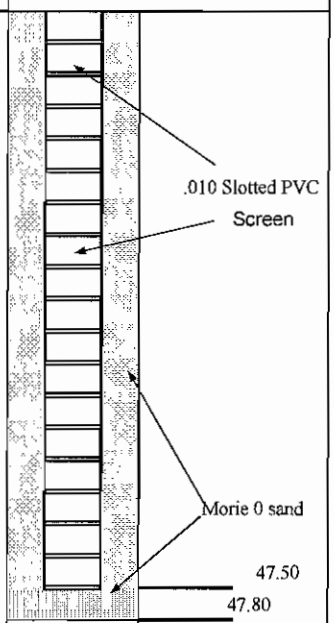
Contractor:	SJB SERVICES
Driller:	SJB VARIES
Inspector:	DANIEL LIPP
Rig Type:	CME 75/85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	sunny 40
Date/Time Start	10/11/96 0900
Date/Time Finish	10/15/96 0900

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	6	12	Same as above
				7	
		40		3	
				2	
	SS-21	41	10	2	Gray medium to fine sand, some silt, wet
				2	
		42		2	
				8	
	SS-22	43	15	7	Gray medium to fine sand, some fine gravel, some wood, wet
				9	
		44		3	
				woh	
	SS-23	45	24	woh	Brown and gray clay, trace medium to fine sand
				2	
		46		2	
				woh	
	SS-24	47	20	woh	Same as above
				woh	
		48		woh	

WELL CONSTRUCTION

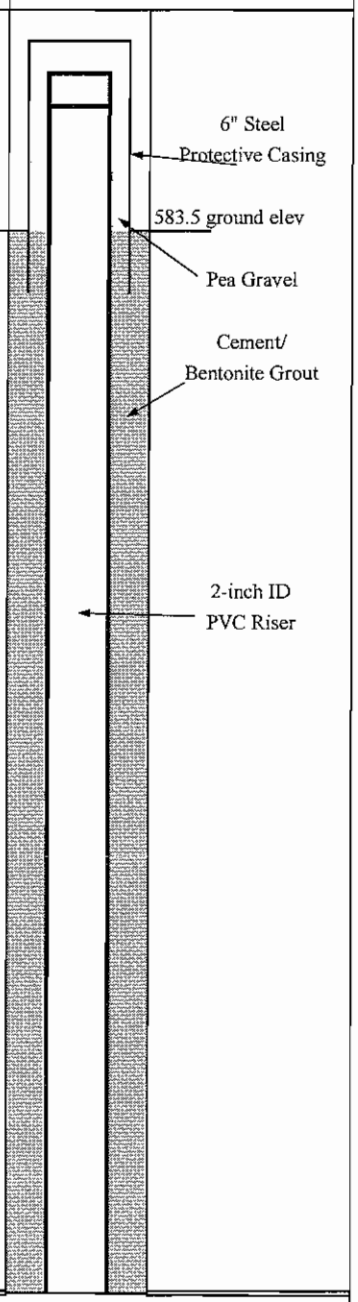


STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO. MW-7
Driller:	SJB VARIES					
Inspector:	DANIEL LIPP				PROJECT NAME Cherry Farm/River Road	Sheet 1 of 3
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location: Southeast corner of River Road
Method:	VARIED					infront of treatment building.
GROUNDWATER	OBSERVATIONS				Weather sunny 40	
Date					Date/Time Start 10/16/96 0910	
From						
DTW					Date/Time Finish 10/18/96 1200	

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				2	
	SS-1	1	10	4	Black medium to fine sand, some course gravel, moist fill
				6	
		2		8	
				2	
	SS-2	3	24	4	Black medium to fine sand, moist fill
				4	
		4		8	
				20	
	SS-3	5	18	24	Course gravel, some black medium to fine sand, dry fill
				13	
		6		13	
				50/0	
	SS-4	7	0		No recovery
		8			
				25	
	SS-5	9	6	50/0	Black sand, slag, tan resin like material
		10			
				25	
	SS-6	11	12	10	Gray black, blue, slag, wet slag
				15	
		12		50/.4	
	SS-7	13	NA		Not attempted in slag
		14			
				50/.2	
	SS-8	15	0.20		Wet gray slag
		16			
				50/.2	
	SS-9	17	0.20		Cement like wet gray slag

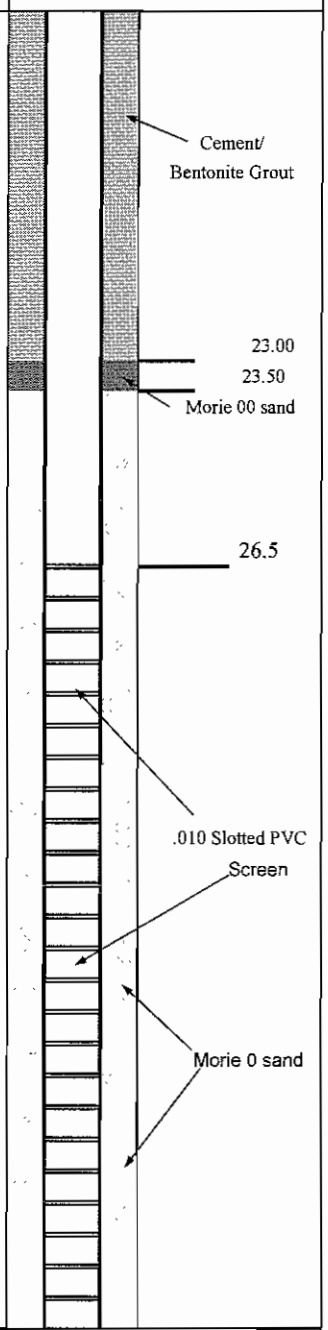


STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE	BORING NO.	MW-7
Driller:	SJB VARIES				DRILLING RECORD		
Inspector:	DANIEL LIPP				PROJECT NAME Cherry Farm/River Road	Sheet 2 of 3	
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location:	
Method:	VARIED						
					Weather sunny 40		
GROUNDWATER	OBSERVATIONS						
Date					Date/Time Start 10/16/96 0910		
From							
DTW					Date/Time Finish 10/18/96 1200		

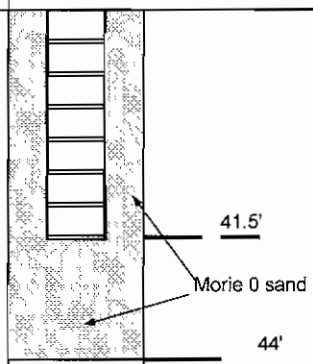
Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		18			
				29	
	SS-10	19	14	17	Gray slag to 19' then black brown silty sand, top of marsh
				9	deposit
		20		2	
	SS-11	21	NA	NA	Not attempted
		22			
				2	
	SS-12	23		2	Gray fine slag, wet
				4	
		24		5	
				2	
	SS-13	25	24	2	Black silt and clay, trace black medium to fine sand, wet
				4	
		26		5	
				2	
	SS-14	27	15	1	Same as above
				2	
		28		2	
				3	
	SS-15	29	18	3	Gray black fine sand, some (-) silt, wet, alot of slag in
				4	top of spoon
		30		4	
				2	
	SS-16	31	12	5	Gray fine sand, wet dilatent, wash slag in spoon
				7	
		32		9	
				5	
	SS-17	33	4	6	Gray fine sand, wet dilatent, 8" of wash in spoon
				6	
		34		6	
				5	
	SS-18	35	12	2	medinm dark brown/gray soft silt and clay, 4" of dark
				5	gray/brown medium to fine sand, wet,dilatent
		36		6	
				4	
	SS-19	37	12	3	Medium dark brown/gray silty clay and fine sand
				4	dilatent, wet soft
		38		4	
				2	



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevations determined at the time the borehole was drilled.

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO.	MW-7
Driller:	SJB VARIES						
Inspector:	DANIEL LIPP				PROJECT NAME Cherry Farm/River Road	Sheet 3 of 3	
Rig Type:	CME 75/85 TRAC				PROJECT NUMBER 726673.41	Location:	
Method:	VARIED						
					Weather sunny 40		
GROUNDWATER	OBSERVATIONS						
Date					Date/Time Start 10/16/96 0910		
From							
DTW					Date/Time Finish 10/18/96 1200		
Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	WELL CONSTRUCTION	
	SS-20	39	18	2	Medium dark gray/brown silty clay soft, some fine dark gray		
				2	sand within, wet/soft		
		40		2			
				3			
	SS-21	41	12	3	Soft silty clay and fine medium brown sand, as above		
				5			
		42		5			
				2			
	SS-22	43	20	2	Top 6" as above, bottom 14" soft wet medium red/gray silt clay		
				1			
		44		1			



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depths and elevatious determined at the time the borehole was drilled.

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-1

Sheet 1 of 1

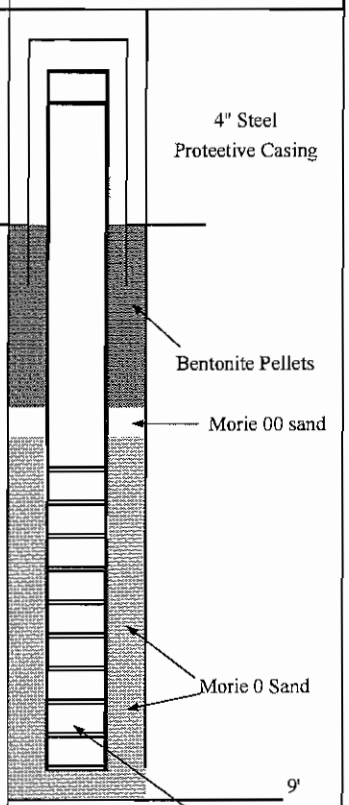
Contractor:	SJB SERVICES
Driller:	SJB VARIES
Inspector:	GEORGE HERMANCE
Rig Type:	CME 7585 TRAC
Method:	VARIED
PROJECT NAME	CHERRY FARM/RIVER ROAD
PROJECT NUMBER	726673.41
Location:	Northwest corner of cherry farm
Weather	sunny 45
Date/Time Start	12/11/96 0915
Date/Time Finish	12/11/96 0938

GROUNDWATER OBSERVATIONS

Date				
From				
DTW			0.00	

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				4	
	SS-1	1	18	3	Brown clayey silt for 10" then black medium to fine sand, trace
				4	silt, moist
		2		4	
				7	
	SS-2	3	14	7	Blaek brown medium to fine sand, wet, then dark gray silty
				4	elay at bottom
		4		3	
				3	
	SS-3	5	16	1	Black medium to fine sand, some (-) silt, trace (+) roots to 4 5'
				1	then gray fine sand and silt, damp to dilatent
		6		2	
				2	
	SS-4	7	15	1	Gray black fine sand and silt
				3	
		8		1	
				2	
	SS-5	9	15	1	Gray medium to fine sand, some silt, wet
				2	
		10		2	
	SS-6	11			
		12			
	SS-7	13			
		14			
	SS-8	15			
		16			
	SS-9	17			

WELL CONSTRUCTION



STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING-SCIENCE
DRILLING RECORD

BORING NO. OW-1

Sheet 2 of 2

Location:

Contractor: SJB SERVICES

Driller:

Inspector: GEORGE HERMANCE

Rig Type: CME 7585 TRAC

Method: VARIED

PROJECT NAME CHERRY FARM/RIVER ROAD

PROJECT NUMBER 726673.41

Weather sunny 45

Date/Time Start 12/11/96 0915

Date/Time Finish 12/11/96 0938

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Percent Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				12	
		18		49	
				5	
	SS-10	19		2	Gray sloppy slag to 18.5 then black and gray sandy
				2	silt, roots (woodchips)
		20		1	
		21			
		22			
		23			
		24			
		25			
		26			
		27			
		28			
		29			
		30			
		31			
		32			
		33			
		34			
		35			
		36			
		37			
		38			

COMMENTS

18'

18.5 morie 0 sand

STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY:

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-2

Sheet 1 of 2

Location:

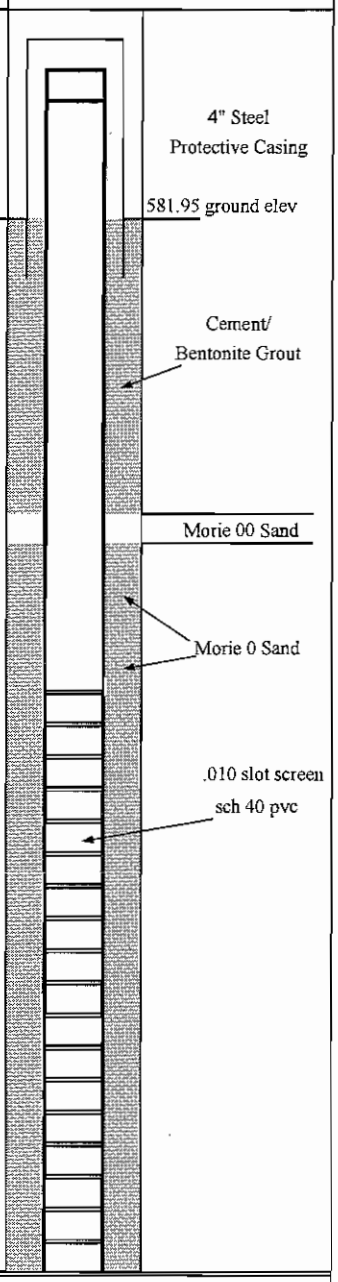
Contractor:	SJB SERVICES
Driller:	SJB VARIES
Inspector:	DANIEL LIPP
Rig Type:	CME 7585 TRAC
Method:	VARIED
PROJECT NAME	CHERRY FARM/RIVER ROAD
PROJECT NUMBER	726673.41
Weather	sunny 45
Date/Time Start	10/9/96 1430
Date/Time Finish	10/9/96 1700

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				5	
	SS-1	1	20	3	Black medium to fine sand, trace wood, trace red fine sand
				5	moist fill
		2		4	
				7	
	SS-2	3	24	13	Black medium to fine sand, trace red fine sand, moist fill
				25	
		4		23	
				8	
	SS-3	5		12	Black medium to fine sand, some wood, trace fine sand, moist
				9	fill
		6		5	
				4	
	SS-4	7	8	3	Black medium to fine sand, trace red fine sand, moist fill
				3	
		8		2	
				3	
	SS-5	9	12	5	Black medium to fine sand, trace wood, trace metal
				5	
		10		10	
				23	
	SS-6	11	8	15	Black wood, some medium to fine sand, moist fill
				4	
		12		5	
				4	
	SS-7	13	15	3	Black medium to fine sand, some tan fine sand, moist fill
				4	
		14		4	
				5	
	SS-8	15	12	3	Black medium to fine sand, some wood, wet
				3	
		16		2	
				2	
	SS-9	17	24	1	Black medium to fine sand, top of marsh deposit at 17.8'

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-2

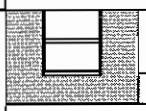
Sheet 2 of 2

Contractor:	SJB SERVICES
Driller:	SJB VARIES
Inspector:	DANIEL LIPP
Rig Type:	CME 7585 TRAC
Method:	VARIED
PROJECT NAME	CHERRY FARM/RIVER ROAD
PROJECT NUMBER	726673.41
Location:	
Weather	sunny 45
Date/Time Start	10/9/96 1430
Date/Time Finish	10/9/96 1700

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Percent Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				2	
		18		2	
	SS-10	19			
		20			
		21			
		22			
		23			
		24			
		25			
		26			
		27			
		28			
		29			
		30			
		31			
		32			
		33			
		34			
		35			
		36			
		37			
		38			

WELL CONSTRUCTION



17.50

17.8 morie 0 sand

STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-3

Sheet 1 of 1

Contractor: SJB SERVICES
Driller: SJB VARIES
Inspector: JEFF POULSEN
Rig Type: CME 7585 TRAC
Method: VARIED

PROJECT NAME CHERRY FARM/RIVER ROAD
PROJECT NUMBER 726673.41

Location: along river, middle of cherry farm

Weather sunny 45

Date/Time Start 12/10/96 1150

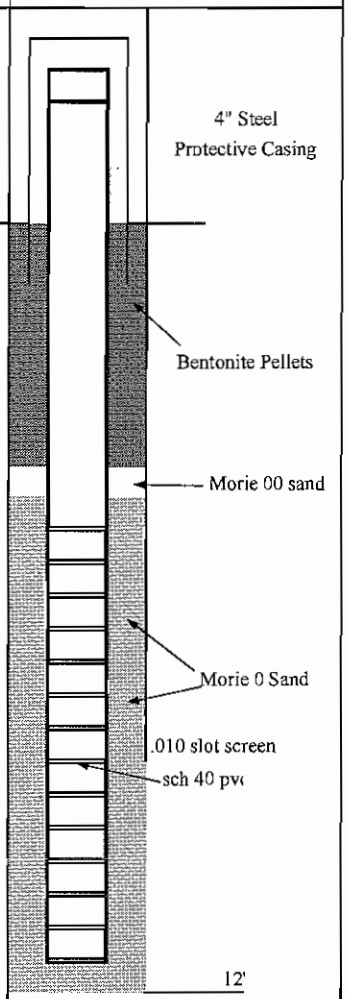
Date/Time Finish 12/10/96 1325

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				3	
	SS-1	1	12	3	6" of clay cover, 6" of fine black silt and sand, damp
				3	
		2		3	
				3	
	SS-2	3	18	4	12" same as above, 6" waste fill, black sand/cinders
				17	
		4		6	
				7	
	SS-3	5	12	7	Black waste fill, dry
				11	
		6		9	
				7	
	SS-4	7	12	6	Same as above
				17	
		8		30	
				27	
	SS-5	9	16	19	6" waste fill black, wet, 10" of marsh deposit, silt/clay, organic
				4	material
		10		2	
				4	
	SS-6	11	12	2	Medium gray/brown fine silt and sand, organics
				2	
		12		4	
	SS-7	13			
		14			
	SS-8	15			
		16			
	SS-9	17			

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-4

Sheet 1 of 1

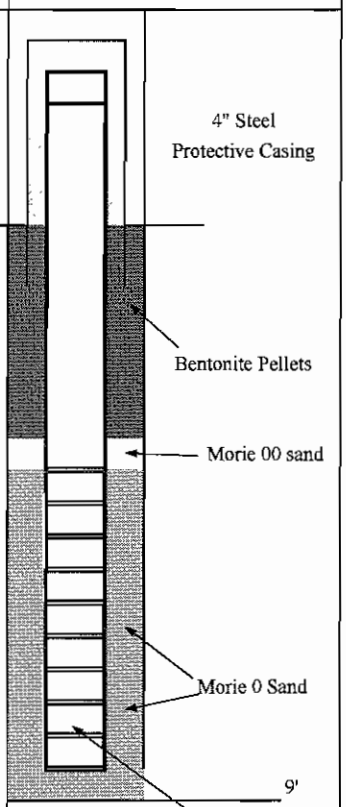
Contractor:	SJB SERVICES
Driller:	SJB VARIES
Inspector:	JEFF POULSEN
Rig Type:	CME 7585 TRAC
Method:	VARIED
PROJECT NAME	CHERRY FARM/RIVER ROAD
PROJECT NUMBER	726673.41
Location:	along river, middle of cherry farm
Weather	sunny 45
Date/Time Start	12/10/96 1015
Date/Time Finish	12/10/96 1300

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				8	
	SS-1	1	18	8	6" of clay cover, black to dark brown waste fill, einders, gravel,
				10	sand, damp
		2		20	
				14	
	SS-2	3	18	22	black to dark brown waste fill, cinders, gravel, sand, damp
				24	
		4		30	
				24	
	SS-3	5	12	25	Same as above, wet
				17	
		6		10	
				6	
	SS-4	7	12	2	6" same as above, 6" fine silt, marsh deposits
				1	
		8		1	
				1	
	SS-5	9	5	1	Marsh deposit
				1	
		10		1	
	SS-6	11			
		12			
	SS-7	13			
		14			
	SS-8	15			
		16			
	SS-9	17			

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-5

Contractor: SJB SERVICES
Driller: SJ B VARIES
Inspector: DANIEL LIPP
Rig Type: CME 7585 TRAC
Method: VARIED

PROJECT NAME CHERRY FARM/RIVER ROAD
PROJECT NUMBER 726673.41

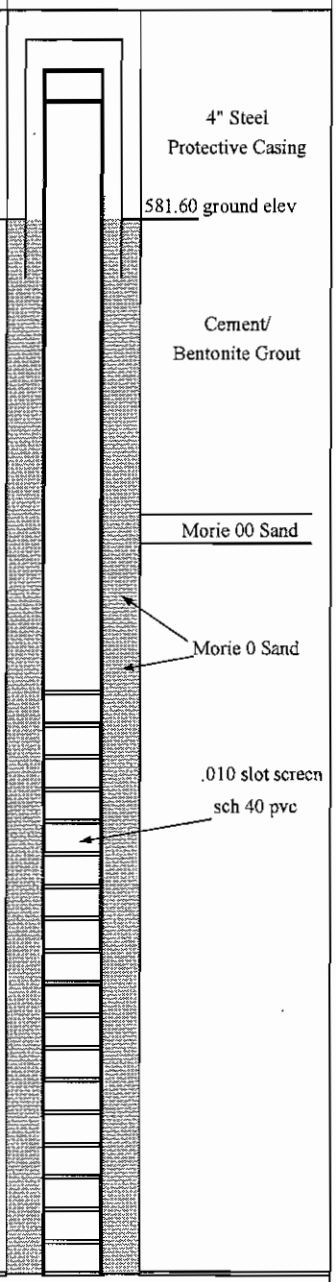
Sheet 1 of 2
Location: along river, southwest end of cherry farm

Weather sunny 45
Date/Time Start 10/10/96 1430
Date/Time Finish 10/10/96 1730

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				5	
	SS-1	1	18	5	Black medium to fine sand, trace red fine sand, moist fill
				5	
		2		6	
				5	
	SS-2	3	24	6	Same as above
				10	
		4		17	
				9	
	SS-3	5	24	11	Brown medium to fine sand, some red fine sand, moist fill
				11	
		6		12	
				7	
	SS-4	7	18	6	Brown medium to fine sand, some red fine sand, some tan fine
				7	sand, moist fill
		8		7	
				8	
	SS-5	9	15	4	Tan fine sand, some black medium to fine sand, trace red fine
				2	moist fill
		10		2	
				1	
	SS-6	11	8	4	Brown medium to fine sand, trace brown fine sand, moist fill
				2	
		12		4	
				4	
	SS-7	13		6	Black medium to fine sand, some brown fine sand, moist fill
				25	
		14		37	
				5	
	SS-8	15	15	8	Black medium to fine sand, trace tan fine sand, moist fill
				10	
		16		8	
				7	
	SS-9	17		8	Black medium to fine sand, trace wood, water at 16'

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING SCIENCE DRILLING RECORD

Contractor:	SJB SERVICES	BORING NO.	OW-5
Driller:	SJ B VARIES		
Inspector:	DANIEL LIPP	PROJECT NAME	CHERRY FARM/RIVER ROAD
Rig Type:	CME 7585 TRAC	PROJECT NUMBER	726673.41
Method:	VARIED	Sheet	2 of 2
		Location:	
		Weather	sunny 45
GROUNDWATER OBSERVATIONS			
Date		Date/Time Start	10/10/96 1430
From			
DTW		Date/Time Finish	10/10/96 1730

Photovac Reading	Sample I.D.	Sample Depth	Percent Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	WELL CONSTRUCTION
				12		
		18		19		
				3		18.50
	SS-10	19	18	4	Brown and black silty clay, trace black medium to fine	19' morie 0 sand
				2	sand, wet	
		20		1		
		21				
		22				
		23				
		24				
		25				
		26				
		27				
		28				
		29				
		30				
		31				
		32				
		33				
		34				
		35				
		36				
		37				
		38				

STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-6

Sheet 1 of 1

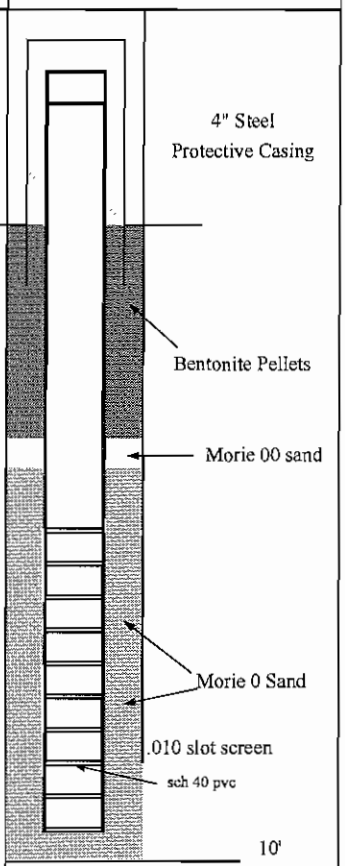
Contractor:	SJB SERVICES
Driller:	SJB VARIES
Inspector:	JEFF POULSEN
Rig Type:	CME 7585 TRAC
Method:	VARIED
PROJECT NAME	CHERRY FARM/RIVER ROAD
PROJECT NUMBER	726673.41
Location:	along river, southwest corner of cherry farm
Weather	sunny 45
Date/Time Start	12/9/96 1530
Date/Time Finish	12/9/96 1555

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				1	
	SS-1	1	16	2	Red clay, fill cover
				7	
		2		3	
				6	
	SS-2	3	12	7	6" of red clay, 6" black cinders and wet sand, wet
				7	
		4		15	
				8	
	SS-3	5	12	26	Dark gray/brown course gravel, layers of tan fine sand and
				20	silt, wet
		6		7	
				1	
	SS-4	7	24	2	6" same as above, 18" fine gray/black sand and silt, organic
				1	odor, wet
		8		2	
				6	
	SS-5	9	18	2	Same as above
				2	
		10		3	
	SS-6	11			
		12			
	SS-7	13			
		14			
	SS-8	15			
		16			
	SS-9	17			

WELL CONSTRUCTION



STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-7

Sheet 1 of 1

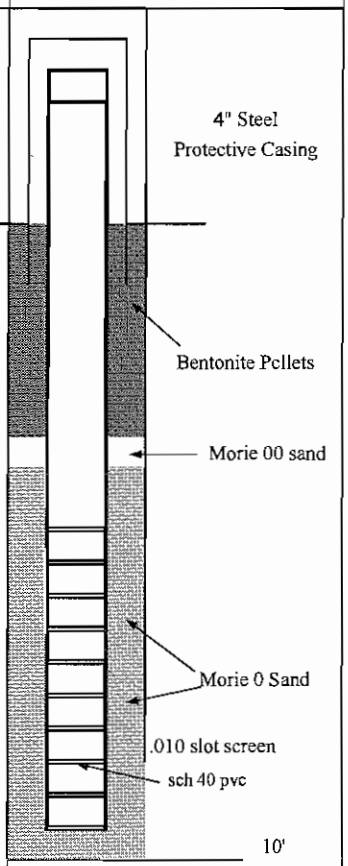
Contractor:	SJB SERVICES
Driller:	SJB VARIES
Inspector:	JEFF POULSEN
Rig Type:	CME 7585 TRAC
Method:	VARIED
PROJECT NAME	CHERRY FARM/RIVER ROAD
PROJECT NUMBER	726673.41
Location:	along river,Northwest corner of river road
Weather	sunny 45
Date/Time Start	12/9/96 1445
Date/Time Finish	12/10/96 0940

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0		1	
	SS-1	1	16	2	Red clay, fill, cover
				7	
		2		3	
				6	
	SS-2	3	12	7	12" red clay, 6" black cinders and wet sand
				7	
		4		15	
				8	
	SS-3	5	12	26	Dark gray/brown course gravel, layers tan wet fine sand and
				20	silt
		6		7	
				1	
	SS-4	7	24	2	6" same as above, 18" gray/black fine sand/silt, wet organices
				1	
		8		2	
				5	
	SS-5	9	2	5	2" of gray silty clay, some odor, very soft
				6	
		10		10	
	SS-6	11			
		12			
	SS-7	13			
		14			
	SS-8	15			
		16			
	SS-9	17			

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-8

Contractor: SJB SERVICES
Driller: SJB VARIES
Inspector: JEFF POULSEN
Rig Type: CME 7585 TRAC
Method: VARIED

PROJECT NAME CHERRY FARM/RIVER ROAD
PROJECT NUMBER 726673.41

Sheet 1 of 1
Location: along river, southwest end of river road

Weather sunny 45

Date/Time Start 12/9/96 1115

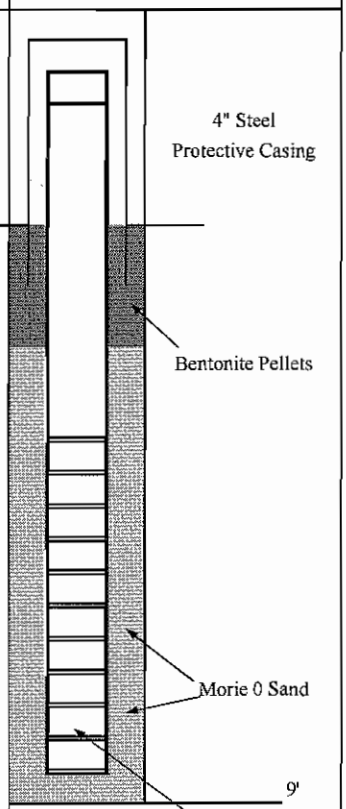
Date/Time Finish 12/9/96 1400

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				2	
	SS-1	1	18	2	Red cover clay, damp, geofabric at 1.5'
				2	
		2		4	
				3	
	SS-2	3	18	3	1' light brown sand fill, 1' black waste fill, sand, gravel, slug
				6	
		4		1	
				2	
	SS-3	5	12	3	Black waste fill, sand, 0.5" of gravel, damp
				50/1	
		6			
				12	
	SS-4	7	16	38	Dark gray black waste fill, einders, gravel, sand, slight odor
				40	
		8		50/2	
				52	
	SS-5	9	8	50/2	Blaek gray waste fill, wet
		10			
	SS-6	11			
		12			
	SS-7	13			
		14			
	SS-8	15			
		16			
	SS-9	17			

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-9

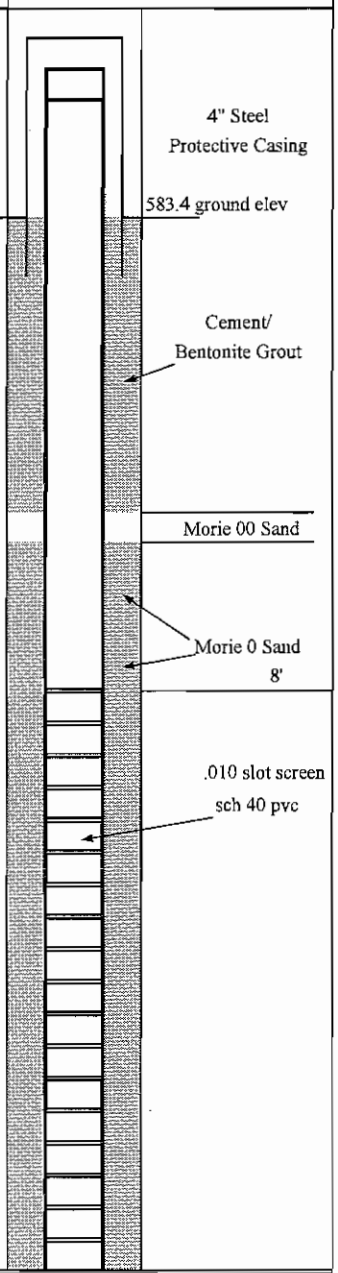
Sheet 1 of 2

Contractor:	SJB SERVICES
Driller:	SJB VARIES
Inspector:	DANIEL LIPP
Rig Type:	CME 7585 TRAC
Method:	VARIED
PROJECT NAME	CHERRY FARM/RIVER ROAD
PROJECT NUMBER	726673.41
Location:	near river, middle of river road
Weather	sunny 45
Date/Time Start	10/25/96 0836
Date/Time Finish	10/25/96 0954

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				3	
	SS-1	1	16	4	Black and brown medium to fine sand, slag, moist
				2	
		2		2	
				5	
	SS-2	3	24	7	Black, brown and tan medium to fine sand, slag, moist
				5	
		4		50	
				10	
	SS-3	5	12	30	Black and tan medium to fine sand, trace slag, all fill, moist
				50/.2	
		6			
				50/.3	
	SS-4	7	2		Slag, crystalline in nature
		8			
				33	
	SS-5	9	18	32	Black brown medium to fine sand, gray crystalline slag, fine
				18	gravel, dry mixture in shoe
		10		38	
				25	
	SS-6	11	12	15	Black fine sand and silt fill, gray slag in shoe of spoon, moist
				50/.4	
		12			
				50/0	
	SS-7	13	0		No recovery, small chunk of brick slag 13', wet
		14			
				12	
	SS-8	15	6	50/.4	Slag, gray white brick, moist to wet
		16			
				12	
	SS-9	17	20	22	Wet gray slag



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. OW-9

Contractor: SJB SERVICES
Driller: SJB VARIES
Inspector: DANIEL LIPP
Rig Type: CME 7585 TRAC
Method: VARIED

PROJECT NAME CHERRY FARM/RIVER ROAD
PROJECT NUMBER 726673.41

Sheet 2 of 2
Location:

Weather sunny 45

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Date/Time Start 10/25/96 0836

Date/Time Finish 10/25/96 0954

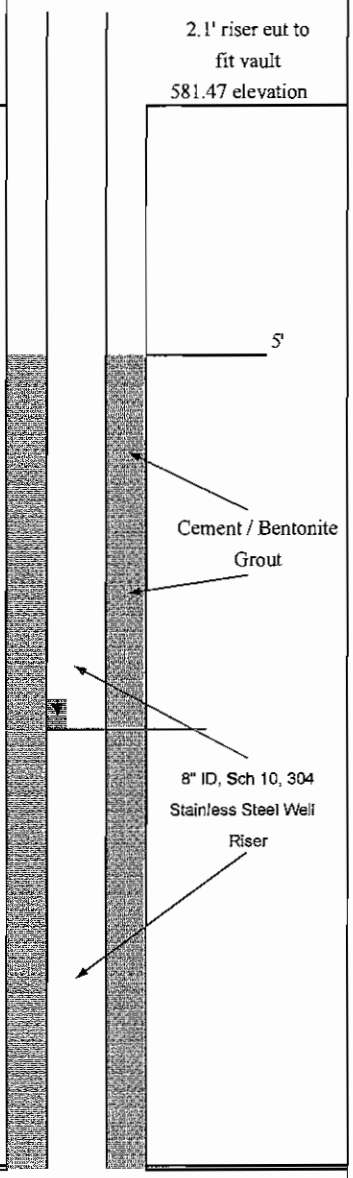
Photovac Reading	Sample I.D.	Sample Depth	Percent Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	COMMENTS
				12		
		18		49		18'
				5		18.5 morie 0 sand
	SS-10	19		2	Gray sloppy slag to 18.5 then black and gray sandy	
				2	silt, roots (woodchips)	
		20		1		
		21				
		22				
		23				
		24				
		25				
		26				
		27				
		28				
		29				
		30				
		31				
		32				
		33				
		34				
		35				
		36				
		37				
		38				

STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Ground surface elevation at time of drilling

Contractor:	SJB SERVICES				PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO.	RW - 1
Driller:	ART KOSKE						
Inspector:	GEORGE HERMANCE				PROJECT NAME Cherry Farm/River Road	Sheet 1 of 3	
Rig Type:	CME 75-85 TRAC				PROJECT NUMBER 726673.41	Location: Northwest Corner - Cherry Farm	
Method:	VARIED						
					Weather Sunny,		
GROUNDWATER	OBSERVATIONS						
Date					Date/Time Start 9/10/96 0930hrs		
From							
DTW					Date/Time Finish 9/16/96 1530 hrs		

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				1	
	SS-1	1	15	8	Black, Brown, Tan, medium to fine Sand, some (-) Silt,
				14	trace(+) roots, moist
		2		9	
				6	
	SS-2	3	12	6	Black, Brown, medium to fine Sand, trace (+) Silt, trace (-)
				8	clay, trace (-) fine Gravel, trash, plastic, moist
		4		7	
				4	
	SS-3	5	12	3	Blaek, Tan , medium to fine Sand, loose, moist,
				5	
		6		6	
				7	
	SS-4	7	4	7	Black, Tan , medium to fine Sand, cardboard, moist,
				8	
		8		6	
				1	
	SS-5	9	12	3	Black , medium to fine Sand, trace (-) glass, moist, cement
				5	
		10		4	
				1	
	SS-6	11	17	3	Black and Tan, medium to fine Sand, wet
				5	
		12		1	
				3	
	SS-7	13	15	4	Black and Tan, medium to fine Sand, trace (-) Slag, wet
				3	
		14		4	
				1	
	SS-8	15	20	3	Black and Tan, medium to fine Sand, traee (+) Silt, wet
				4	
		16		5	
				2	
	SS-9	17	24	3	Black and Tan, medium to fine Sand, trace (+) Silt, to 17.5'



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

Contractor: SJB SERVICES	PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO.	RW - 1
Driller: ART KOSKE			
Inspector: GEORGE HERMANCE	PROJECT NAME Cherry Farm/River Road	Sheet 2 of 3	
Rig Type: CME 75-85 TRAC	PROJECT NUMBER 726673.41	Location:	
Method: VARIED			

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

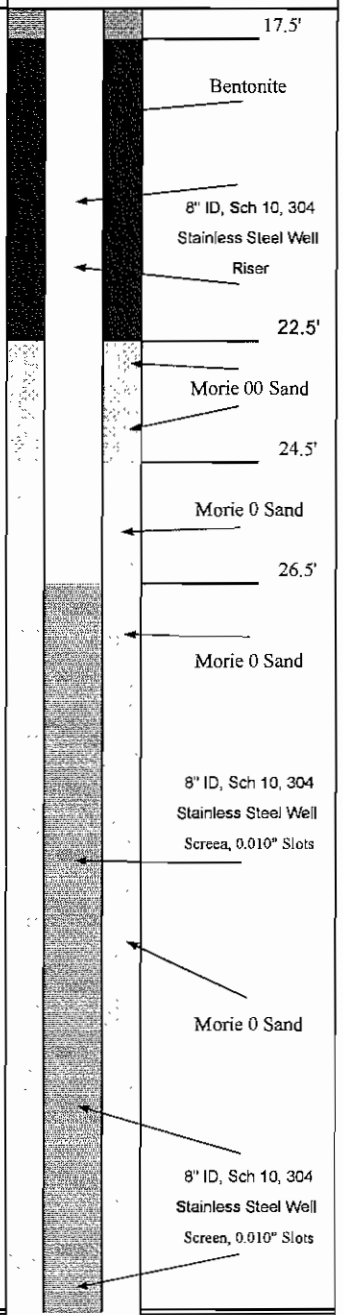
Weather: Sunny,

Date/Time Start: 9/10/96 0930hrs

Date/Time Finish: 9/16/96 1530 hrs

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				5	then stained gray black, sandy Silt, moist, stiff, roots, wood
		18		2	Top of Marsh Deposit at 17.5'
				WOH	
	SS-10	19	14	WOH	Gray, medium to fine Sand, some Silt, trace roots, wet, loose,
				1	roots in black Sand and Silt
		20		1	
				1	
	SS-11	21	12	2	Gray, medium to fine Sand, some (-) Silt, trace (--) roots, wet
				2	
		22		4	
				1	
	SS-12	23	18	1	Gray, medium to fine Sand, some (-) Silt, trace (--) roots, wet
				2	dilatent
		24		2	
				WOR	
	SS-13	25	18	2	Gray, medium to fine Sand, some (-) Silt, wet
				1	dilatent
		26		4	
				3	
	SS-14	27	15	9	Gray, medium to fine Sand, some (-) Silt, wet
				11	dilatent, loose at bottom
		28		11	
				1	
	SS-15	29	20	11	Gray, medium to fine Sand, some Silt, trace (-) fine Gravel,
				13	wet, dilatent , gravel at 29.5'
		30		19	
				1	
	SS-16	31	24	4	Gray, medium to fine Sand, some (-) Silt, wet
				7	dilatent,
		32		9	
				2	
	SS-17	33	12	7	Gray, medium to fine Sand, some (-) Silt, wet
				6	dilatent,
		34		5	
				3	
	SS-18	35	24	7	Gray, medium to fine Sand, some (-) Silt, wet
				7	dilatent,
		36		10	
				WOR	
	SS-19	37	24	WOH	Gray ,medium to fine Sand, trace Silt, wet, dilatent
				1	
		38		1	
				WOR	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 1

Sheet 3 of 3

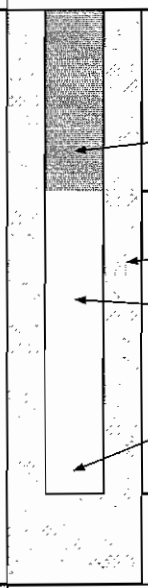
Location:

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Weather	Sunny,
Date/Time Start	9/10/96 0930hrs
Date/Time Finish	9/16/96 1530 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	14	WOR	Gray medium to fine Sand, trace(+) Silt, trace (+) Clay, some
				WOR	layering, soft, wet
		40		WOH	
				WOR	
	SS-21	41	18	WOH	Gray medium to fine Sand, some Silt in layers, trace Clay
				2	for the last 6"
		42		3	
				1	
	SS-22	43	6	1	Gray, Tan, Silt and Clay, wet
				1	
		44		1	
				WOR	
	SS-23	45	6	WOR	Gray, Tan, Silt and Clay, wet
				WOR	
		46		WOR	
				WOR	
	SS-24	47	0	WOR	No Recovery
				2	
		48		2	



8" ID, Sch 10, 304 Stainless Steel Well Screen, 0.010" Slots

41.5'

Morie 0 Sand

8" ID, Sch 10, 304 Stainless Steel Well Riser / Sump

46.5'

Morie 0 Sand

48'

STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 2

Sheet 1 of 3

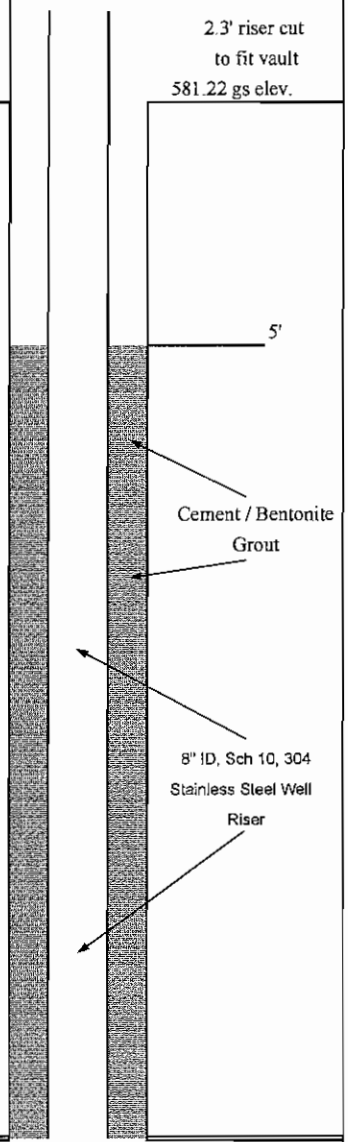
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	Northwest Corner - Cherry Farm
Weather	Sunny, 60 degrees
Date/Time Start	9/16/96 0815hrs
Date/Time Finish	9/18/96 1130 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				5	
	SS-1	1	15	17	Black, medium to fine Sand, some (-) Silt, wood, moist
				12	
		2		16	
				17	
	SS-2	3	24	21	Black, medium to fine Sand, some Silt, wood, trace (-) Clay,
				29	moist, fill
		4		31	
				10	
	SS-3	5	24	5	Black , medium to fine Sand, little Silt, trace Slag, wood,
				4	moist
		6		4	
				3	
	SS-4	7	24	4	Black, fiue Sand, little(+) Silt, fill, wet at 7 feet
				3	
		8		2	
				1/12	
	SS-5	9	18		Black, medium to fine Sand, trace (+) Silt, wet , fill
				1	
		10		1	
				1	
	SS-6	11	20	1	Black, medium to fine Sand, little (+) Silt , trace very fine,
				1	gravel, wet, fill
		12		1	
				1	
	SS-7	13	24	1	Black, medium to fine Sand, little Silt, wet, fill
				1	
		14		2	
				1	
	SS-8	15	24	1	Black, medium to fine Sand, little (-) Silt, trace Clay, wet, fill
				5	
		16		6	
				1	
	SS-9	17	24	1	Black, medium to fine Sand, little (-) Silt, wet to 17.3'

WELL CONSTRUCTION



STANDARD PENETRATION

SS = SPLIT SPOON

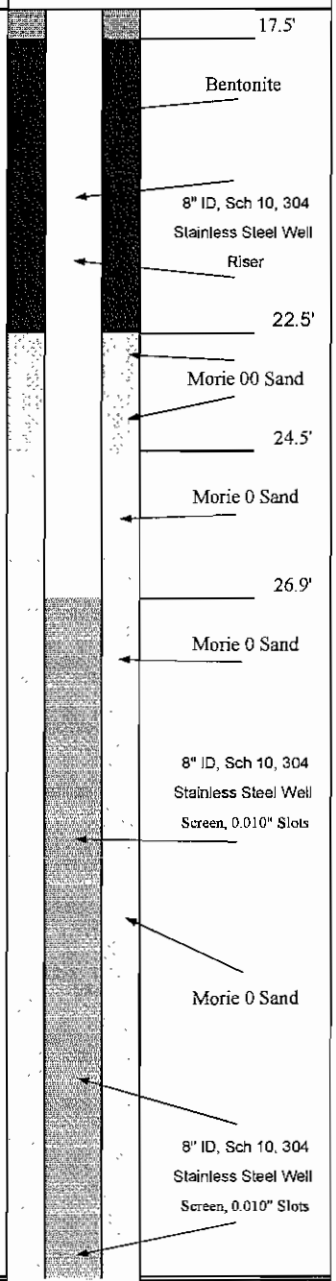
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

Contractor:	SJB SERVICES	BORING NO.	RW - 2
Driller:	ART KOSKE		
Inspector:	GEORGE HERMANCE	PROJECT NAME: Cherry Farm/River Road	Sheet 2 of 3
Rig Type:	CME 75-85 TRAC	PROJECT NUMBER: 726673.41	Location:
Method:	VARIED		
		Weather: Sunny, 60 degrees	
GROUNDWATER OBSERVATIONS		Date/Time Start: 9/16/96 0815hrs	
Date		Date/Time Finish: 9/18/96 1130 hrs	
From			
DTW			

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				7	then stained black and gray fine Sand and Silt, trace Clay, roots,
		18		5	Top of Marsh Deposit at 17.3'
				1	
	SS-10	19	16	2	Gray, medium to fine Sand, some Silt, trace (+) roots,
				2	grass, wet
		20		3	
				2	
	SS-11	21	12	1	Gray, medium to fine Sand, some Silt, trace (+) roots, wet
				1	
		22		1	
				2	
	SS-12	23	14	2	Gray, medium to fine Sand, some (-) Silt, trace (--) roots to
				1	22.5', wet, dilatent
		24		2	
				2	
	SS-13	25	12	1	Gray, medium to fine Sand, some Silt, wet
				2	dilatent
		26		1	
				2	
	SS-14	27	24	2	Gray, medium to fine Sand, some Silt, wet
				5	dilatent, some color bands
		28		6	
				3	
	SS-15	29	6	10	Gray, medium to fine Sand, some (+) Silt, wet
				13	dilatent
		30		13	
				7	
	SS-16	31	22	10	Gray, medium to fine Sand, trace (+) Silt, wet
				7	dilatent,
		32		6	
				8	
	SS-17	33	24	12	Gray, fine Sand, little (-) Silt, wet
				14	dilatent,
		34		16	
				10	
	SS-18	35	24	14	Gray, fine Sand, little (-) Silt, wet
				14	dilatent,
		36		14	
				8	
	SS-19	37	24	7	Gray, medium to fine Sand, little Silt, to 37.5' then Gray
				2	medium to fine Sand layers with Clayey Silt, wet, dilatent
		38		3	
				3	



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 2

Sheet 3 of 3

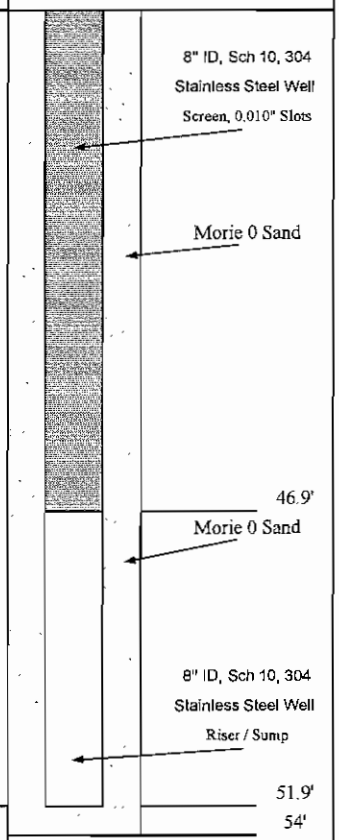
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	Sunny, 60 degrees
Date/Time Start	9/16/96 0815hrs
Date/Time Finish	9/18/96 1130 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	14	2	Gray medium to fine Sand layered with tanish Clayey Silt
				2	wet, dilatent
		40		4	
				2	
	SS-21	41	12	2	Same as 38' to 40'
				2	
		42		3	
				2	
	SS-22	43	12	3	Gray medinm to fine Sand layered with tanish Clayey Silt
				5	wet, dilatent
		44		6	
				3	
	SS-23	45	12	1	Same as 42' to 44'
				3	
		46		3	
				1	
	SS-24	47	6	1	Same as 44' to 46'
				2	
		48		1	
				4	
	SS-25	49	6	3	Running Sand, Clayey Silt in Shoe of Spoon
				5	
		50		6	
				3	
	SS-26	51	0	1	Running Sand
				9	
		52		14	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 3

Sheet 1 of 3

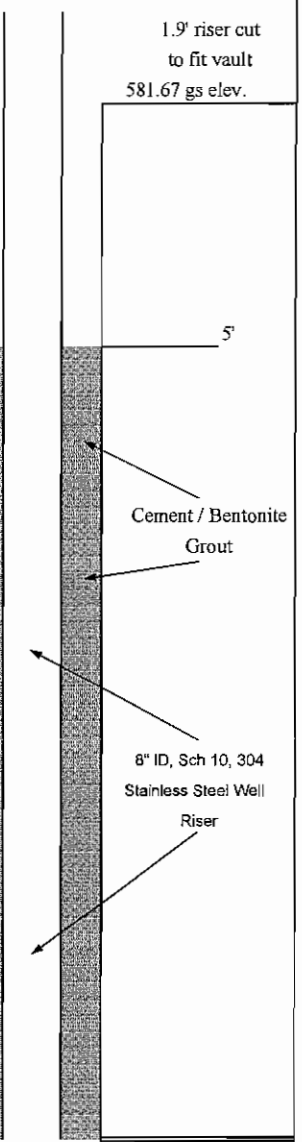
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	Northwest Center - Cherry Farm
Weather	Sunny,
Date/Time Start	9/19/96 0855hrs
Date/Time Finish	9/23/96 1000 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				3	
	SS-1	1	18	4	Black and Tan medium to fine Sand, dry, loose
				4	
		2		5	
				3	
	SS-2	3	16	4	Black, some Tan, medium to fine Sand, trace (-) Silty
				6	Clay, damp, loose
		4		7	
				4	
	SS-3	5	22	10	Brown clay then Black medinm to fine Sand and SILT, trace
				18	(-) Clay, then back to medium to fine Sand, damp
		6		25	
				12	
	SS-4	7	20	11	Black and Tan medium to fine Sand, some(-) Silt, trace (-)
				10	Clay, damp to moist
		8		9	
				3	
	SS-5	9	16	3	Black and Tan medium to fine Saud, little (-) Silt, damp
				3	
		10		3	
				1	
	SS-6	11	20	1	Black and brown medium to fine Sand, little Silt, trace (-)
				2	Clay, wet at 10.5'
		12		2	
				50	
	SS-7	13	8	50/.3	Black and gray medium to fine Sand (slag), slag in shoe of
					spoon, wet
		14			
				18	
	SS-8	15	6	50/.3	Black, tan, red Slag, Sand, Silt, moist, wet
					easy drill past 15'
		16			
				25	
	SS-9	17	16	38	Black , brown, white, gray, Slag and Sand, some Silt

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 3

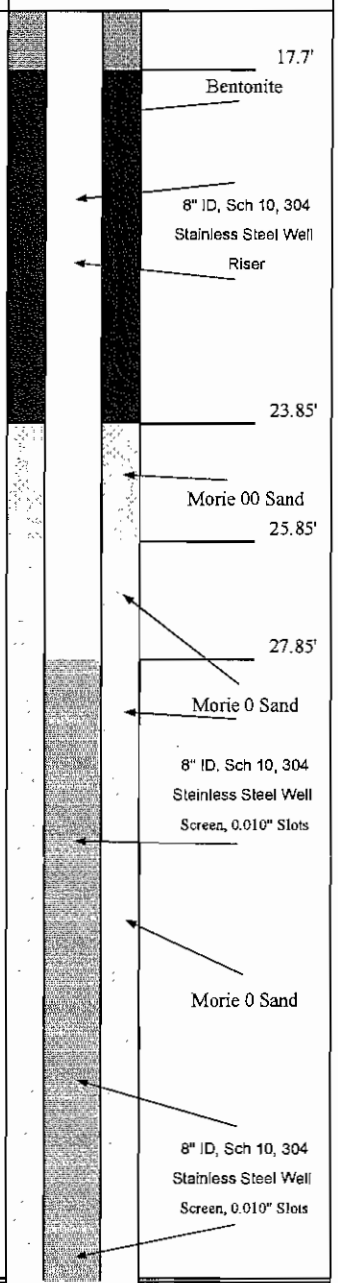
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Sheet	2 of 3
Location:	
Weather	Sunny,
Date/Time Start	9/19/96 0855hrs
Date/Time Finish	9/23/96 1000 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				28	Top of Marsh Deposit at 17.5', Brown silty Sand, wet
		18		8	
				3	
	SS-10	19	16	4	Black, medium to fine Sand and Silt, little roots, to 18.5',
				3	wet 18.5', to 20' Gray, medium to fine SAND, little Silt, trace
		20		4	roots, wet
				3	
	SS-11	21	15	2	Gray, medium to fine Sand, some (-) Silt, trace (-) roots, wet
				2	dilatent
		22		2	
				2	
	SS-12	23	12	2	Gray, medium to fine Sand, little Silt, trace (-) roots to 23'
				2	wet, dilatent
		24		3	
				8	
	SS-13	25	0	4	No Recovery
				4	
		26		2	
				2	
	SS-14	27	18	1	Gray, medium to fine Sand, little Silt, trace (-) very fine
				2	Gravel, wet, dilatent
		28		4	
				5	
	SS-15	29	10	8	Gray, medium to fine Sand, little Silt, trace fine Gravel, and
				7	wet dilatent, fine Sand and Silt
		30		8	
				10	
	SS-16	31	2	8	Gray medium to fine Sand and Silt, wet, dilatent
				10	
		32		9	
				6	
	SS-17	33	18	8	Gray medium to fine Sand, little Silt, trace (-) very fine
				9	Gravel, wet, dilatent
		34		12	
				13	
	SS-18	35	0	13	No Recovery
				10	
		36		10	
				6	
	SS-19	37	18	4	Gray medium to fine Sand, trace (-) Silt, wet, dilatent
				4	
		38		5	
				3	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 3

Sheet 3 of 3

Location:

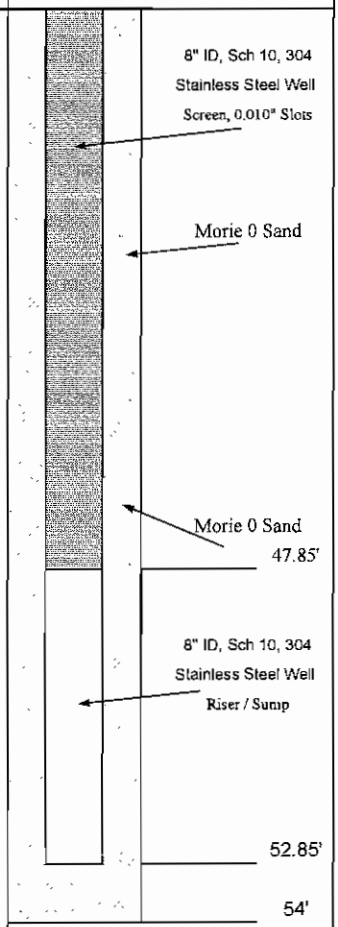
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Weather	Sunny,
Date/Time Start	9/19/96 0855hrs
Date/Time Finish	9/23/96 1000 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	18	1	Gray medium to fine Sand layered with Gray brown Clayey
				2	Silt, wet, dilatent, spacing <0.05'
		40		3	
				1	
	SS-21	41	14	1	Same as 38' to 40'
				5	
		42		4	
				5	
	SS-22	43	16	3	Gray medium to fine Sand layered with a red gray Silty Clay/
				2	Clayey Silt, wet, dilatent, spaeing about 0.1'
		44		2	
				1	
	SS-23	45	18	1	Same as 42' to 44'
				2	
		46		1	
				3	
	SS-24	47	12	2	Same as 44' to 46', thicker layering
				1	
		48		2	
				2	
	SS-25	49	8	1	Gray red Silty Clay/Clayey Silt, wet, dilatent
				3	some fine Sand stringers
		50		1	
				3	
	SS-26	51	20	2	Same as 48' to 50'
				1	
		52		1	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 4

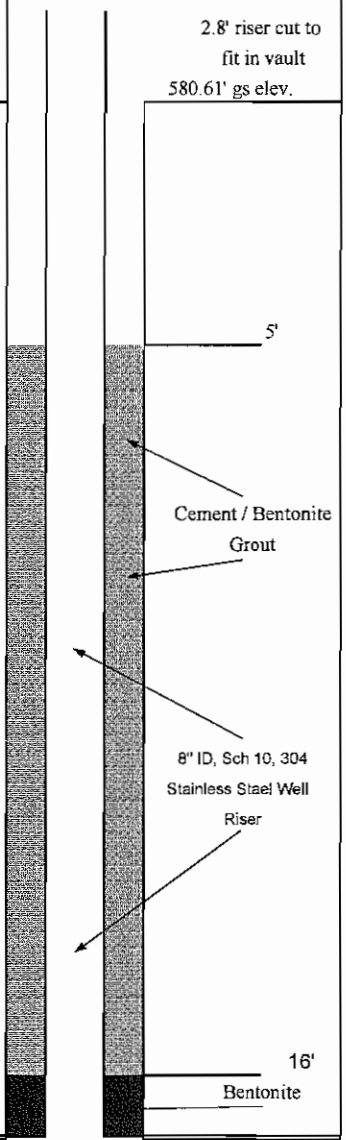
Sheet 1 of 3

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	Cherry Farm
Weather	Sunny, Cool
Date/Time Start	9/25/96 1000hrs
Date/Time Finish	9/27/96 1000 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				2	
	SS-1	1	18	3	Brown Clayey Silt, trace Sand, trace very fiue Gravel, moist
				2	
		2		4	
				6	
	SS-2	3	18	7	Brown Clayey Silt to 2.5', thcn Black and Tan fine Sand, little
				19	Silt, trace Slag, gravel, moist
		4		22	
				5	
	SS-3	5	14	13	Black, Tan, Red medium to fine Sand, little Silt, slag, wood,
				17	damp
		6		29	
				27	
	SS-4	7	12	18	Black, Tan, Yellow, Red fine Sand, little Silt, slag, wood,
				13	moist, fill
		8		14	
				5	
	SS-5	9	16	5	Black and Tan, medium to finc Sand, little Silt, traee Slag
				2	moist, fill
		10		2	
				3	
	SS-6	11	24	12	Black fine Sand, little (-) Silt, trace Slag, fill, damp to wet
				6	
		12		3	
				3	
	SS-7	13	18	4	Black, Tan, mcdium to fine Sand, trace (+) Silt, wet, NAPL,
				4	fill
		14		1	
				1	
	SS-8	15	24	1	Black red and Brown, fine Sand, Silty Clay, wet, soft, NAPL
				1	stench
		16		1	
				woh	
	SS-9	17	24	woh	Stained Clayey Silt, Marsh Deposit changes to gray Sand and



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 4

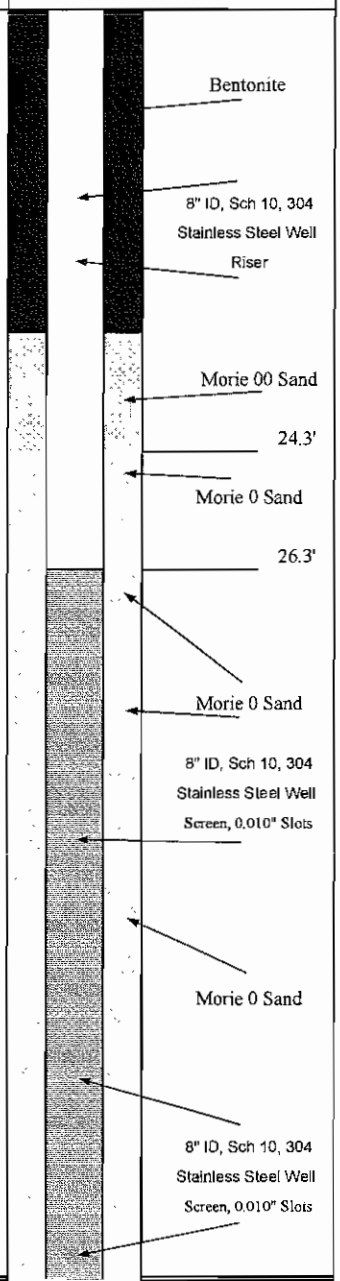
Sheet 2 of 3

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	Sunny, Cool
Date/Time Start	9/25/96 1000hrs
Date/Time Finish	9/27/96 1000 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				WOH	Silt with roots at 18'.
		18		1	
				1/18	
	SS-10	19	15		Gray, medium to fine Sand, little Silt, wet, roots
		20		3	
				2	
	SS-11	21	20	2	Gray, medium to fine Sand, little (-) Silt, wet, roots
				3	
		22		6	
				2	
	SS-12	23	20	4	Gray fine Sand, little (-) Silt, wet, dilatent
				2	
		24		5	
				1	
	SS-13	25	24	2	Gray fine Sand, some (-) Silt, wet, dilatent
				1	
		26		3	
				3	
	SS-14	27	24	5	Gray fine Sand, some (-) Silt, wet, dilatent
				3	
		28		8	
				2	
	SS-15	29	18	7	Gray fine Sand, little (+) Silt, trane fine Gravel, wet
				9	
		30		13	
				6	
	SS-16	31	20	7	Gray fine Sand, little (-) Silt, trace (-) fine Gravel, wet, dilatent
				8	
		32		13	
				8	
	SS-17	33	12	4	Gray fine Sand, wet, dilatent
				5	
		34		5	
				10	
	SS-18	35	16	11	Gray fine Sand, trace (+) Silt, trace (-) very fine Gravel, wet
				10	dilatent
		36		11	
				7	
	SS-19	37	24	4	Gray fine Sand, little (-) Silt, trace (-) very fine Gravel, roots
				3	and shells, Silt banding at 37.8'
		38		3	
				1	



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 4

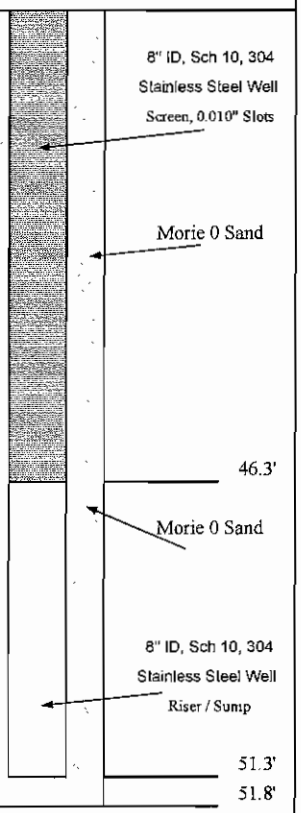
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Sheet	3 of 3
Location:	
Weather	Sunny, Cool
Date/Time Start	9/25/96 1000hrs
Date/Time Finish	9/27/96 1000 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	14	2	Gray medium to fine Sand interbedded with Brown, Tan
				2	Clayey Silt spaced at 0.1', sand beds vary in thickness
		40		4	
				4	
	SS-21	41	22	4	Gray medium to fine Sand, trace Silt bands, wet, dilatent
				5	
		42		5	
				4	
	SS-22	43	20	1	Gray fine Sand, interbedded with 0.1' thick layers of Silty Clay
				5	wet
		44		2	
				1	
	SS-23	45	16	3	Tan Silty Clay, interbedded with Gray fine Sand, wet
				1	
		46		1	
				woh/18	
	SS-24	47	18		Same as 44' to 46', but Gray fine Sand and Silt
		48		1	
				1	
	SS-25	49	6	1	Same as 46' to 48'
				1	
		50		1	
				1	
	SS-26	51	12	1	Same as 48' to 50' to refusal
				1	
		52		50/.2	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 5

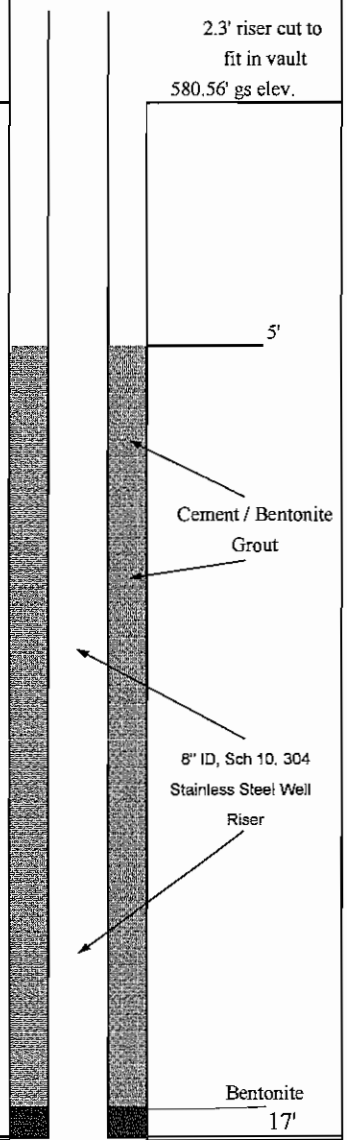
Sheet 1 of 3

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	Cherry Farm
Weather	Cloudy, Rain, Wind, 60 degrees
Date/Time Start	9/27/96, 1545 hrs.
Date/Time Finish	9/30/96 1505 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				4	
	SS-1	1	10	4	Black and Brown, medium to fine Sand, moist
				3	
		2		2	
				6	
	SS-2	3	12	19	Black and Brown, medium to fine Sand, moist
				19	
		4		13	
				4	
	SS-3	5	16	7	Black and Tan, medium to fine Sand, moist
				7	
		6		5	
				3	
	SS-4	7	16	3	Black and Tan, medium to fine Sand, trace red fine Sand,
				3	moist
		8		3	
				1	
	SS-5	9	10	2	Black and Tan, medium to fine Sand, trace red fine Sand,
				2	moist fill
		10		1	
				2	
	SS-6	11	15	1	Dark Brown, black, fine Sand, little Silt
				2	
		12		4	
				20	
	SS-7	13	24	21	same as 10' to 12'
				19	
		14		15	
				2	
	SS-8	15	18	5	same as 10' to 12'
				4	
		16		5	
				2	
	SS-9	17	24	2	16' to 17' fill as above



STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 5

Sheet 2 of 3

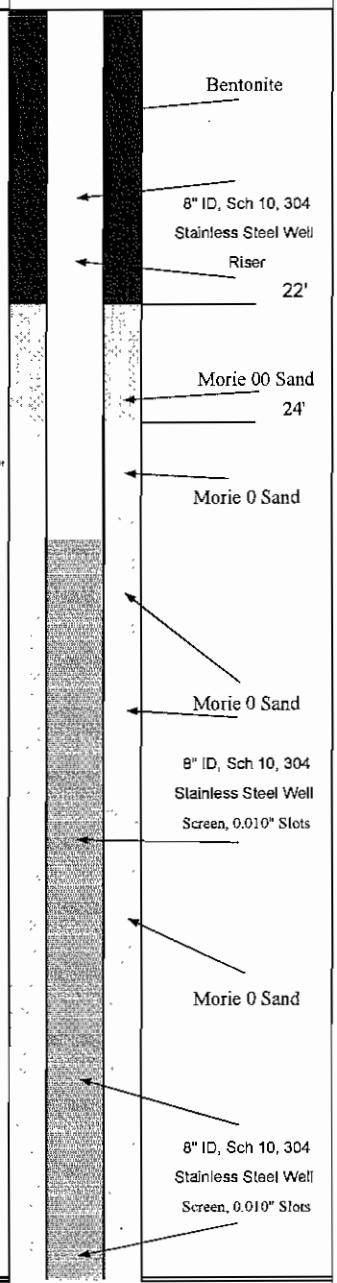
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	Cloudy, Rain, Wind, 60 degrees
Date/Time Start	9/27/96, 1545 hrs.
Date/Time Finish	9/30/96 1505 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				1	17' to 18' dark red and brown Clay, fuel/salvent odor
		18		1	
				woh/18	
	SS-10	19	20		Dark red and brown Clay, oily odor, slight sheen, trace organics
		20		20	
				1/12	
	SS-11	21	14		Brown Black stained Clayey Silt, soft, wet, dilatent, NAPL
				1	
		22		1	
				woh/24	
	SS-12	23	24		Same as 20' to 22'
		24			
				1	
	SS-13	25	20	1	Brown and Gray, Clayey Sand, little Silt, wet, soft, all gray last 6"
				1	
		26		1	
				3	
	SS-14	27	18	5	Gray fine Sand and Silt, wet, dilatent
				9	
		28		9	
				3	
	SS-15	29	12	5	Gray fine Sand, some Silt, wet, dilatent
				5	
		30		6	
				5	
	SS-16	31	18	3	Gray fine Sand, little (-) Silt, wet, dilatent
				6	
		32		5	
				7	
	SS-17	33	24	4	Same as 30' to 32'
				8	
		34		9	
				8	
	SS-18	35	10	12	Gray fine Sand, little Silt, wet, dilatent
				13	
		36		13	
				8	
	SS-19	37	10	10	Gray fine Sand, little Silt, wet, dilatent
				12	
		38		14	
				13	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 5

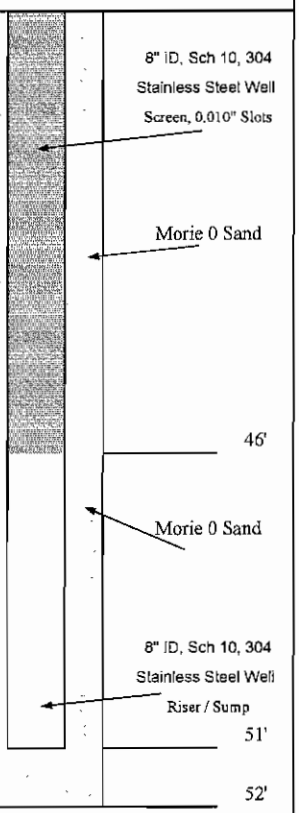
Sheet 3 of 3

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	Cloudy, Rain, Wind, 60 degrees
Date/Time Start	9/27/96, 1545 hrs.
Date/Time Finish	9/30/96 1505 hrs

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	12	11	Gray medium to fine Sand, little Silt, wet, dilatent
				6	
		40		3	
				5	
	SS-21	41	10	7	Dark gray medium to fine Sand, layers of Silt, wet, dilatent
				9	
		42		11	
				5	
	SS-22	43	12	4	Same a 40' to 42'
				9	
		44		12	
				2	
	SS-23	45	0	2	No Recovery, Wash Only
				2	
		46		1	
				1	
	SS-24	47	6	3	Tan, brown Silty Clay layers with gray black medium to fine
				4	Sand, 'interbeds
		48		6	
				1	
	SS-25	49	6	2	Same as 46' to 48' with more Silt
				2	
		50		3	
				1	
	SS-26	51	10	4	Gray and Tan fine Sand and Silt, trace (+) Clay, wet, dilatent
				5	
		52		9	

WELL CONSTRUCTION



STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

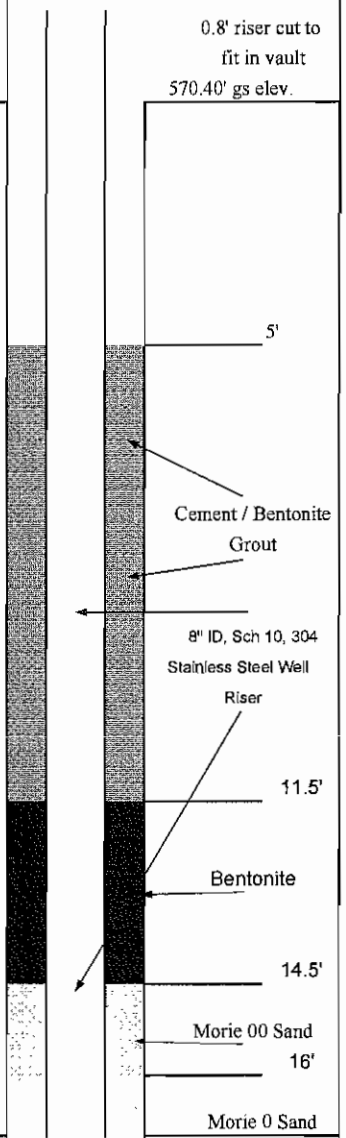
BORING NO. RW - 6

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Sheet	1 of 3
Location:	Cherry Farm/ RiverRoad
Weather	Rain, 45 degrees
Date/Time Start	10/21/96, 0823 hrs.
Date/Time Finish	10/22/96 1700 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			0.8' riser cut to fit in vault, 570.40' gs elev.
				woh	
	SS-1	1	18	5	Black medium to fine Sand, some Silt, wet, dilatent
				4	
		2		4	
				2	
	SS-2	3	24	1	Brown, Black medium to fine Sand for 6", then Gray Clay for
				1	12", then Red Clay for 6", Very strong odor "moth balls"
		4		1	
				woh/24	
	SS-3	5	0		No Recovery
		6			
				woh/24	
	SS-4	7	18		Red, Brown Silty Clay, trace (-) Sand, trace (-) Gravel, wet, soft
					Strong "moth ball" odor
		8			
				1	
	SS-5	9	24	1/18"	Red, Brown Clay and Silty Clay, naphthalene? odor, wet,soft
		10			
				1	
	SS-6	11	24	1/18"	Red, Brown Silt and Clay to 11', top of Marsh at 11', Black fine
					Sand and Silt, little(-) Clay, wet, soft, gray at 12'
		12			
				woh/24	
	SS-7	13	6		Black and Gray fine Sand, Black Silty Clay, wet, soft.
		14			
				1	
	SS-8	15	18	3	Gray medium to fine Sand, trace (+) Silt, wet, dilatent
				3	
		16		4	
				3	
	SS-9	17	18	2	Gray medium to fine Sand, trace (+) Silt, wet, dilatent

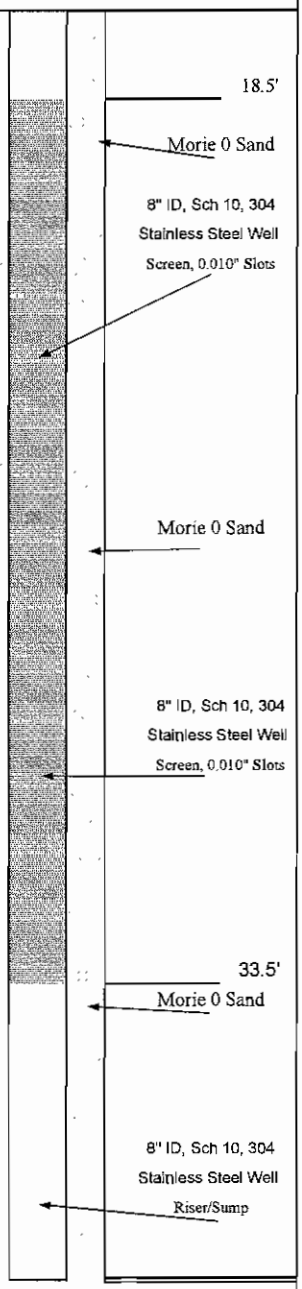


STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

Contractor:	SJB SERVICES	PARSONS ENGINEERING SCIENCE DRILLING RECORD	BORING NO.	RW - 6
Driller:	ART KOSKE			
Inspector:	GEORGE HERMANCE	PROJECT NAME	Cherry Farm/River Road	Sheet 2 of 3
Rig Type:	CME 75-85 TRAC	PROJECT NUMBER	726673.41	Location:
Method:	VARIED			
		Weather	Rain, 45 degrees	
GROUNDWATER OBSERVATIONS		Date/Time Start	10/21/96, 0823 hrs.	
Date				
From		Date/Time Finish	10/22/96 1700 hrs	
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				4	
		18		3	
				2	
	SS-10	19	10	3	Gray medium to fine Sand, little (-) Silt, wet, dilatent
				3	
		20		3	
				2	
	SS-11	21	12	4	Gray fine Sand, trace (+) Silt, trace (-) very fine Gravel, wet
				4	dilatent
		22		8	
				2	
	SS-12	23	24	6	Same as 20' to 22'
				7	
		24		7	
				2	
	SS-13	25	14	4	Gray medium to fine Sand, trace Silt, trace (+) very fine Gravel,
				4	wet, dilatent
		26		9	
				2	
	SS-14	27	6	4	Gray medium to fine Sand, trace (-) Silt, wet, dilatent
				10	
		28		12	
				5	
	SS-15	29	12	7	Gray and Blaek Clay and fine Sand, trace (+) Silt, wet
				7	
		30		10	
				9	
	SS-16	31	0	2	No Recovery
				4	
		32		4	
				3	
	SS-17	33	6	2	Tan Silty Clay, wet, dilatent, soft
				1	
		34		1	
				2	
	SS-18	35	18	4	Tan Silty Clay, some fine Sand in layers, wet, soft
				2	
		36		3	
				1	
	SS-19	37	19	1	Gray, Tan Silty Clay, some Sand and Silt layers, wet
				2	
		38		1	
				5	



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 6

Sheet 3 of 3

Location:

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Weather	Rain, 45 degrees
Date/Time Start	10/21/96, 0823 hrs.
Date/Time Finish	10/22/96 1700 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL	WELL CONSTRUCTION
	SS-20	39	12	7	Tan Silty Clay to 38.5', then to 39.5' broken coarse to fine Sand	Morie 0 Sand
				30	and 'Gravel, Green Shale at 39.5', Top of Rock at 39.5'	39.5'
		40		50/0		

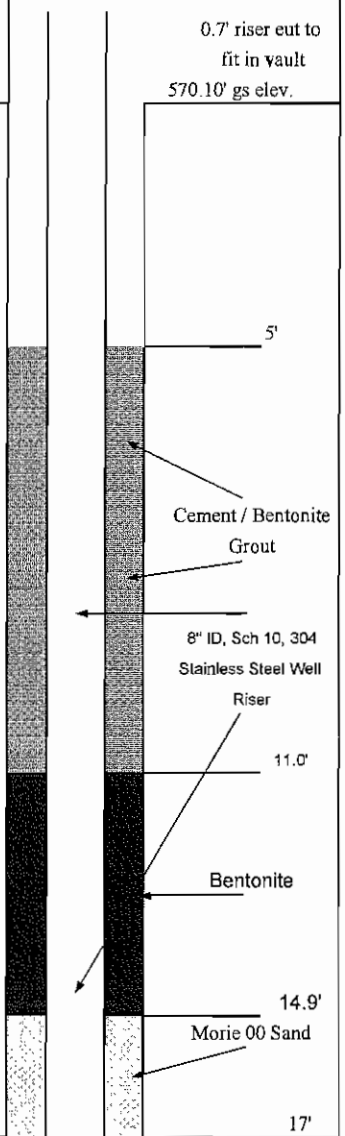
STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

Contractor:	SJB SERVICES	BORING NO.	RW - 7
Driller:	ART KOSKE		
Inspector:	GEORGE HERMANCE	PROJECT NAME: Cherry Farm/River Road	Sheet 1 of 3
Rig Type:	CME 75-85 TRAC	PROJECT NUMBER: 726673.41	Location: Cherry Farm/ RiverRoad
Method:	VARIED		
		Weather: Partly Sunny, 45 degrees	
GROUNDWATER OBSERVATIONS		Date/Time Start: 10/23/96, 0854 hrs.	
Date		Date/Time Finish: 10/24/96 1700 hrs	
From			
DTW			

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				5	
	SS-1	1	12	12	Black medium to fine Sand, traee (-) Silt, Slag, moist
				15	
		2		15	
				50/0	
	SS-2	3	0		Probably Slag
		4			
				5	
	SS-3	5	16	4	Black Slag for 8", then Blaek Gray fine Sand and Silt, trace (+)
				2	roots, top of marsh deposit, reworked, wet
		6		2	
				3	
	SS-4	7	6	4	Brown, Gray medium to fine Sand, traee (+) Silt, trace roots,
				2	wet
		8		3	
				1	
	SS-5	9	16	1	Gray fine Sand and Silt, trace (+) roots, marsh deposit
				3	
		10		4	
				2	
	SS-6	11	6	5	Same as 8' to 10'
				3	
		12		4	
				2	
	SS-7	13	14	1	Gray medium to fine Sand, little(-) Silt, trace (-) roots, wet,
				3	dilatent
		14		5	
				2	
	SS-8	15	16	1	Gray medium to fine Sand, little Silt, wet, dilatent
				1	
		16		1	
				4	
	SS-9	17	24	5	Same as 14' to 16'



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

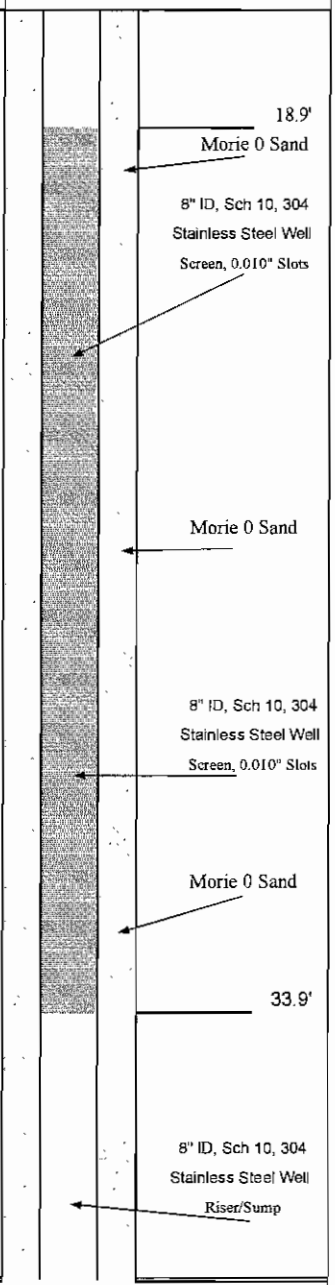
BORING NO. RW - 7

Sheet 2 of 3

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	Partly Sunny, 45 degrees
Date/Time Start	10/23/96, 0854 hrs.
Date/Time Finish	10/24/96 1700 hrs

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				5	
		18		8	
				6	
	SS-10	19	24	3	Gray, fine Sand, trace (+) Silt, wet, dilatent
				6	
		20		5	
				3	
	SS-11	21	10	4	Gray, fine Sand, trace (+) Silt, trace(-) very fine Gravel, wet,
				8	dilatent
		22		11	
				15	
	SS-12	23	24	12	Gray, medium to fine Sand, trace (-) Silt, trace (+) very fine
				11	Gravel, wet
		24		8	
				8	
	SS-13	25	12	8	Gray, medium to fine Sand, little Silt, trace (-) very fine Gravel
				5	wet, dilatent
		26		3	
				6	
	SS-14	27	6	5	Black and Gray fine Sand and Silt, wet, dilatent
				6	
		28		10	
				5	
	SS-15	29	6	4	Same as 26' to 28' with some Silt stringers
				7	
		30		10	
				5	
	SS-16	31	12	7	Black and Gray medium to fine Sand, some Silt, trace (+) very
				6	fine Gravel, wet
		32		8	
				5	
	SS-17	33	16	3	Same as 30' to 32'
				4	
		34		4	
				3	
	SS-18	35	6	4	Dark gray medium to fine Sand, some Silt, trace(-) very fine
				5	Gravel to 35' then Tan Silty Clay, wet
		36		7	
				1	
	SS-19	37	6	3	Gray Tan Silt and Silty Clay, wet
				2	
		38		3	
				5	



WELL CONSTRUCTION

STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 7

Sheet 3 of 3

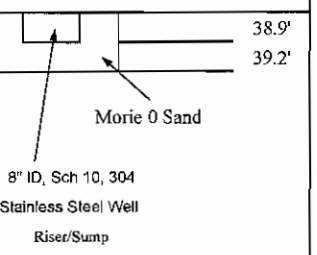
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	Partly Sunny, 45 degrees
Date/Time Start	10/23/96, 0854 hrs.
Date/Time Finish	10/24/96 1700 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	12	4	Tan gray Silt to 39.2' then Green Shale,
				50/.2	Top of rock at 39.2'
		40			

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 8

Sheet 1 of 3

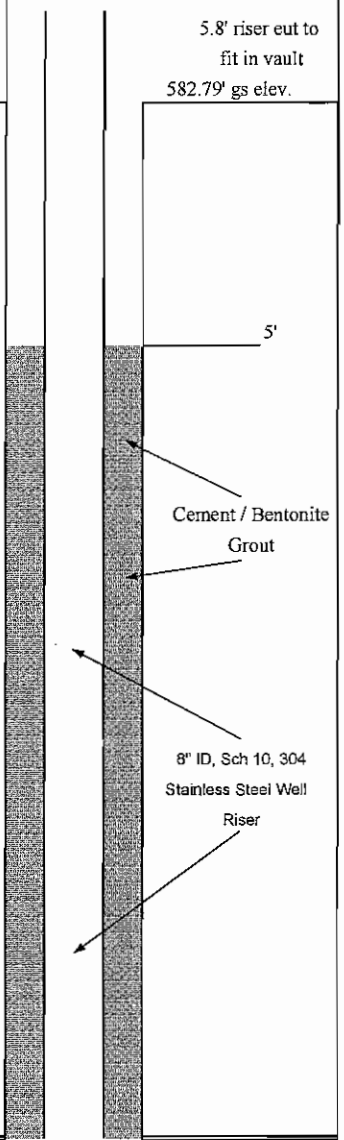
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	Cherry Farm
Weather	Overcast, 60 degrees
Date/Time Start	10/1/96, 1628 hrs.
Date/Time Finish	10/4/96 1025 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				7	
	SS-1	1	20	17	Black , Brown, Gray, wood, slag and Sand, moist
				8	
		2		7	
				17	
	SS-2	3	12	10	Gray, Blaek, Slag, some Saud, moist
				50	
		4		50/.2	
				50/0	
	SS-3	5	0		No Recovery
		6			
				50/.5	
	SS-4	7	6		Slag and Brick
		8			
				50/.4	
	SS-5	9	3		Slag, moist
		10			
				50	
	SS-6	11	12	50	Gray, Brown, Black, Green Slag, wet
				50/0	
		12			
				29	
	SS-7	13	12	50	Gray, Brown, Blaek, Green Slag, wet
				50/0	
		14			
				45	
	SS-8	15	10	50/.4	Gray and Tan Slag, wet
		16			
				34	
	SS-9	17	12	35	Gray Slag, wet

WELL DIAGRAM



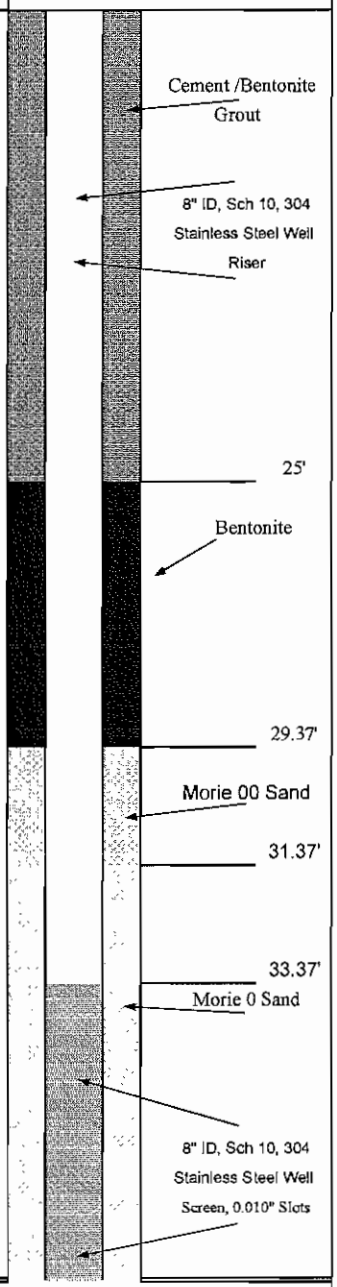
STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

Contractor:	SJB SERVICES	BORING NO.	RW - 8
Driller:	ART KOSKE		
Inspector:	GEORGE HERMANCE	PROJECT NAME	Cherry Farm/River Road
Rig Type:	CME 75-85 TRAC	PROJECT NUMBER	726673.41
Method:	VARIED	Sheet	2 of 3
		Location:	
		Weather	Overcast, 60 degrees
GROUNDWATER OBSERVATIONS		Date/Time Start	10/1/96, 1628 hrs.
		Date/Time Finish	10/4/96 1025 hrs

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				50/.4	
		18			
				14	
	SS-10	19	15	18	Gray Slag, wet to 19', then Black Silty Sand and Clay, trace roots
				4	to 20'
		20		3	
				2	
	SS-11	21	12	2	Dark Gray fine Sand and Silt, trace (+) roots, wet, trace (-)
				1	Clay
		22		1	
				2	
	SS-12	23	24	1	Gray, Brown fine Sand and Silt, wet, trace (+) roots
				2	
		24		2	
				1	
	SS-13	25	20	2	Gray fine Sand, some Silt, trace (+) roots, wet
				1	
		26		4	
				1	
	SS-14	27	18	1	Gray fine Sand, some Silt, wet, dilatent
				1	
		28		1	
				2	
	SS-15	29	24	1	Gray fine Sand, some (-) Silt, trace (-) roots, wet, dilatent
				2	
		30		3	
				2	
	SS-16	31	24	2	Gray fine Sand, some (-) Silt, wet, dilatent
				5	
		32		5	
				2	
	SS-17	33	24	2	Same as 30' to 32'
				2	
		34		1	
				8	
	SS-18	35	20	10	Gray fine Sand, little (+) Silt, trace (-) very fine Gravel, wet,
				12	dilatent
		36		13	
				7	
	SS-19	37	24	9	Same as 34' to 36'
				7	
		38		11	
				2	



WELL CONSTRUCTION

STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 8

Sheet 3 of 3

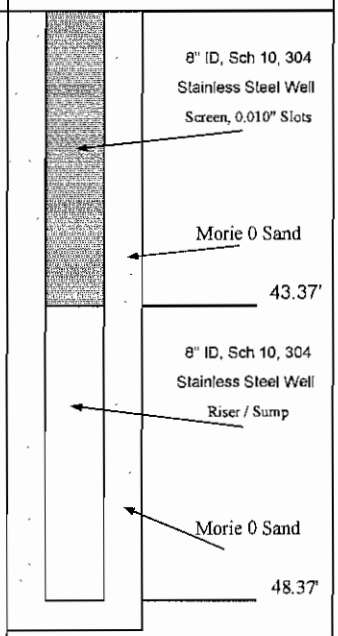
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	Overcast, 60 degrees
Date/Time Start	10/1/96, 1628 hrs.
Date/Time Finish	10/4/96 1025 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	12	3	Gray fine Sand, little Silt, trace (+) Clay, trace (-) very fine
				2	Gravel, wet, dilatent
		40		4	
				3	
	SS-21	41	8	4	Same as 38' to 40'
				2	
		42		5	
				7	
	SS-22	43	12	8	Gray medium to fine SAND, trace (+) Silt, wet
				10	
		44		11	
				4	
	SS-23	45	6	3	Tan Clayey Silt with gray fine Sand layers, wet
				2	
		46		2	
				2	
	SS-24	47	12	1	Tan Silty Clay, trace (-) fine Sand in layers, wet, soft
				3	
		48		1	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 9

Sheet 1 of 3

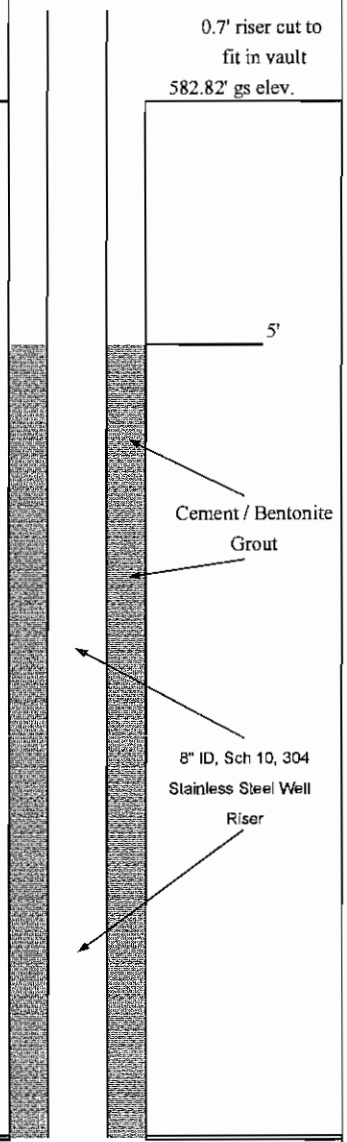
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	River Road
Weather	Partly Cloudy, 40 degrees
Date/Time Start	10/4/96, 1527 hrs.
Date/Time Finish	10/9/96 1715 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				6	
	SS-1	1	6	9	Black fine Sand, Silt, Slag, dry fill
				11	
		2		6	
				5	
	SS-2	3	6	5	Black and Red fine Sand, Slag, Gravel, dry fill
				5	
		4		11	
				6	
	SS-3	5	12	10	Red and Tan brick, Slag, fill, moist
				6	
		6		6	
				8	
	SS-4	7	12	12	Blue, white, Black, Tan, Slag, Sand, moist fill
				10	
		8		7	
				4	
	SS-5	9	8	6	Black and Pink, Slag, moist
				9	
		10		7	
				4	
	SS-6	11	12	4	Broken Slag, black Silt and Sand, moist
				4	
		12		4	
				8	
	SS-7	13	14	4	Black and Red Broken Slag, Sand, some Silt, wet at 13'
				3	
		14		50/.4	
				1	
	SS-8	15	6	4	Black Slag, wet
				8	
		16		6	
				4	
	SS-9	17	12	3	Black Slag, wet to 17'. Then Black fine Sand and Silt, wet,

WELL DIAGRAM



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

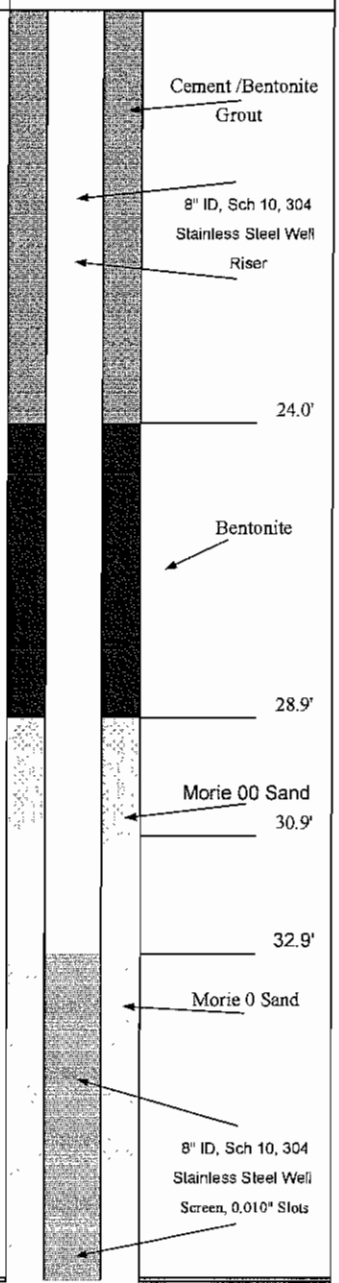
BORING NO. RW - 9

Sheet 2 of 3

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	Partly Cloudy, 40 degrees
Date/Time Start	10/4/96, 1527 hrs.
Date/Time Finish	10/9/96 1715 hrs

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
				2	roots, 'Top of Marsh Deposit at 17'
		18		2	
				18	
	SS-10	19	0	20	No Recovery
				50/0	
		20			
				1	
	SS-11	21	18	1	Gray fine Sand, little Silt, trace (+) roots, wet, dilateut
				2	
		22		2	
				1	
	SS-12	23	18	2	Gray fine Sand, little Silt, trace (+) roots, wet, dilatent
				2	
		24		2	
				2	
	SS-13	25	12	3	Gray fine Sand, little Silt, trace (-) roots, wet, dilatent
				5	
		26		8	
				8	
	SS-14	27	20	14	Gray fine Sand, little (-) Silt, wet, dilatent
				13	
		28		13	
				5	
	SS-15	29	16	8	Gray fiue Saud, trace (+) Silt, wet, dilatent
				9	
		30		10	
				5	
	SS-16	31	15	8	Same as 28' to 30'
				10	
		32		13	
				5	
	SS-17	33	22	9	Gray medium to fine Sand, trace (-) Silt, wet, dilatent
				12	
		34		18	
				13	
	SS-18	35	18	12	Gray medinm to fine Sand, trace (-) Silt, trace (-) very fine
				11	Gravel, wet, dilatent
		36		13	
				15	
	SS-19	37	16	12	Same as 34' to 36'
				10	
		38		14	
				7	



STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 9

Sheet 3 of 3

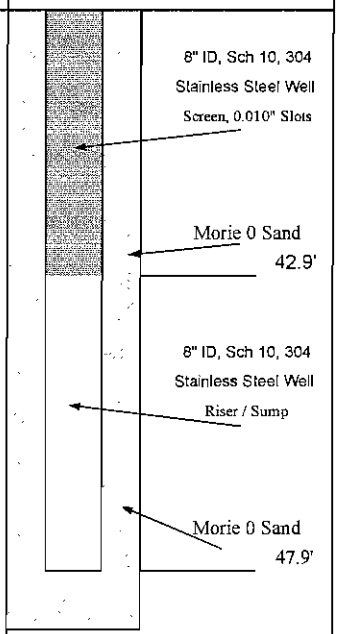
Location:

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Weather	Partly Cloudy, 40 degrees
Date/Time Start	10/4/96, 1527 hrs.
Date/Time Finish	10/9/96 1715 hrs

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	15	7	Gray medium to fine Sand, little (-) silt, trace(-) very fine
				6	Gravel, wet , dilatent
		40		7	
				5	
	SS-21	41	20	7	Gray medium to fine Sand, trace (+) very fine Gravel, trace (-)
				5	Silt, wet
		42		11	
				6	
	SS-22	43	24	10	Same as 40' to 42'
				7	
		44		8	
				6	
	SS-23	45	24	4	Gray fine Sand and Silt, trace Clay, wet
				3	
		46		4	
				2	
	SS-24	47	12	3	Gray medium to fine Sand, layered with Tan Silty Clay, wet
				1	
		48		2	

WELL CONSTRUCTION



STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 10

Sheet 1 of 3

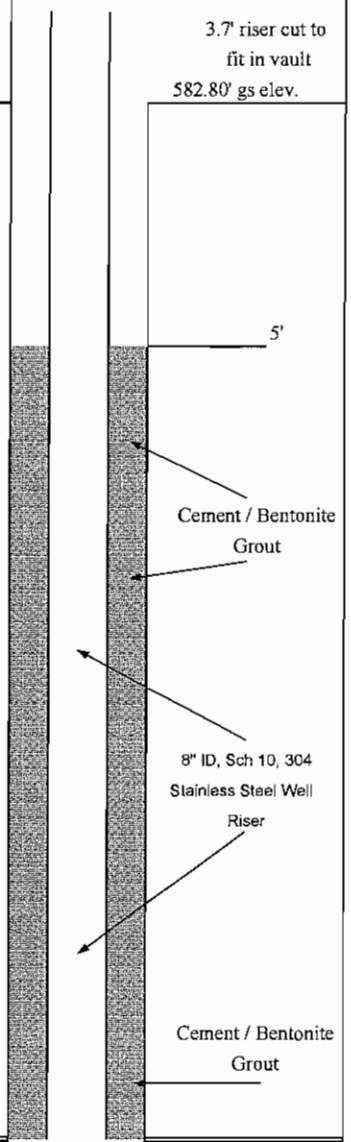
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	River Road
Weather	Clear, Cold, Calm, 40 degrees
Date/Time Start	10/15/96, 0800 hrs.
Date/Time Finish	10/18/96 1130 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				5	
	SS-1	1	2	10	Fill, soil, rock chips, coarse ground, dry
				11	
		2		8	
				20	
	SS-2	3	4	50/0	Fill as above, soil, gravel, rock debris, dry
		4			
				3	
	SS-3	5	6	3	light to dark gray, fine to medium Sand, little gravel, angular
				6	dry
		6		6	
				11	
	SS-4	7	18	27	6 to 6.5' as above
				40	6.5' to 8' light gray salt and pepper fine Sand, medium Gravel
		8		35	angular, lime like odor, loose, damp
				50/.5	
	SS-5	9	2		Light Gray, Pink, Green Fill, fine to medium Sand, fill, rock
					chips, lime odor, damp
		10			
				40	
	SS-6	11	12	50/.2	Light gray gravel and Sand, as above
		12			
				10	
	SS-7	13	4	50/.5	Strong alkali odor, gray fill as above
		14			
				50/.4	
	SS-8	15	4		Light gray salt and pepper loose Sand and Gravel, damp,
					alkali odor, damp
		16			
				40	
	SS-9	17	12	50/.3	light gray fine to medium Sand, medium gravel, angular

WELL DIAGRAM



STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

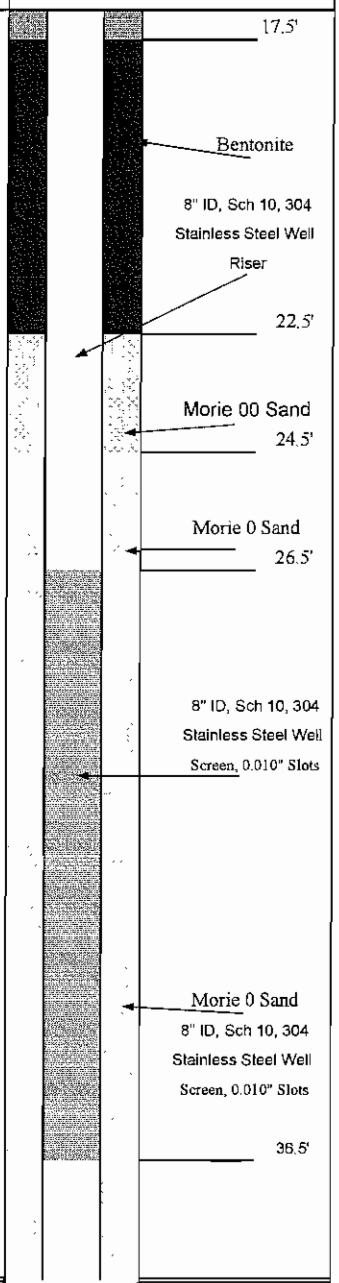
SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

Contractor:	SJB SERVICES	BORING NO.	RW - 10
Driller:	ART KOSKE		
Inspector:	GEORGE HERMANCE	PROJECT NAME: Cherry Farm/River Road	Sheet 2 of 3
Rig Type:	CME 75-85 TRAC	PROJECT NUMBER: 726673.41	Location:
Method:	VARIED		
		Weather: Clear, Cold, Calm, 40 degrees	
GROUNDWATER OBSERVATIONS		Date/Time Start: 10/15/96, 0800 hrs.	
Date		Date/Time Finish: 10/18/96 1130 hrs	
From			
DTW			

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
					trace to little Silt, wet at 16.5'
		18			
				1	
	SS-10	19	20	2	18' to 18.5' as above, 18.5' to 20' through black fine Sand,
				2	trace dark brown, gray, black, fine Sand and Silt, organic
		20		1	deposits
				4	
	SS-11	21	15	2	Black fine Sand and Silt, trace (-) Clay, trace (+) roots, wet
				2	
		22		1	
				3	
	SS-12	23	18	5	Black fine Sand and Silt, trace (-) Clay, wet
				4	
		24		6	
				2	
	SS-13	25	15	1	Black fine Sand and Silt,trace (-) Clay, wet and dilatent
				3	
		26		2	
				3	
	SS-14	27	18	2	Black fine Sand and Silt to 26.5' then Gray fine Sand, little Silt
				6	wet, dilatent
		28		7	
				2	
	SS-15	29	14	5	Gray fine Sand, little Silt, wet, dilatent, trace (-) roots in layers
				5	
		30		8	
				5	
	SS-16	31	10	7	Gray medium to fine Sand, little (-) Silt, wet, dilatent
				9	
		32		12	
				5	
	SS-17	33	18	7	Same as 30' to 32'
				9	
		34		12	
				4	
	SS-18	35	12	3	Gray medium to fine SAND, trace (+) Silt, wet, dilatent,
				6	
		36		4	
				1	
	SS-19	37	14	7	Gray medium to fine SAND, little (+) Silt in some layers, wet,
				8	dilatent
		38		5	
				6	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 10

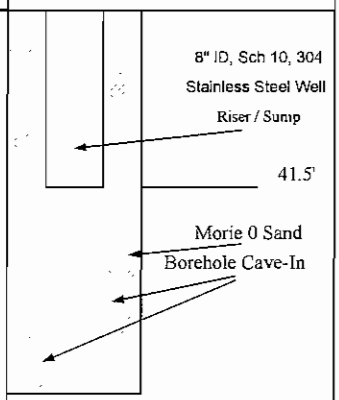
Sheet 3 of 3

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	Clear, Cold, Calm, 40 degrees
Date/Time Start	10/15/96, 0800 hrs.
Date/Time Finish	10/18/96 1130 hrs

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	12	4	Gray fine Sand with layers of Silt, trace (+) Clay, wet , dilatent
				2	
		40		3	
				3	
	SS-21	41	12	2	Gray fine Sand Layered with Tan Silty Clay, wet, dilatent
				1	
		42		3	
				2	
	SS-22	43	15	3	
				1	Same as 40' to 42'
		44		3	
				8	
	SS-23	45	10	5	Gray medium to fine SAND layered with Tan Silty Clay, wet
				6	
		46		4	
				5	
	SS-24	47	18	3	Same as 44' to 46'
				5	
		48		2	

WELL CONSTRUCTION



STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 11

Sheet 1 of 3

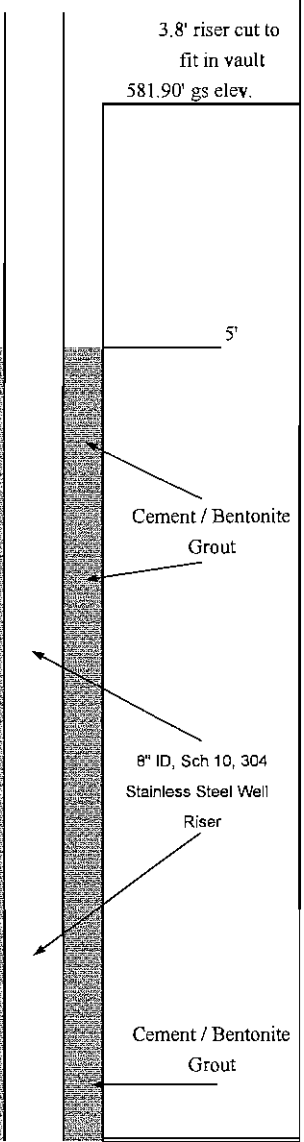
Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	River Road
Weather	Partly Cloudy, 40 degrees
Date/Time Start	10/10/96, 1135 hrs.
Date/Time Finish	10/14/96 1600 hrs

GROUNDWATER OBSERVATIONS

Date	01/00/00			
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		0			
				1	
	SS-1	1	12	1	Brown Clayey Silt, trace fine Gavel, moist, cover soil
				2	
		2		3	
				5	
	SS-2	3	20	6	Brown, Black Silty Clay, Black fine Sand, Slag, fill
				9	moist
		4		25	
				25	
	SS-3	5	6	50/.2	Bricks, Fill
		6			
				14	
	SS-4	7	16	24	Black, White, Blue, Gray, Slag and fine Sand, moist
				15	
		8		19	
				10	
	SS-5	9	16	13	Brown fine Sand, gray Slag, cement slag, damp
				12	
		10		10	
				6	
	SS-6	11	14	5	Brown fine Sand, gray Slag, cement slag, damp
				13	
		12		7	
				8	
	SS-7	13	2	50/.1	Brown fine Sand and Slag, wet, spoon is wet at 14'
		14			
				19	
	SS-8	15	8	50/.4	Gray Slag, wet
		16			
				9	
	SS-9	17	6	50/.4	Slag, wet

WELL DIAGRAM



STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

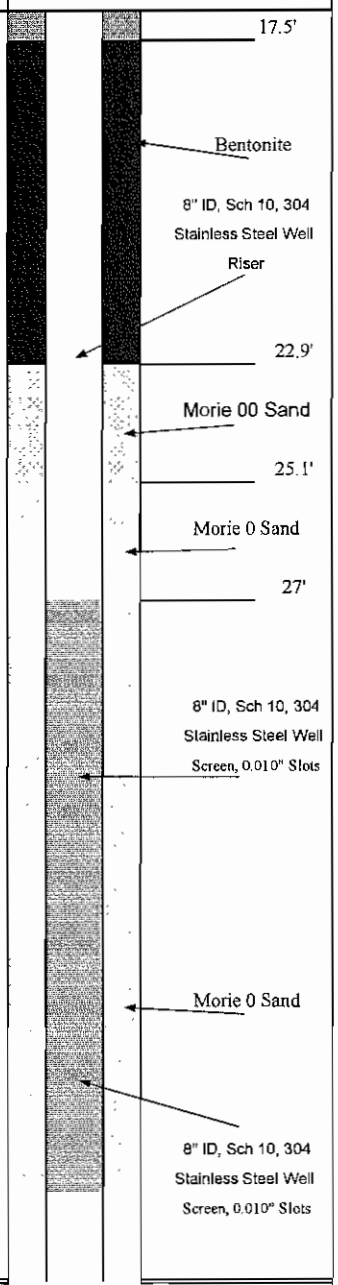
BORING NO. RW - 11

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Sheet	2 of 3
Location:	
Weather	Partly Cloudy, 40 degrees
Date/Time Start	10/10/96, 1135 hrs.
Date/Time Finish	10/14/96 1600 hrs

GROUNDWATER OBSERVATIONS

Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
		18			
				4	
	SS-10	19	24	3	Slag for 0.5' then Black Gray fine Sand and Silt, trace (+) roots,
				2	trace (-) Clay. wet
		20		2	
				3	
	SS-11	21	0	2	No recovery
				3	
		22		2	
				2	
	SS-12	23	8	3	Dark gray and Black, Sandy Silt, wet, trace (+) roots
				4	
		24		3	
				2	
	SS-13	25	12	4	Gray laminated fine Sand, some (-) Silt, wet, dilatent
				4	
		26		7	
				7	
	SS-14	27	18	7	Gray fine Sand, little Silt, wet, dilatent
				11	
		28		13	
				4	
	SS-15	29	16	5	Gray fine Sand, trace (+) Silt, wet, dilatent
				7	
		30		8	
				7	
	SS-16	31	12	8	Gray fine Sand, trace (+) very fine Gravel, Trace (-) Silt, wet
				6	
		32		5	
				5	
	SS-17	33	15	6	Gray medium to fine Sand to 33' , then Gray fine Sand layered
				7	with light gray clayey silt, wet
		34		10	
				2	
	SS-18	35	12	5	Gray fine Sand layered with light gray clayey silt, wet
				3	
		36		2	
				5	
	SS-19	37	18	3	Same as 34' to 36'
				2	
		38		2	
				2	



WELL CONSTRUCTION

STANDARD PENETRATION
SS = SPLIT SPOON
A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

PARSONS ENGINEERING SCIENCE
DRILLING RECORD

BORING NO. RW - 11

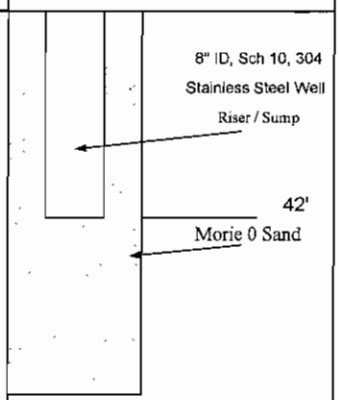
Sheet 3 of 3

Contractor:	SJB SERVICES
Driller:	ART KOSKE
Inspector:	GEORGE HERMANCE
Rig Type:	CME 75-85 TRAC
Method:	VARIED
PROJECT NAME	Cherry Farm/River Road
PROJECT NUMBER	726673.41
Location:	
Weather	Partly Cloudy, 40 degrees
Date/Time Start	10/10/96, 1135 hrs.
Date/Time Finish	10/14/96 1600 hrs

GROUNDWATER OBSERVATIONS				
Date				
From				
DTW				

Photovac Reading	Sample I.D.	Sample Depth	Inches Recovery	SPT	FIELD IDENTIFICATION OF MATERIAL
	SS-20	39	17	2	Same as 36' to 38'
				2	
		40		3	
				4	
	SS-21	41	20	2	Tan, Gray Silty Clay with fine Sand lamina, wet
				1	
		42		1	
				1	
	SS-22	43	16	3	Same as 40' to 42'
				5	
		44		3	
				2	
	SS-23	45	14	20	Tan, Gray Silty Clay to 45' then Green Shale, TOR at 45'
				50/.2	

WELL CONSTRUCTION



STANDARD PENETRATION

SS = SPLIT SPOON

A = AUGER CUTTINGS

SUMMARY: Depth and elevation noted at time borehole was drilled

APPENDIX B

SAMPLING FORMS

WELL SAMPLING RECORD

Site Name | Well ID

Samplers

Total Well Depth (TOC)	feet
Initial Static Water Level (TOC)	feet
Well Diameter	inches

Purging Data

Method | Date/Time

Water Volume = (Total Depth of Well - Depth To Water) x Casing Volume per Foot

Well depth	DTW	Casing Vol. per foot	Water Volume

gallons

Casing Volumes (gal/ft.):					
1-inch	0.041	4-inch	0.64	10-inch	4
2-inch	0.16	6-inch	1.4		
3-inch	0.36	8-inch	2.5		

Volume of Purge Water Removed gallons

Sampling Data

Method | Date/Time

Parameters	Bottle	Preservation	Method

Field Parameters

	1 Volume	*2 Volume*	3 Volume	*Sample*
pH				
Temp. (°C)				
Spec. Cond. (mS/cm)				
Turbidity (NTU)				
Dissolved oxygen (DO)				
ORP				

Comments:

SURFACE WATER SAMPLING RECORD

Site Name | Sample ID

Samplers

Sample Description

Drainage Direction
Type of Water Body
Physical Appearance/Odor
Color/Stain

Sampling Data

Method
Depth

Date/Time

Parameters	Bottle	Preservation	Method

Field Parameters

pH
Temp. (°C)
Spec. Cond. (mS/cm)
Turbidity (NTU)
Dissolved oxygen (DO)
ORP

Comments

APPENDIX C

INSPECTION FORMS

POST-REMEDIAL ACTION CAP INSPECTION REPORT FORM
CHERRY FARM/RIVER ROAD SITE, TONAWANDA, NEW YORK

Date/Time: Attendees:

INSPECTION OF:	Condition		Action Required		Comments/Location
	Adequate/ Stable	Damaged/ Deteriorating	Yes	No	
1. Facility Access Control					
A. Security Fences					
1. Gaps beneath fence					
2. Chain-link fabric					
3. Fence posts					
B. Site access gates					
1. Gate repairs					
2. Gate locks					
C. Warning signs					
D. Access roads					
E. Buildings					
F. Exterior Lighting at Plant					
2. Final Cover System					
A. Vegetative Cover					
1. Cover Growth					
2. Mowing					
B. Settlement					
C. Erosion					
D.Drainage Controls					
1. Vegetated Swales					
2. Rip Rap Lined Swales					
3. Culverts					
4. Riprap Shoreline					
5. Barrier Islands					
6. Gabion Walls					
E. Animal Control					
F. Debris, Litter, Waste					
3. In-river Sediment Caps					
4. Groundwater Monitoring System					
A. Monitoring Wells					
1. Well Casing and Cap					
2. Protective Casing					
3. Locks					
4. Surface Seal					
5. Floats/Pumps	NA				
6. Piping					
7. Sedimentation					
8. LNAPL					
B. Observation Wells					
1. Sedimentation					
2. LNAPL					
B. Sumps					
1. Sedimentation					
2. LNAPL					
3. Floating Debris					

APPENDIX D

SPECIFICATION FOR FINISH GRADING, TOPSOIL, AND SEEDING

SECTION 02990

FINISH GRADING, TOPSOIL AND SEEDING

PART 1 - GENERAL

1.01 Work Specified

A. The work specified herein includes the material, equipment, and labor necessary to provide finish grading and to place topsoil, fertilizer, seed, mulch, and erosion control fabric. The mulch and erosion control fabric shall be placed as follows:

1. Mulch - shall be utilized on all slopes.
2. Natural erosion control fabric - shall be utilized as indicated on the Drawings.

B. Related work specified in other sections:

1. Section 01500 - Temporary Facilities and Field Office
2. Section 01564 - Erosion Control
3. Section 02222 - Excavation
4. Section 02260 - Landfill Cover Construction
5. Section 02269 - QA/QC for Landfill Cover Soil Material

1.02 Submittals

A. Materials and Products: Submit for approval data.

1. Topsoil Source: The Contractor shall submit for approval by the Engineer, a written statement giving location of topsoil source. If soil amendments are proposed, submit amendment types, quantities, mixes and test results.
2. Grass Seed Vendors Certificate: The Contractor shall submit the seed vendor's certified statement for the grass seed mixture required, stating common name, percentage by weight, and percentages of purity, and germination.
3. Fertilizer: Submit manufacturer's product data showing contents and test results.
4. Hydroseeders: The Contractor shall submit for approval by the Engineer, all data concerning hydroseeding equipment (if used) including all material application rates.
5. Erosion Control Fabrics: The Contractor shall submit for approval by the Engineer, the erosion control fabric manufacturer's literature, samples and specifications.

B. Installer - Submit the name of subcontractors (if used) and Qualification Statements.

C. Manufacturer's Certification - Certify that products meet or exceed specified requirements.

1.03 Quality Assurance

A. All plants shall conform to or surpass minimum quality standards as defined by the American Association of Nurserymen. All plant materials must be clearly labeled with genus, species, and common name. These plants may be inspected for conditions of root ball, disease, insects, or injury. All rejected plant materials must be removed immediately from the job site and must be replaced by

the Contractor at no cost to the Owner within 5 working days. The Engineer has the right to inspect and reject plant materials up to the final acceptance.

B. Certificates. In addition to any other certificates specified, the Contractor shall furnish a certificate with each delivery of material, in containers or bulk, the analysis of the material, together with the date of delivery. All certificates shall be delivered to the Engineer, who will inspect the materials prior to its use.

C. Seeding. Seed shall be labeled in accordance with USDA Rules and Regulations under the Federal Seed Act and applicable State seed laws. Seed shall be furnished in sealed bags or containers bearing the date of the last germination which shall be within a period of six (6) months prior to commencement of planting operations. Seeding material shall be inspected upon arrival at the job site, and unacceptable material shall be removed from the job site. Seed shall be from same or previous year's crop; each variety of seed shall have a purity of not less than 85%, a percentage of germination not less than 90%, shall have a weed content of not more than 1% and contain no noxious weeds.

PART 2 - PRODUCTS

2.01 Topsoil

A. Topsoil shall be natural, friable, fertile soil of loamy character, capable of sustaining healthy plant life, and reasonably free from subsoil, roots, heavy or stiff clay, stones larger than 2 inches in greatest dimension, noxious weeds, sticks, brush, litter, and other deleterious matter. Topsoil as delivered to the site or stockpiled shall meet the following requirements:

a. shall be well graded with a maximum particle size of 2 inches, 85 to 100 percent passing 1 inch, 65 to 95 percent passing 1/4 inch, and 20 to 80 percent passing a Number 200 sieve. Clay content of material passing the Number 200 sieve shall not be greater than 30 percent, as determined by hydrometer analysis;

b. pH between 6.0 and 7.5;

c. shall contain not less than 3 percent organic matter nor more than 20 percent as determined by loss of ignition of moisture-free samples dried at 100° to 110° Celsius;

d. free of pest larvae; and

e. soluble salt content not greater than 500 ppm.

B. Quality Control

1. The Company shall provide the services of an Engineer and an independent soils testing laboratory to conduct quality assurance testing.

2. The following material property test methods and frequency shall be conducted for soil:

Material Property	Test Method	Frequency
Grain-size Analysis with Fines	ASTM D-422	10,000 cubic yards
Soil pH	ASTM D-4972	10,000 cubic yards
Organic Content	ASTM D-2974	10,000 cubic yards

---

3. Additional testing will required if alternate sources are proposed or utilized.

C. Fertilizer

All soil placed for riverbank restoration and wetland creation shall be amended with fertilizer. Fertilizer shall be a starter fertilizer of commercial stock, of neutral character, with elements derived from organic sources. It shall be a complete, prepared and packaged material and shall contain a minimum of 8% nitrogen, 20% phosphoric acid and 10% potash. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

2.03 Grass Seed

The seed mixture will consist of the following proportions or approved equal.

Common Name	% By Weight
Red, Chewing, and Tall Fescue	40
Perennial Ryegrass	25
Annual Ryegrass	15
Cliomax Timothy	15
White Clover	05

2.04 Fertilizer

A. Fertilizer shall be a starter fertilizer of commercial stock, of neutral character, with elements derived from organic sources. It shall be a complete, prepared and packaged material and shall contain a minimum of 18 percent nitrogen, 24 percent phosphoric acid, and 6 percent potash. Other fertilizer mixes may be acceptable provided the application rate is adjusted to provide equal quantities. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

1. Product and Manufacturers:
    a. Scotts Starter Fertilizer by Scott and Son
    b. or equal

2.05 Mulch

A. Straw Mulch

Mulch shall be comprised of clean, threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10 inches or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.

B. Hydromulch

Hydromulch - Wood Cellulose Fiber Pulp.

a. Provide a specially prepared wood cellulose fiber, processed to contain no growth or germination inhibitor factors, and dyed an appropriate color to facilitate visual metering of application of the materials.

b. Hydromulch manufactured from recycled paper products will be acceptable.

c. Product and Manufacturer:
    1. Conwed Virgin Wood Fiber Mulch by Conwed, Inc.
    2. Silva Fiber by Weyerhaeuser Co.
    3. or equal

2.06 Natural Erosion Control Fabric

A. The natural erosion control fabric shall be a machine-produced mat of 100 percent biodegradable material.

1. Straw matting

a. The material shall contain straw at 0.5 pounds per square yard with netting on one side only.

b. Product and Manufacturer:

1. Erosion Mat S75 by North American Green

2. or equal

2. Wood Excelsior Blanket

a. Provide a specially prepared machine produced mat of curled and barbed wood excelsior. 80 percent of the fibers shall be 6-inches or longer. Fibers shall be evenly distributed through the blanket and secured by a photodegradable plastic mesh. The fibers shall not contain growth or germination inhibitors.

b. Product and Manufacturer:

1. Curlex Blanket by American Excelsior Co.

2. or equal

3. Jute Mesh

a. Provide a mesh blanket of coired coconut fiber twine.

b. Product and Manufacturer:

1. Bio D-Mat 90 by Rolanka International, Inc.

2. or equal.

B. The wire staples for securing erosion control fabrics shall be U-shaped and formed of 11-gauge plain iron wire with dimensions of 6-inch minimum length and 2-inch minimum width.

PART 3 - EXECUTION

A. All final grade surfaces shall receive six (6) inches minimum of compacted topsoil, seeding, mulch/or erosion control fabric, and fertilizer in accordance with this section.

B. All final grade surfaces outside the cover limits that have been disturbed or damaged during completion of the work shall be reseeded using a mixture of seed which shall produce similar vegetative growth as existed prior to commencement of the work.

C. The Contractor shall place mulch or erosion control fabric as follows:

1. Mulch on all slopes less or equal to 15 percent.

2. Natural erosion control fabric on all disturbed or constructed slopes greater than 15 percent or as indicated on the Drawings, whichever is more stringent.

3.01 Application Procedures

A. Topsoil

1. The Contractor shall place a minimum of six (6) inches of compacted topsoil over excavated areas, the landfill cover area, and the disturbed areas as directed by the Engineer.

2. The underlying soil shall be tilled to a depth of 2 inches by disking or harrowing before topsoil placement. Tillage shall be parallel to contours, and shall not be performed when the cover is frozen or excessively wet.

3. Topsoil shall be placed to a depth sufficiently greater than required so that after compaction, the complete work will conform to the lines, grades, and elevations indicated on the Drawings and the six (6) inch minimum requirement. No topsoil shall be spread in water or while frozen or muddy.

4. The topsoil shall then be rolled or compacted with a cultipacker weighing not more than 100 pounds per foot of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional topsoil, and the surface shall be regraded and rolled until a smooth and even finished grade is created.

B. Fertilizer

1. The fertilizer shall be applied with a mechanical spreader at a minimum rate of 200 lbs/acre or in accordance with the manufacturer's suggested rate.

2. After topsoil has been spread and the fertilizer applied, it shall be carefully prepared by scarifying or harrowing to a depth of 2 inches and left in a roughened condition for seeding. All stiff clods, lumps, roots, litter and other foreign material shall be removed from the area and disposed of by the Contractor.

C. Seeding

1. The seed mixture shall be applied uniformly upon the prepared surface with a hand or mechanical spreader at a minimum rate of 100 lbs/acre. The seed shall be raked lightly into the surface and rolled. Seeding shall be conducted from April 1 to May 30 or from August 15 to October 1.

D. Mulch and Erosion Control Fabrics

1. Mulch or erosion control fabric shall be placed immediately after the application of fertilizer and seed.

2. Areas that have been seeded and have a slope less than or equal to 15 percent shall be protected from erosion by the placement of straw mulch or hydromulch. Straw mulch shall be applied with a mulch blower at a uniform rate of 1500 lbs/acre and anchored by use of a tackifier.

3. Natural erosion control fabrics shall be installed in lieu of the mulch in areas that have a slope greater than 15 percent or as indicated on the Drawings.

E. Watering

1. Following applications of the mulch or erosion control fabric, the seed bed shall be moistened. A muddy soil condition will not be acceptable. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory growth. Watering shall be done in such a manner to prevent washing out of seed.

2. The stand of grass resulting from the seeding shall not be considered satisfactory until accepted by the Owner. If areas are determined to be unacceptable, the remaining mulch or erosion control fabric will be removed and all areas shall be reseeded, refertilized and remulched and erosion control fabric replaced as per the above application procedures at the Contractor's expense.

3.02 Maintenance

A. The Contractor shall begin a maintenance period immediately after planting of grass and landscape materials.

B. The Contractor shall maintain grass areas, for the periods required to establish an acceptable growth, but not less than 60 days, after seeding. If seeded in the fall and not given a full 60 days of maintenance, or if not considered acceptable by the Owner and the Engineer at that time, continue maintenance during following spring until acceptable grass stand is established.

C. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory sod growth. Watering shall be in such a manner as to prevent washing out of seed.

3.03 Warranty

A. The warranty period shall be one year from the date of substantial completion or correction period. Areas of erosion shall be immediately repaired, re-seeded, re-mulched and maintained until an acceptable grass stand is established. Areas to be repaired shall also include areas failing to produce a full, uniform strand of grass.

-- END OF SECTION 02990 --

APPENDIX E

OPERATIONS, MAINTENANCE, AND MONITORING HEALTH AND SAFETY PLAN

GROUNDWATER & ENVIRONMENTAL SERVICES, INC.

SITE-SPECIFIC HEALTH AND SAFETY PLAN FOR

Cherry Farms - River Road

4100 River Road

Tonawanda, New York 14150

ANNUAL UPDATE COMPLETED ON (DATE): 3/10/2017

EMERGENCY PHONE NUMBERS:

Local Police 911

Local Fire 911

Local Rescue 911

Local Hospital Name, Phone Number & Address (Map and directions are attached):

Hospital Name	Kenmore Mercy Hospital
Street Address	2950 Elmwood Avenue
City, State, Zip	Kenmore, New York 14217
Phone Number	716-447-6100

National Response Center (NRC): 1-800-424-8802
The NRC should be contacted in the event of a significant chemical release. Once notified, the NRC will activate a federal response to the spill. *Please confirm with the client and project manager to determine if the spill should be reported*.

Poison Control Center: 1-800-222-1222
The Poison Control Center should be contacted in the event of accidental poisoning. They will provide information on immediate treatment for the poisoning.

Project Contact Information:

Role	Name	Phone Number	Cell Phone Number
Site Supervisor	GES Personnal	N/A	GES Personnel Cell Phone
Project Manager	Genevieve Bock	800-360-9405 ext.4302	856-906-5642
Vice President of Corporate Health and Safety	Thomas M. Baylis	1-800-426-9871 ext. 3021	610-587-1124
Client Representative	David Flynn	716-847-5473	716-430-9940

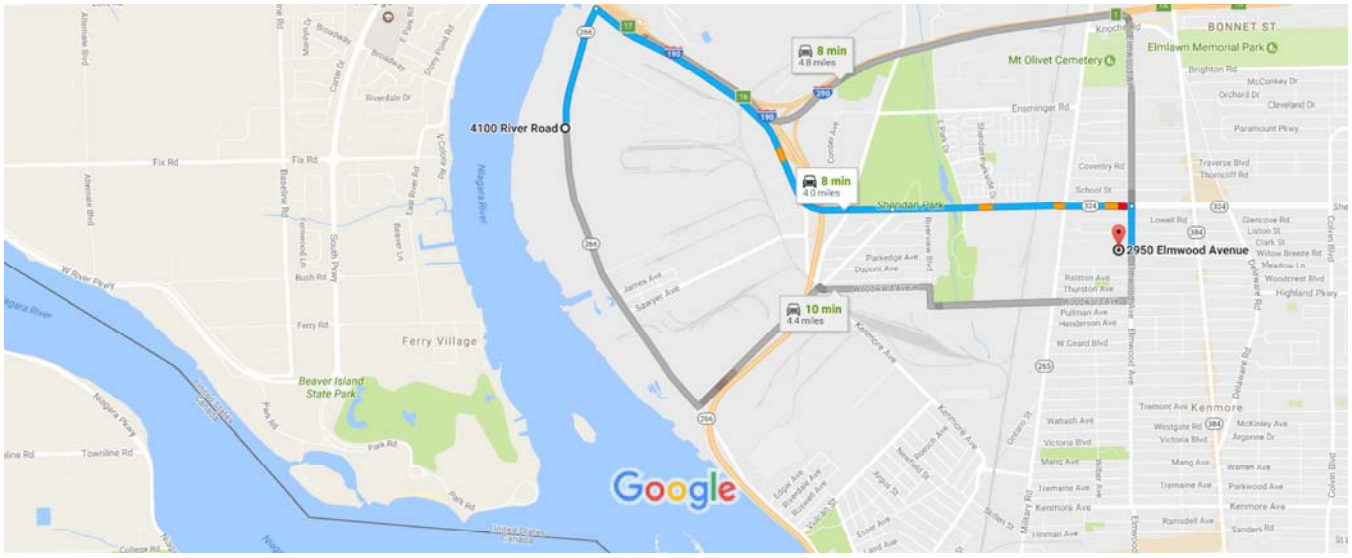
DO NOT TRANSPORT SERIOUSLY INJURED PERSONNEL TO THE HOSPITAL
CALL 911

HOSPITAL ROUTE MAPS

Google Maps

4100 River Rd, Tonawanda, NY 14150 to 2950 Elmwood Avenue, Kenmore, NY

Drive 4.0 miles, 8 min



Map data ©2017 Google 2000 ft

4100 River Rd

Tonawanda, NY 14150

1. Head north on River Rd — 0.6 mi
2. Turn right onto Grand Island Blvd — 2.0 mi
3. Merge onto Sheridan Dr — 1.2 mi
4. Turn right onto Elmwood Ave — 0.2 mi

2950 Elmwood Ave

Kenmore, NY 14217

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Table of Contents

LIST OF FIGURES

LIST OF ATTACHMENTS

1.0 INTRODUCTION

1.1 APPROVALS

	Name	Title	Date	Signature
Prepared By	Jessica Thomas	Associate Engineer	3/10/2017	
Reviewed By (Project Manager)	Genevieve Bock	Sr. Project Engineer	3/20/2017	APPROVED By gbock at 2:54 pm, Mar 20, 2017
Approved By	Mark Lancaster	RHSO	3/28/2017	APPROVED By Mark Lancaster at 4:17 pm, Mar 28, 2017

1.2 SITE BACKGROUND

Project Name	Cherry Farms - River Road
Site Address	4100 River Road, Tonawanda, NY 14150
Nearest Intersection	River Road and Grand Island Blvd
Township/Municipality	Tonawanda
County	Erie
Additional Information	Site includes and active waste treatment plant with four recovery sumps.

1.3 SCOPE OF WORK

Task 1 – General Site Activities

Task 2 – Site Visit

Task 3 – O&M

Task 4 – Groundwater Sampling

Task 5 – Liquid Level Gauging

Task 6 – System Sampling

Task 7 – CAP maintenance

Task 8 –

Task 9 –

Task 10 –

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Responsibility	Name	Task Description
Project Manager	Genevieve Bock	Oversee and coordinate all budget and technical aspects for the project
Regional Health & Safety Manager/Officer	Mark Lancaster	Coordinate all health and safety operations for the project site
Site Supervisor	GES Personnel	Oversee and coordinate all health and safety aspects from the project site

3.0 OSHA TRAINING REQUIREMENTS

3.1 GENERAL TRAINING REQUIREMENTS

All personnel performing activities covered by this plan must be trained in accordance with the requirements of 29 CFR 1910.120(e). The Project Manager will verify and document that all GES personnel meet the applicable training requirements prior to the start of site work, including:

- OSHA 1910.120 initial 40-hour training
- OSHA annual eight-hour refresher training within the last year
- OSHA eight-hour supervisory training for on-site managers and supervisors and GES requirements
- At least one GES employee will have American Red Cross (or equivalent) first aid and CPR training, and will be present on-site at all times

The Corporate HSSE (CHSSE) department will maintain documentation for training certification.

Subcontractors chosen to perform well drilling, excavation, materials disposal, utility installation in trenches, and any other site activities where the potential exists for contact with contaminants must provide written documentation of HAZWOPER training, for each of his employees who will be involved in activities at this site, before the start of work.

3.2 PRE-ENTRY MEETING

A Pre-entry meeting reviewing the Site Specific Health and Safety Plan for all proposed work location personnel shall be held and documented in this HASP and in the site log.

This meeting shall be prior to the commencement of any on-site work activities. A site- specific briefing is provided to all site visitors who enter this site beyond the site entry point. For visitors, the site-specific briefing provides information about site hazards, the site lay-out including work zones and places of refuge, the emergency alarm system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate.

3.3 FIRST AID/CPR TRAINING

At least one member of the GES staff assigned to the project will have American Red Cross (or equivalent) First Aid and cardiopulmonary resuscitation (CPR) training. At least one trained individual will be present on-site at all times. CHSSE will maintain all training documentation.

4.0 MEDICAL SURVEILLANCE REQUIREMENTS

4.1 GENERAL MEDICAL SURVEILLANCE REQUIREMENTS

All personnel performing activities requiring the use of an air-purifying respirator covered by this plan must be active participants in an ongoing medical monitoring program in accordance with the requirements of 29 CFR 1910.120(f). Subcontractors chosen to perform selected site activities must provide written documentation of such, for each employee who will be involved in activities at this site, before the start of work.

4.2 DRUG AND ALCOHOL COMPLIANCE

All personnel performing activities covered by this plan must have had a negative drug and alcohol screen performed within the last 12 months.

4.3 ACCIDENT / INCIDENT MEDICAL SURVEILLANCE

As a follow-up to a work-related injury, all employees are entitled and encouraged to seek medical attention. All accidents and potential exposures must be reported **immediately** to the office leadership and / or RHSSE, who will coordinate with CHSSE to arrange for appropriate medical attention. Depending on the type of incident, it may be critical to perform tests within 24 to 48 hours. *Failure to report an injury or incident immediately will result in disciplinary action*. The *GES Incident/Injury Case Management Procedure* can be found in **Attachment I**.

Events surrounding Near Loss incidents will be recorded in the daily log and documented in accordance with the GES Incident Reporting Procedures.

5.0 HAZARD ASSESSMENT

Job Safety Analyses (JSAs) are required for most site activities. Each JSA must identify and quantify the health and safety hazards associated with each task and site operation, and to evaluate risks to workers. Using this information, appropriate control methods are selected to mitigate or (preferably) eliminate the identified risks.

5.1 CHEMICAL HAZARDS

5.1.1 Contaminant Characterization and Potential Routes of Exposure

The main routes of exposure for field personnel include:

- Inhalation of contaminant vapors;
- Inhalation of contaminated particulate matter;
- Ingestion of contaminated material;
- Dermal absorption of contaminated material; or,
- Injection of contaminated material

Site personnel can reduce their exposure potential by:

- Using the required PPE for task as determined by a pre-task risk assessment;
- Practicing contamination avoidance;
- Following proper decontamination procedures; and,
- Observing good personnel hygiene

5.1.2 General Chemical Data

In order to protect site personnel from the hazards associated with site contaminants of concern found during projects at GES Sites, an Exposure Monitoring Program will be implemented to control potential chemical exposures. **Attachment B** contains this program along with data tables on the contaminants of concern. These tables provide information on each contaminant's characteristics, such as routes of exposure, health hazards, ionization potentials, exposure limits, etc. All hazardous chemicals brought on- site by GES personnel or its subcontractors will be managed in accordance with 29 CFR 1910.1200 and the GES Hazard Communication Program. This will include adherence to the Globally Harmonized System (GHS), proper labeling, an inventory list of all hazardous materials brought onsite, and a copy of each chemical's Material Safety Data Sheet (MSDS) / Safety Data Sheet (SDS) will be maintained on-site. **Attachment C** contains MSDSs / SDS of hazardous substances generally used by GES personnel.

5.2 PHYSICAL HAZARDS

A variety of physical hazards may be present, but these hazards are similar to those associated with any field project.

5.2.1 Slips/Trips/Falls/Cuts

- Utilize proper housekeeping practices, such as removal of debris and tools from the work area to keep the area clear of trip hazards.
- Use caution tape or barricade fencing where warranted to keep unauthorized personnel from entering the work area.
- Replace manhole covers securely to prevent tripping and vehicle accidents.
- Use hose cutters when cutting piping.
- Walkways and work spaces will be kept clear of cords, hoses, pipes, etc. that cause trip hazards.
- If trip hazards cannot be removed from the work area, they shall be taped down and cones shall be placed to identify the hazard.

5.2.2 Excessive Noise

- Use hearing protection during loud mechanical operations such as drilling, Geoprobing and excavating operations, inside a remedial shed when equipment is operating loudly or in other high decibel situations in accordance with the *GES Hearing Protection Policy*.
- This could include noise generated by adjacent and unrelated 3rd party activities.

5.2.3 Airborne Particulate (ears, eyes, nose, mouth, inhalation)

- Eye protection is to be worn at all times on site.
- Respiratory protection is to be worn when site activities cause excessive particulates, such as performing carbon change-outs.

5.2.4 On-site Traffic

- High visibility and/or reflective clothing shall be worn, and safety cones, flags and barricades deployed, as specified in the GES Traffic Control Procedures.

5.2.5 Ladder Safety

- Working at heights (individuals feet above 6 feet or working next to excavation / trench greater than 6 feet...) must be approved by VP HSSE or RHSSE
- Ladders must be inspected prior to use. Any damaged ladder will be discarded immediately.
- Painted ladders are forbidden.
- Never stand on the top step of the ladder.
- Extension ladders must extend 36" beyond work area.
- Pitch ladders at a 4:1 ratio.
- Extension and straight ladders must be tied off.
- Fall protection must be worn when working with both hands from a ladder with feet six (6) feet or more above ground.

5.2.6 Air Compressor

- Eye and hearing protection is to be worn at all times on site.
- Hot steam will burn skin upon contact.
- Use proper pressure relief valves before performing O&M on an air compressor.

5.2.7 Electrical

- Inspect all electrical equipment and extension cords prior to use.
- All electrical circuits and equipment must be grounded in accordance with the NEC regulations.
- Spark producing equipment is not to be used in operating remedial system sheds.
- Lockout/Tag out procedures will be in effect if equipment is to be repaired.
- Refer to the GES Lockout Tag out Procedures for full details.
- Use three-pronged plugs and heavy-duty extension cords.
- A GFCI is required when using an extension cord.
- Workers must not have wet hands or be standing in water while plugging/unplugging energized equipment.
- Plugs and receptacles will be kept out of water (unless they are approved for submersion).

ONLY "Qualified" GES staff (a subset of the O&M staff) are permitted to work on energized electrical equipment that exceeds 50 volts.

ONLY "Authorized" GES staff are permitted to work on energized electrical equipment that is rated at less than 50 volts.

The remaining staff may only work on de-energized, locked and tagged-out equipment.

5.2.8 Power Tools

- Equipment will be inspected for defects prior to use.
- Eye protection is to be worn at all times on site.
- Employees using tools that may subject their hands to an injury, such as cuts, abrasions, punctures, or burns will wear protective gloves.
- Loose or frayed clothing, dangling jewelry, or loose long hair will not be worn when working with power tools.
- A GFCI will be used with all power tool operations.
- Shielding or guarding will be in effect if applicable.

5.2.9 Back Strain

- Utilize required lifting procedures when loading and unloading heavy equipment.
- Bend down at the knees rather than bending the back.
- Use a mechanical lifting device or a lifting aid such as hand carts, drum dollies or lift gates when lifting heavy objects.

5.2.10 Site Security

- Do not permit anyone who is not properly trained and outfitted with the appropriate PPE to enter the Exclusion or Contamination Reduction Zones (this includes GES personnel, clients, etc.)
- Use caution tape or barricade fencing where warranted to keep unauthorized personnel from entering the work area.
- On sites where it is believed that security is an issue, two employees will be used for all field work. The "buddy-system" will be in place and the two employees will be in constant communication and within each other's line of sight. There will be a cellular phone available to call 911 if a violent condition presents itself.
- When acts of violence occur or when an employee(s) feels that they are being placed in a threatening position they must immediately leave the site.
- All potential acts of violence or threats by non-GES personnel must be immediately reported to the Office leadership and / or Project Manager and Regional HSSE . The situation will be discussed to determine future action on the site in question.
- If any GES employee notices suspicious persons or activities in a GES office or in the vicinity of a work area, he or she should immediately report the observation to his or her supervisor or Regional Operations Manager.

5.2.11 Biological Hazards (insects, snakes, poisonous plants and animals)

- Do not touch or contact poisonous plants, such as poison ivy/poison oak.
- If available, apply an over-the-counter barrier cream, such as Ivy Block® to prevent contact with plant oils.
- Wash hands and arms immediately with soap and water if skin contacts the plants.
- Wear long pants with socks pulled over legs to prevent skin contact with plants and insects.
- Inspect yourself carefully for insects or ticks after being outdoors.
- Spray any wasp/hornet nests with an insect repellant from a safe distance recommended by the product's manufacturer.
- Do not antagonize snakes or wild animals.

5.2.12 Heat Stress

- Know and recognize the signs and symptoms of heat-related illnesses, as follows:
  - Heat cramps
  - Heat exhaustion:
    - Cool, moist, pale, or flushed skin Headache
    - Nausea
    - Dizziness, weakness and exhaustion Heat stroke:
    - Red, hot, dry, skin Changes in consciousness Rapid, weak pulse
    - Rapid, shallow breathing
- Adjust work schedules to provide time intervals for intake of juices, juice products and water in an area free from contamination.

5.2.13 Cold Stress

- Know and recognize the signs and symptoms of cold-related illnesses, as follows:
  - Frostbite:
    - Lack of feeling in the affected area
    - Skin that appears waxy, is cold to the touch or is discolored (flushed, white, yellow or blue)
  - Hypothermia:
    - Shivering Numbness Glassy stare Apathy
    - Loss of consciousness
- Have appropriate clothing available and dress in layers to protect against cold weather.
- Adjust work schedules to provide sufficient rest periods in a heated area for warming up during operations conducted in cold weather.

5.2.14 Confined Space (CS) Entry

- Confined Space Entry is prohibited without an approved permit and the approval of VP HSSE.
- The *GES Confined Space Entry Requirements* must be followed, including but not limited to air monitoring, presence of attendant and permit completion.

5.2.15 Fall Hazards

- OSHA-approved man-lifts and ladders will be used for access to elevated locations.
- Employees must wear a safety belt with a lanyard attached to the boom or basket when working from a man-lift.
- If the elevated location is inaccessible by a man-lift, CHSSE shall be contacted to determine the appropriate fall protection.
- Complete details are found in the *GES Fall Protection* Program.

5.2.16 Hot Work

- A GES and/or client/facility hot work permit will be completed prior to the start of the work.
- The Site Supervisor will conduct a safety briefing on hot work rules and procedures, and all hot work participants will sign the permit.
- Hot work will not be performed if there is a possibility of an explosive atmosphere or an oxygen-enriched atmosphere.
- The Site Supervisor will designate a person for fire watch duty, who will have access to **2 (two) 20 pound Class ABC dry chemical fire extinguishers** and will remain on-duty for one-half hour after the hot work is complete.
- All hot work equipment will be inspected daily, prior to use. If the equipment is found to be defective, it will be removed from the site, or tagged with a "Do Not Use" sign until it is repaired.
- All welding and cutting personnel will be trained in the safe operation of their equipment.
- Refer to the GES *Hot Work Requirement Policy* for complete details.

5.3 RADIOLOGICAL HAZARDS

If site-specific potential radiological information becomes available, the hazards will be addressed in an addendum to the HASP. Ionizing Radiation action levels can be found in **Attachment B, Table 2.**

6.0 SITE CONTROL MEASURES

6.1 SITE ZONES

A controlled work area should be established in the immediate vicinity of the site activities covered by this plan. Only those persons who can comply with the requirements of this plan should be allowed into this area during any work activities, which may result in exposure to the hazards associated with the specific task being performed. The work site should be marked off with at least the following items from the GES Traffic Control Procedures: Four (4) traffic cones with flags reaching 70 inches in combined height, caution tape or other barricade device, two (2) work area signs or barricades at the site entrances and a flashing amber light on the company vehicle.

NOTE: When activities involve invasive activities on sites in which the Project Manager Regional Engineering and CHSSE have determined the area to be highly-contaminated, a three-zone system will be used to control the potential spread of contamination.

These zones are characterized by the presence or absence of chemical and biological hazards and the activities contained within them.

Zone boundaries should be clearly marked at all times and the flow of personnel among the zones must be controlled. The site should be monitored for changing conditions that may warrant adjustment of zone boundaries. Zone boundaries are adjusted as necessary to protect personnel and clean areas. Whenever boundaries are adjusted, zone markings must also be changed and workers immediately notified of the change.
For the purpose of this plan, the following definition of terms is provided:

- **Exclusion Zone** - The immediate area of the work activity to be performed or an area fully enclosing the hazards present. Personnel and equipment will enter and exit the Exclusion Zone from the designated access points in the Contamination Reduction Zone (CRZ).

- **Contamination Reduction Zone** - The transition area between the contaminated and uncontaminated area. Based on monitoring results, the CRZ boundaries may be adjusted to ensure that the Support Zone remains uncontaminated. Workers and equipment exit the Exclusion Zone through the designated access point(s) into the CRZ. Workers and equipment are then decontaminated in the CRZ, according to the procedures specified in the Decontamination section of this HASP. Workers and equipment then exit the CRZ into the Support Zone through the designated access points.

  If necessary, emergency decontamination procedures are implemented. Emergency decontamination procedures are described in **Section 9.2** of this HASP and in **Attachment G** (if necessary).

- **Support Zone** - The Support Zone is the clean area of the site, beyond the outer boundary of the CRZ. There should be no contamination in this zone. Administrative, clerical, and other support functions are based in the Support Zone.

  Air and surface monitoring are conducted in the Support Zone as needed to ensure that it remains uncontaminated. If contamination is detected, zone boundaries are adjusted until corrective action is taken and monitoring results indicate that this zone is again uncontaminated.

6.2 COMMUNICATIONS

Emergency numbers are listed on the cover of this HASP. Work will not be conducted on-site without access to a telephone, site personnel will be informed of its location. If a telephone is not available on site, a cell phone will be made available for emergency use.

7.0 PERSONAL PROTECTIVE EQUIPMENT

7.1 GENERAL

Site safety and health hazards are eliminated or reduced to the greatest extent possible through engineering controls and work practices. Where hazards are still present, a combination of engineering controls, work practices, and PPE are used to protect employees.

The level of protection worn by site personnel will be enforced by the Site Supervisor. Levels of protection may be upgraded or downgraded at the discretion of the CHSSE, based on real-time air monitoring data and prior site experience. Any changes in the level of protection will be documented. Levels of protection less than those designated in this HASP must first be approved by the CHSSE Department.

7.2 LEVEL D PROTECTION

Level D PPE provides minimal protection against chemical hazards. A respirator is not required. Level D PPE includes:

- Cotton coveralls or long pants and a shirt with sleeves
- Reflective safety vest or hi-visibility shirt.
- Safety glasses
- Steel-toe/steel-shank work boots
- Work gloves
- Hearing protection (as required by task)
- Hard Hat (as required by task or client)
- Chemical resistant gloves (as required by task or client)

7.3 MODIFIED LEVEL C PROTECTION

Modified Level C PPE includes the items listed in Section 7.2 above, and the following items:

- Full-face APR or Half-face APR respirator equipped with the appropriate chemical cartridges

7.4 LEVEL C PROTECTION

Level C PPE provides a higher level of respiratory and skin protection against chemical hazards than Level D. Level C PPE includes the items listed in Section 7.2 above, and the following items:

- Poly-coated Tyvek (yellow) or Saranex(shiny white)
- Steel-toe/steel-shank work boots and chemical resistant over-boots, or chemical resistant steel-toe/steel shank boots
- Chemical resistant inner gloves
- Chemical resistant outer gloves
- Seal arm, leg, and zipper joints with tape, as required
- Half-face or full-face, air-purifying respirator equipped with appropriate cartridges

7.5 LEVEL A AND B PROTECTION

Level A PPE should be worn when the highest level of respiratory and skin protection is needed, or if the contaminants of concern are unknown. Level B PPE should be worn when the highest level of respiratory protection is required, but a lesser level of skin protection is needed. The tasks covered under this HASP do not require the use of Level A or B PPE.

Separate Health and Safety Plans will be developed for Level A/Level B investigations and for Emergency Responses, which may involve the use of Level A and/or Level B health and safety measures.

8.0 DECONTAMINATION

8.1 GENERAL

At a minimum, the procedures outlined below shall be followed for decontamination:

- Remove gross contamination from tools, respirator, monitoring equipment, boots, etc., prior to leaving the "exclusion zone", using paper towels, handi-wipes, etc.

- Completely decontaminate soiled equipment in the Contamination Reduction Zone using detergent and water and dispose of all cleaning materials as follows.

  - Due to the small quantity of waste generated during decontamination, it is allowable in most states to dispose of lightly contaminated materials in the site dumpster. It is important, however, to ensure that there is no chance of vapor generation or fluid leaking from the dumpster. At no time are materials containing free product to be disposed of in this manner. In this case, arrangements must be made for use of labeled drums and proper disposal.

  - All decontamination materials including protective sheeting, rags, sorbents, disposable personal protective equipment, and decontamination fluids should be carefully screened with a Photo- ionization Detector (PID) prior to disposal to determine relative levels of contamination.

  - Lightly contaminated decontamination fluids should either be treated via the site treatment system prior to discharge or disposed of via the sanitary sewer system. Highly contaminated decontamination fluids must be stored in labeled drums and proper disposal arrangements must be made.

    Note: All Federal, State, County and/or City requirements regarding disposal must be complied with. Below - document specific requirements.

- Dispose of contaminated gloves, Tyvek suits, used cartridges, paper towels, etc., by placing in a plastic bag and discarding in accordance with applicable standards.

- Wash hands and face thoroughly with soap and water before lunch or coffee breaks, and as soon as practical after finishing work for the day.

- Particular care should be taken to protect any skin injuries. If open wounds exist on hands or forearms, handling chemicals should be restricted or eliminated.

- Shower as soon as possible.

- A site-specific decontamination plan (if required) is located in **Attachment G**.

9.0 EMERGENCY ACTION PLAN

9.1 PERSONAL INJURY WITHIN THE EXCLUSION ZONE

Site operations shall be temporarily halted and all site personnel shall assemble in the Contamination Reduction Zone. The Site Supervisor shall evaluate the nature of the injury and, if indicated by the hazards present on site, the injured person shall be decontaminated to the extent possible prior to movement to the Support Zone.

Contact shall be made for an ambulance and with the designated medical facility (if required). An individual certified in Standard First Aid and Adult CPR may choose to initiate the appropriate first aid. No persons shall reenter the Exclusion Zone until:

a) The conditions resulting in the emergency have been corrected;
b) The hazards have been reassessed;
c) The Site Safety Plan has been reviewed; and,
d) Site personnel have been briefed on any changes in the Site Safety Plan.

9.2 PERSONAL INJURY WITHIN THE DECONTAMINATION ZONE

The Site Supervisor shall evaluate the nature of the injury and, if indicated by the hazards present on site, the injured person shall be decontaminated to the extent possible prior to movement to the Support Zone.

Contact shall be made for an ambulance and with the designated medical facility (if required). An individual certified in Standard First Aid and Adult CPR may choose to initiate the appropriate first aid.

If the injury increases risk to other site workers, all site personnel shall move to the Contamination Reduction Zone and site activities will stop until the risks can be assessed and either removed or minimized.

9.3 PERSONAL INJURY WITHIN THE SUPPORT ZONE

The Site Supervisor will assess the nature of the injury and determine if the cause of injury or loss of the injured person will affect continuation of site operations. If the injury will not affect the safety or performance of other site workers, operations may continue, with the person certified in first aid initiating the appropriate first aid and necessary follow up as stated above.

If the injury increases risk to other site workers, all site personnel shall move to the Contamination Reduction Zone and site activities will stop until the risks can be assessed and either removed or minimized.

9.4 FIRE/EXPLOSION

If a fire is observed in the incipient phase (i.e., when it begins) and if the site personnel witnessing the fire feel secure in attempting to control the fire, the individual can attempt to extinguish the fire by using the onsite fire extinguisher. The fire extinguisher should be a 10 or 20 pound (lb.) dry chemical, Class A, B, and C extinguisher and is adequate for paper and wood based products (A), flammable and combustible liquids (B), and electrical (C) type fires.

If there is no fire extinguisher available or if site personnel do not feel secure in attempting to extinguish the fire, site personnel shall perform the following:

- Secure the site, if possible.
- Evacuate the area using the nearest safe pathway from the area.
- Proceed to the nearest phone and call 911 and provide the emergency operator all required information. This will activate the emergency response system.

If more than one individual is on the site team, the individual activating the evacuation plan shall verbally communicate to the other site personnel that there is an emergency condition and that they should evacuate from the work area. If contact cannot be made verbally with the other site personnel, any of the following systems can be used as long as the system is audible above background noise. The system can be the site vehicle horn, a whistle, an air horn, or other acceptable device. The system used for initiating an evacuation from the site shall be discussed during the tailgate meeting with the other site personnel prior to beginning the workday. The system that is decided upon shall be documented in the site logbook.

If an explosion or other unsafe condition occurs that the site supervisor had determined will place the other site personnel at risk, then the evacuation system described above should be activated immediately.

9.5 PERSONAL PROTECTIVE EQUIPMENT FAILURE

If any site worker experiences a failure or alteration of protective equipment that affects the protection factor that person and his/her buddy, if applicable, shall immediately leave the Exclusion Zone. Reentry shall not be permitted until the equipment has been repaired or replaced.

9.6 EQUIPMENT FAILURE

If any other equipment on site fails to operate properly, the Site Supervisor shall be notified and then determine the effect of this failure on continuing operations. If the failure will affect the safety of personnel, all personnel shall leave the Exclusion Zone until the situation is evaluated and appropriate actions are taken.

10.0 STANDARD OPERATING SAFETY PROCEDURES, ENG. CONTROLS, AND WORK PRACTICES

10.1 WORK PERMITS

Work permits will be required for Confined Space Entry, Hot Work and Lockout/Tag out as well as any Federal and client permitted activity. These permits must be obtained from the Project Manager or RHSSE prior to site work.

10.2 GENERAL SITE RULES

The following general site rules apply to all personnel while on the site:

- Before daily site operations begin, the daily site safety checklist will be completed, the subcontractor's training documentation will be reviewed (as required by section 3 of this plan), and a pre-entry briefing will be held to review the site's health and safety plan concerns and emergency procedures. This meeting will be registered in this Health and Safety Plan. Attendance will be documented.

- One site worker will be assigned to keep the daily log for all health and safety-specific site activities, unless otherwise specified.

- All personnel will wear steel-toe safety boots. Hard hats will be worn when working near heavy equipment (drill rigs, excavating equipment, etc.), when individuals are working with overhead hazards present, when required in the Job Safety Analysis (JSA), or when required by the client.

- Eye protection and high visibility clothing/reflective safety vests will be donned at all times while on site.

- Possession of alcohol or illegal substances on the job site or consumption during hours of site operations is strictly prohibited.

- Food and/or beverages are not permitted in the site's Exclusion or Contamination Reduction Zones. Food and/or beverages will be permitted in the Support Zone, if proper decontamination procedures are being followed.

- Smoking, including the use of e-cigarettes, is not permitted on any site. Chewing tobacco, snuff, application of cosmetics and/or lip balm is not permitted in the site's Exclusion or Contamination Reduction Zones.

- A change in level of protection will be based on air monitoring equipment readings taken in the breathing zone.

- Field personnel will use air monitoring equipment and not their nose to determine site contamination (i.e., sniffing sampled soils or water in jars, confined spaces, open bore holes or trenches, etc.). Odors detected during the course of standard operating procedures, however, should be noted in the daily log.

- Field personnel should not stand with their head directly over a well when it is being opened.

- First Aid Kit(s) and Fire Extinguisher(s) will be available in all company vehicles and/or within

50 feet of the working area.

Note: Hot work activities require that a person onsite shall act as a fire watch with a Class A, B, C dry chemical extinguisher within 10 feet of the activity, and all necessary work requirements are satisfied.

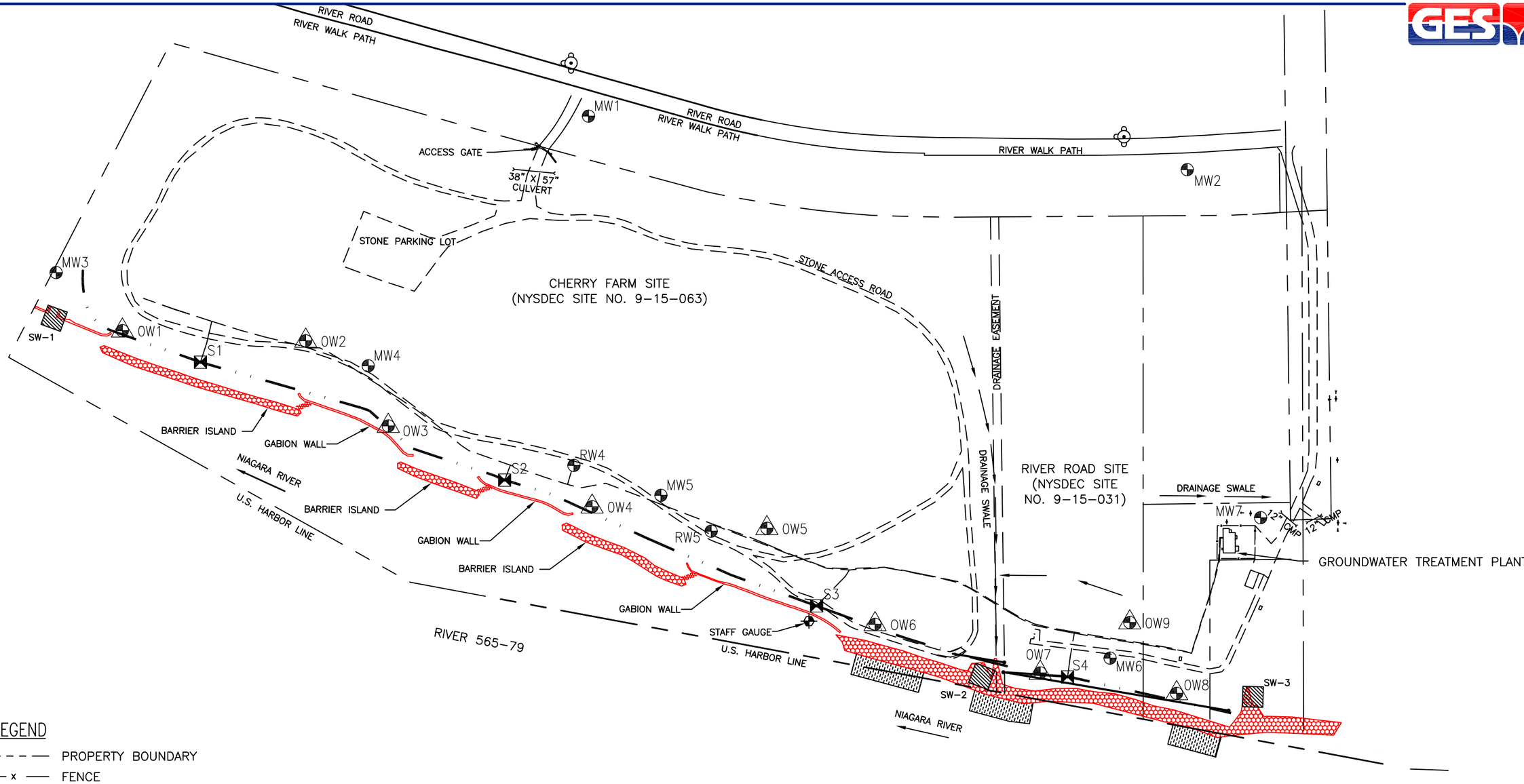
Any revisions to the final Site-Specific Health and Safety Plan must be reviewed by the Project/Case Manager and approved by RHSSE or a Principal Hydrogeologist, at a minimum.

11.0 ADDITIONAL STANDARD OPERATING SAFETY PROCEDURES

See Attachments

ATTACHMENT A

SITE MAPS



LEGEND

- PROPERTY BOUNDARY
- FENCE
- TRENCH SUMP
- MONITORING WELL
- OBSERVATION WELL
- SHALLOW GROUNDWATER TRENCH
- GROUNDWATER CONVEYANCE PIPING

DRAFTED BY: W.G.S.	**SITE MAP**
CHECKED BY:	**CHERRY FARM (RIVER ROAD SITE) 4100 RIVER ROAD TONAWANDA, NEW YORK**
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 495 AERO DRIVE, SUITE 3, CHEEKTOWAGA, NEW YORK 14225
	SCALE IN FEET: 0 APPROXIMATE 250 / DATE: 1-19-17 / FIGURE:

M:\Graphics\0900-Buffalo\Misc\Cherry Farms\Tonawanda\Cherry Farms (Tonawanda) SM.dwg, B-250, WShea

ATTACHMENT B

EXPOSURE MONITORING PROGRAM

FOR THE CONTAMINANTS OF CONCERN

EXPOSURE MONITORING PROGRAM

REAL-TIME MONITORING

Photo-ionization Detector (PID): Real-time monitoring for volatile organic compounds (VOCs) will be conducted using a photo-ionization detector (PID). The PID will be used to monitor employee breathing zones during all invasive activities. **Table 1** lists PID action levels and response requirements

Combustible Gas Indicator/Oxygen Level Meter: Real-time monitoring for combustible gases and oxygen levels will be conducted using a Combustible Gas Indicator (CGI)/Oxygen Level Meter. The CGI will test for the presence of combustible gases by continuously monitoring the lower explosive limit (LEL) of organic vapors. The CGI will be used to monitor the LEL prior to, and during, Confined Space (CS) entries and during work near an excavation in contaminated soil. The Oxygen Level Meter will detect an oxygen-deficient or oxygen-enriched atmosphere, and will be used prior to, and during, all CS entry activities. If ionizing radiation is suspected at a site, a Geiger counter will be used to measure exposure under guidance of a Health Physicist. **Table 2** lists CGI, Oxygen Level Meter, and ionizing radiation action levels and response requirements.

Depending on the Contaminants of Concern, other forms of real-time monitoring equipment may be required to quantify chemical hazards and protect workers from exposure. These may include, but are not limited to bio-aerosol monitors, detector tubes, dust monitors, FROG meters, etc.

- Calibration of Real-Time Monitoring Equipment: Monitoring and calibration protocols will be performed in accordance with the manufacturer's guidelines. Calibration will be performed, at a minimum, prior to each day's use.

- Calibration logs will be maintained by the field personnel performing the calibrations.

ACTION LEVELS

Tables 1 and 2 list the action levels and response requirements for a PID and CGI/Oxygen Level Meter. Changing levels of protection, upgrading respiratory protection, or changing work practices is based on maintaining the upper limit of the action level for approximately **10 minutes** sustained in the breathing zone (i.e., a non-transient reading) or at the discretion of the Site Supervisor. If changes in protection levels are required, the Site Supervisor will, stop the job, notify the Project Manager who will contact Regional Engineering and CHSSE to determine if administrative or engineering controls can be implemented to mitigate or eliminate the hazard.

Table 1 provides action levels that must be complied with when petroleum products such as gasoline are the known site contaminants.

Tables 4 & 5 provide space to document site-specific action levels, should the site contain other potential site contaminants. Action levels must be determined by consultation with/approval by CHSSE, based on established chemical exposure limits and monitoring instrument response factors.

TABLE 1 OVM ACTION LEVELS	
Meter Response (Breathing Zone)	**Action Required**
PID response <5 units above background	No respiratory protection required (i.e., Level D)
PID response >5 units above background (Bkgd.) and < 50 units above Bkgd.	Stop work. Investigate the cause of elevated VOC measurements. Contact the Project Manager or office and determine if administrative or engineering controls can be implemented to mitigate or eliminate the elevated readings. If not medically qualified to wear respiratory protection, leave work zone. If the elevated readings cannot be reduced below 5 units above background or eliminated, and if medically qualified, fit tested and trained to wear respiratory protection, then upgrade to Modified Level C, half- face respiratory protection.
PID response >50 units and < 250 units above Bkgd.	Stop work. Investigate the cause of elevated VOC measurements. Contact the Project Manager or office and determine if administrative or engineering controls can be implemented to mitigate or eliminate the elevated readings. If not medically qualified to wear respiratory protection, leave work zone. If the elevated readings cannot be reduced below 5 units above background or eliminated, and if medically qualified, fit tested and trained to wear respiratory protection, then upgrade to Modified Level C, full- face respiratory protection.
PID response > 250 above Bkgd.	Retreat from site [1,2]

[1] If a retreat becomes necessary, CHSSE or Regional Engineering will be consulted in regard to adding mechanical ventilation or possible changes in work practices. Work will not resume until appropriate corrective measures are implemented.

[2] Because direct reading instruments cannot indicate or are not compound specific, concentrations shown on the instruments shall be related to units above background and not parts per million (ppm).

TABLE 2 CGI/O2/RADIATION LEVEL ACTION LEVELS	
Meter Response	**Action**
CGI response < 10 % LEL	Continue normal operations.
CGI response > 10 % and <20 % LEL	Eliminate all sources of ignition from the work area; implement continuous monitoring. However if work is being done in a confined space, retreat from work area.[1]
CGI response > 20 % LEL	Discontinue operations; allow to vent; retreat from work area.[1]
Oxygen level < 19.5%	Retreat from work area. [1]
Oxygen level > 23.5%	Retreat from work area. [1]
3X background to <2 mR/hr.	Radiation above background levels (normally 0.01-0.02 mR/hr.) signifies possible source(s) radiation present. Continue investigation with caution. Perform thorough monitoring. **Consult with a health physicist**.
>2mR/hr.	Potential radiation hazard. Evacuate site. Continue investigation only upon the advice of a health physicist

[1] If a retreat becomes necessary, CHSSE or Regional Engineering will be consulted in regard to adding mechanical ventilation or possible changes in work practices. Work will not resume until appropriate corrective measures are implemented.

TABLE 3
Retail Petroleum Materials of Concern

Contaminant	OSHA TWA (ppm)	ACGIH TLV (ppm)	Hazards	Entry Routes	IP
Benzene	1	10	1,2,4,5,6,9	Inh, Abs, Ing, Con	9.24
Xylene	100	100	1,2,3,4,5,6,7,10	Inh, Abs, Ing, Con	8.56
Ethylbenzene	100	100	1,2,3,10	Inh, Ing, Con	8.76
Toluene	200	50	1,2,3,4,5,7,10	Inh, Abs, Ing, Con	8.82

TWA = Time Weighted Average in parts per million (ppm)
C = Ceiling
IP = Ionization Potential

1 = irritant to skin
2 = irritant to eyes
3 = irritant to respiratory system
4 = may cause headache
5 = may cause dizziness, lightheadedness
6 = may cause nausea and vomiting
7 = may cause liver and kidney damage
8 = irritant to GI tract
9 = carcinogen/possible carcinogen
10 = may cause damage to CNS

TABLE 4
Inorganic Gases and Vapors of Concern

Contaminant	OSHA TWA (ppm)	ACGIH TLV (ppm)	Hazards	Entry Routes	IP

TWA = Time Weighted Average in parts per million (ppm)
C = Ceiling
IP = Ionization Potential

1 = irritant to skin
2 = irritant to eyes
3 = irritant to respiratory system
4 = may cause headache
5 = may cause dizziness, lightheadedness
6 = may cause nausea and vomiting
7 = may cause liver and kidney damage
8 = irritant to GI tract
9 = carcinogen/possible carcinogen
10 = may cause damage to CNS

Note: Consult standard reference manuals for air concentration/toxicity data. Action level depends on PEL/REL/TLV. These Action Levels, if not defined by regulation, is some percent (usually 50%) of the applicable PEL/REL/TLV. That number must also be adjusted to account for instrument response factors.

TABLE 5
***Site Specific hazards (chemicals) of Concern**

Contaminant	OSHA TWA (ppm)	ACGIH TLV (ppm)	Hazards	Entry Routes	IP

TWA = Time Weighted Average in parts per million (ppm)
C = Ceiling
IP = Ionization Potential

1 = irritant to skin
2 = irritant to eyes
3 = irritant to respiratory system
4 = may cause headache
5 = may cause dizziness, lightheadedness
6 = may cause nausea and vomiting
7 = may cause liver and kidney damage
8 = irritant to GI tract
9 = carcinogen/possible carcinogen
10 = may cause damage to CNS

Note: Consult standard reference manuals for air concentration/toxicity data. Action level depends on PEL/REL/TLV. These Action Levels, if not defined by regulation, is some percent (usually 50%) of the applicable PEL/REL/TLV. That number must also be adjusted to account for instrument response factors.

ATTACHMENT C

SITE SAFETY DATA SHEETS (SDS)

Material Safety Data Sheet
Hydrochloric acid

ACC# 94460

Section 1 - Chemical Product and Company Identification

MSDS Name: Hydrochloric acid
Catalog Numbers: SA50-1, SA50-20, SA50-4, SA52-20, SA52-500, SA54-1, SA54-10, SA54-20, SA54-4, SA60-1, SA62-1
Synonyms: Chlorohydric acid; Hydrogen chloride; Muriatic acid; Spirits of salt; Hydrochloride.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7732-18-5	Water	>98	231-791-2
7647-01-0	Hydrochloric acid	<2.0	231-595-7

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: colorless to slight yellow clear liquid.
Warning! May cause eye, skin, and respiratory tract irritation.
Target Organs: No data found.

Potential Health Effects
Eye: May cause eye irritation.
Skin: May cause skin irritation.
Ingestion: May cause irritation of the digestive tract.
Inhalation: May cause respiratory tract irritation. Exposure to the mist and vapor may erode exposed teeth.
Chronic: Prolonged or repeated skin contact may cause dermatitis. Repeated exposure may cause erosion of teeth. Repeated exposure to low concentrations of HCl vapor or mist may cause bleeding of nose and gums. Chronic bronchitis and gastritis have also been reported.

Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.
Ingestion: If swallowed, do NOT induce vomiting. Get medical aid immediately. If victim is fully conscious, give a cupful of water. Never give anything by mouth to an unconscious person.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Not flammable, but reacts with most metals to form flammable hydrogen gas. Use water spray to keep fire-exposed containers cool. Containers may explode when heated.
Extinguishing Media: Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.
Flash Point: Not applicable.
Autoignition Temperature: Not applicable.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 1; Flammability: 0; Instability: 1

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Provide ventilation. Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading and contact with water.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation. Discard contaminated shoes.
Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Do not store in metal containers. Store away from alkalies.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Water	none listed	none listed	none listed
Hydrochloric acid	2 ppm Ceiling	50 ppm IDLH	5 ppm Ceiling; 7 mg/m3 Ceiling

OSHA Vacated PELs: Water: No OSHA Vacated PELs are listed for this chemical. Hydrochloric acid: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear neoprene or polyvinyl chloride gloves to prevent exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Clear liquid
Appearance: colorless to slight yellow
Odor: Not available.
pH: 0.10 (1.0N soln)
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: Not available.
Freezing/Melting Point: Not available.
Decomposition Temperature: Not available.
Solubility: Soluble.
Specific Gravity/Density: Not available.
Molecular Formula:HCl
Molecular Weight:36.46

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Excess heat.
Incompatibilities with Other Materials: Bases.
Hazardous Decomposition Products: Hydrogen chloride.
Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 7732-18-5: ZC0110000
CAS# 7647-01-0: MW4025000; MW4031000
LD50/LC50:
CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg;
.

CAS# 7647-01-0:
Inhalation, mouse: LC50 = 1108 ppm/1H;
Inhalation, mouse: LC50 = 20487 mg/m3/5M;
Inhalation, mouse: LC50 = 3940 mg/m3/30M;
Inhalation, mouse: LC50 = 8300 mg/m3/30M;
Inhalation, rat: LC50 = 3124 ppm/1H;
Inhalation, rat: LC50 = 60938 mg/m3/5M;
Inhalation, rat: LC50 = 7004 mg/m3/30M;
Inhalation, rat: LC50 = 45000 mg/m3/5M;
Inhalation, rat: LC50 = 8300 mg/m3/30M;
Oral, rabbit: LD50 = 900 mg/kg;
.

Carcinogenicity:
CAS# 7732-18-5: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
CAS# 7647-01-0: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information found
Teratogenicity: Female rats were exposed to 450 mg/m3 of HCl for 1 hour either prior to mating or on day 9 of pregnancy. Developmental effects were observed in the offspring. However, this exposure caused toxic effects, including mortality, in the mothers.
Reproductive Effects: No information found
Mutagenicity: See actual entry in RTECS for complete information.

Neurotoxicity: No information found
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Bluegill/Sunfish: 3.6 mg/L; 48 Hr; Lethal (unspecified)
Fish: Bluegill/Sunfish: LD50; 96 Hr; pH 3.0-3.5

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	Not Regulated	Not Regulated
Hazard Class:		
UN Number:		
Packing Group:		

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 7732-18-5 is listed on the TSCA inventory.
CAS# 7647-01-0 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 7647-01-0: 5000 lb final RQ; 2270 kg final RQ
SARA Section 302 Extremely Hazardous Substances
CAS# 7647-01-0: 500 lb TPQ (gas only)
SARA Codes
CAS # 7647-01-0: immediate.
Section 313
This material contains Hydrochloric acid (CAS# 7647-01-0, <2.0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 7647-01-0 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 7647-01-0 is listed as a Hazardous Substance under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

CAS# 7647-01-0 is considered highly hazardous by OSHA.

STATE

CAS# 7732-18-5 is not present on state lists from CA, PA, MN, MA, FL, or NJ.
CAS# 7647-01-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

Not available.

Risk Phrases:

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)

CAS# 7732-18-5: No information available.
CAS# 7647-01-0: 1

Canada - DSL/NDSL

CAS# 7732-18-5 is listed on Canada's DSL List.
CAS# 7647-01-0 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of E.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 7647-01-0 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 12/19/2007
Revision #1 Date: 12/19/2007

SAFETY DATA SHEET

1. Identification

Product identifier: Sulfuric Acid

Other means of identification
Product No.: 9661, 3780, 9704, 9682, V648, V225, V186, V008, 6902, 2900, 2879, 2878, 2877, 2874, 6163, H996, H976, 5859, 2876, 5815, 5802, 9691, 9690, 9684, 9681, 9675, 9674, 9673, 9671, 5557, 5374, 21208, 21201

Recommended use and restriction on use

Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company Name:	Avantor Performance Materials, Inc.
Address:	3477 Corporate Parkway, Suite 200 Center Valley, PA 18034
Telephone:	
	Customer Service: 855-282-6867
Fax:	
Contact Person:	Environmental Health & Safety
e-mail:	info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Physical hazards

Corrosive to metals	Category 1

Health hazards

Skin corrosion/irritation	Category 1
Serious eye damage/eye irritation	Category 1
Carcinogenicity	Category 1A
Specific target organ toxicity - single exposure	Category 3

Environmental hazards

Acute hazards to the aquatic environment	Category 3

_Label elements

Hazard symbol:

Signal word: Danger

Hazard statement: May be corrosive to metals.
Causes severe skin burns and eye damage.
May cause respiratory irritation.
May cause cancer if inhaled.
Harmful to aquatic life.

Precautionary statement

Prevention: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep only in original container. Wash thoroughly after handling. Do not breathe dust/fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection.

Response: IF exposed or concerned: Get medical advice/attention. Absorb spillage to prevent material damage. Immediately call a POISON CENTER or doctor/physician. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

Storage: Store locked up. Store in corrosive resistant container with a resistant inner liner. Store in a well-ventilated place. Keep container tightly closed.

Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification: None.

3. Composition/information on ingredients

Substances

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
SULFURIC ACID		7664-93-9	90 - 100%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion: Call a physician or poison control center immediately. Do NOT induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Inhalation: Move to fresh air. Call a physician or poison control center immediately. Apply artificial respiration if victim is not breathing If breathing is difficult, give oxygen.

Skin contact: Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician or poison control center immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.

Eye contact: Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Call a physician or poison control center immediately. In case of irritation from airborne exposure, move to fresh air. Get medical attention immediately.

Most important symptoms/effects, acute and delayed

Symptoms: Corrosive to skin and eyes.

Indication of immediate medical attention and special treatment needed

Treatment: Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General fire hazards: In case of fire and/or explosion do not breathe fumes.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media: Foam, carbon dioxide or dry powder.

Unsuitable extinguishing media: Do not use water as an extinguisher.

Specific hazards arising from the chemical: Fire may produce irritating, corrosive and/or toxic gases.

Special protective equipment and precautions for firefighters

Special fire fighting procedures: Move containers from fire area if you can do so without risk. Fight fire from a protected location. Use water SPRAY only to cool containers! Do not put water on leaked material. Cool containers exposed to flames with water until well after the fire is out.

Special protective equipment for fire-fighters: Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures: Keep unauthorized personnel away. Keep upwind. Use personal protective equipment. See Section 8 of the MSDS for Personal Protective Equipment. Ventilate closed spaces before entering them. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

Methods and material for containment and cleaning up: Neutralize spill area and washings with soda ash or lime. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. Dike far ahead of larger spill for later recovery and disposal.

Notification Procedures: Dike for later disposal. Prevent entry into waterways, sewer, basements or confined areas. Stop the flow of material, if this is without risk. Inform authorities if large amounts are involved.

Environmental precautions: Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling: Do not get in eyes, on skin, on clothing. Do not taste or swallow. Wash hands thoroughly after handling. Do not eat, drink or smoke when using the product. Use caution when adding this material to water. Add material slowly when mixing with water. Do not add water to the material; instead, add the material to the water. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Use personal protective equipment as required.

Conditions for safe storage, including any incompatibilities: Do not store in metal containers. Keep in a cool, well-ventilated place. Keep container tightly closed. Store in a dry place.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values	Source
SULFURIC ACID - Thoracic fraction.	TWA	0.2 mg/m3	US. ACGIH Threshold Limit Values (2011)
SULFURIC ACID	REL	1 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	1 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	TWA	1 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)

Appropriate engineering controls No data available.

Individual protection measures, such as personal protective equipment

General information: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area.

Eye/face protection: Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection

Hand protection: Chemical resistant gloves

Other: Wear suitable protective clothing.

Respiratory protection: In case of inadequate ventilation use suitable respirator. Chemical respirator with acid gas cartridge.

Hygiene measures: Provide eyewash station and safety shower. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned.

9. Physical and chemical properties

Appearance

Physical state:	Liquid
Form:	Liquid
Color:	Colorless
Odor:	Odorless
Odor threshold:	No data available.
pH:	0.3 (1 N aqueous solution)
Melting point/freezing point:	3 °C
Initial boiling point and boiling range:	337 °C
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Relative density:	1.84 (20 °C)
Solubility(ies)	
Solubility in water:	Miscible with water.
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	Reacts violently with strong alkaline substances.
Chemical stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur. Material reacts with water.
Conditions to avoid:	Moisture. Heat. Contact with incompatible materials.
Incompatible materials:	Water. Cyanides. Strong oxidizing agents. Strong reducing agents. Metals. Halogens. Organic compounds. Potassium.
Hazardous decomposition products:	Oxides of sulfur.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	May cause burns of the gastrointestinal tract if swallowed.
Inhalation:	May cause damage to mucous membranes in nose, throat, lungs and bronchial system.
Skin contact:	Causes severe skin burns.
Eye contact:	Causes serious eye damage.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral
Product: No data available.

Dermal
Product:
No data available.

Inhalation
Product: No data available.

Specified substance(s):
SULFURIC ACID — LC 50 (Guinea pig, 8 h): 0.03 mg/l
LC 50 (Rat, 1 h): 347 mg/l

Repeated dose toxicity
Product: No data available.

Skin corrosion/irritation
Product: Causes severe skin burns.

Serious eye damage/eye irritation
Product: Causes serious eye damage.

Respiratory or skin sensitization
Product: Not a skin sensitizer.

Carcinogenicity
Product: May cause cancer.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:

SULFURIC ACID — Overall evaluation: 1. Carcinogenic to humans.

US. National Toxicology Program (NTP) Report on Carcinogens:
SULFURIC ACID — Known To Be Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro
Product: No mutagenic components identified

In vivo
Product: No mutagenic components identified

Reproductive toxicity
Product: No components toxic to reproduction

Specific target organ toxicity - single exposure
Product: Respiratory tract irritation.

Specific target organ toxicity - repeated exposure
Product: None known.

Aspiration hazard
Product: Not classified

Other effects: No data available.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product: No data available.

Specified substance(s):

SULFURIC ACID — LC 50 (Starry, european flounder (Platichthys flesus), 48 h): 100 - 330 mg/l Mortality
LC 50 (Western mosquitofish (Gambusia affinis), 96 h): 42 mg/l Mortality

Aquatic invertebrates

Product: No data available.

Specified substance(s):

SULFURIC ACID — LC 50 (Common shrimp, sand shrimp (Crangon crangon), 48 h): 70 - 80 mg/l Mortality
LC 50 (Aesop shrimp (Pandalus montagui), 48 h): 42.5 mg/l Mortality

Chronic hazards to the aquatic environment:

Fish

Product: No data available.

Aquatic invertebrates

Product: No data available.

Toxicity to Aquatic Plants

Product: No data available.

Persistence and degradability

Biodegradation

Product: There are no data on the degradability of this product.

BOD/COD ratio

Product: No data available.

Bioaccumulative potential

Bioconcentration factor (BCF)

Product: No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)

Product: No data available.

Mobility in soil: The product is water soluble and may spread in water systems.

Other adverse effects: The product contains a substance which is harmful to aquatic organisms. The product may affect the acidity (pH-factor) in water with risk of harmful effects to aquatic organisms.

13. Disposal considerations

Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws.

Contaminated packaging: Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number:	UN 1830
UN proper shipping name:	Sulfuric acid
Transport hazard class(es)	
Class(es):	8
Label(s):	8
Packing group:	II
Marine Pollutant:	No

IMDG

UN number:	UN 1830
UN proper shipping name:	SULPHURIC ACID (with more than 51% acid)
Transport hazard class(es)	
Class(es):	8
Label(s):	8
EmS No.:	F-A, S-B
Packing group:	II
Marine Pollutant:	No

IATA

UN number:	UN 1830
Proper Shipping Name:	Sulphuric acid
Transport hazard class(es):	
Class(es):	8
Label(s):	8
Marine Pollutant:	No
Packing group:	II

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

SULFURIC ACID Reportable quantity: 1000 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

[X] Acute (Immediate) [X] Chronic (Delayed) [ ] Fire [ ] Reactive [ ] Pressure Generating

SARA 302 Extremely hazardous substance

Chemical identity	RQ	Threshold Planning Quantity
SULFURIC ACID	1000 lbs.	1000 lbs.

SARA 304 Emergency release notification

Chemical identity	RQ
SULFURIC ACID	1000 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
SULFURIC ACID	500lbs

SARA 313 (TRI reporting)

Chemical identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
SULFURIC ACID	10000 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)
SULFURIC ACID Reportable quantity: 1000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):
SULFURIC ACID Threshold quantity: 10000 lbs

US state regulations

US. California Proposition 65
SULFURIC ACID Carcinogenic.

US. New Jersey Worker and Community Right-to-Know Act
SULFURIC ACID Listed

US. Massachusetts RTK - Substance List
SULFURIC ACID Listed

US. Pennsylvania RTK - Hazardous Substances
SULFURIC ACID Listed

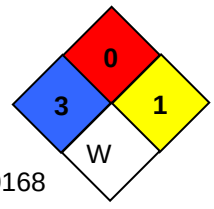
US. Rhode Island RTK
SULFURIC ACID Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EU EINECS List:	On or in compliance with the inventory
EU ELINCS List:	Not in compliance with the inventory.
Japan (ENCS) List:	On or in compliance with the inventory
EU No Longer Polymers List:	Not in compliance with the inventory.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Switzerland Consolidated Inventory:	Not in compliance with the inventory.
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



Flammability
Health

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe
W: Water-reactive

Issue date:	06-11-2014
Revision date:	No data available.
Version #:	1.1
Further information:	No data available.
Disclaimer:	THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED “AS IS,” AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION<(>,<)> WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

SAFETY DATA SHEET

1. Identification

Product identifier: SODIUM HYDROXIDE SOLUTIONS

Other means of identification
Product No.: 3715, 0896

Recommended use and restriction on use

Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer

Company Name:	Avantor Performance Materials, Inc.
Address:	3477 Corporate Parkway, Suite 200 Center Valley, PA 18034
Telephone:	Customer Service: 855-282-6867
Fax:	
Contact Person:	Environmental Health & Safety
e-mail:	info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Physical hazards

Corrosive to metals	Category 1

Health hazards

Skin corrosion/irritation	Category 1A
Serious eye damage/eye irritation	Category 1
Specific target organ toxicity - single exposure	Category 3

Unknown toxicity

Acute toxicity, oral	0 %
Acute toxicity, dermal	0 %
Acute toxicity, inhalation, vapor	100 %
Acute toxicity, inhalation, dust or mist	100 %

Environmental hazards

Acute hazards to the aquatic environment	Category 3

Unknown toxicity

Chronic hazards to the aquatic environment	39 %

Label elements

Hazard symbol:

Signal word: Danger

Hazard statement: May be corrosive to metals.
Causes severe skin burns and eye damage.
May cause respiratory irritation.
Harmful to aquatic life.

Precautionary statement

Prevention: Keep only in original container. Do not breathe dust/fume/gas/mist/vapors/spray. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection.

Response: Absorb spillage to prevent material damage. IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician. Wash contaminated clothing before reuse.

Storage: Store in corrosive resistant container with a resistant inner liner. Store locked up. Store in a well-ventilated place. Keep container tightly closed.

Disposal: Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification: None.

3. Composition/information on ingredients

Mixtures

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
SODIUM HYDROXIDE		1310-73-2	35 - 45%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion: Call a physician or poison control center immediately. Do NOT induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.

Inhalation: Move to fresh air. If breathing stops, provide artificial respiration. If breathing is difficult, give oxygen. Call a physician or poison control center immediately.

Skin contact: Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician or poison control center immediately. Wash contaminated clothing before reuse. Destroy or thoroughly clean contaminated shoes.

Eye contact: Immediately flush with plenty of water for at least 15 minutes. If easy to do, remove contact lenses. Call a physician or poison control center immediately.

Most important symptoms/effects, acute and delayed

Symptoms: Corrosive to skin and eyes. Respiratory tract irritation.

Indication of immediate medical attention and special treatment needed

Treatment: Treat symptomatically. Symptoms may be delayed.

5. Fire-fighting measures

General fire hazards: No data available.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media: The product is non-combustible. Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media: None known.

Specific hazards arising from the chemical: Product is highly caustic. Wear appropriate protective gear if spilled during fire fighting. Contact with metals may evolve flammable hydrogen gas.

Special protective equipment and precautions for firefighters

Special fire fighting procedures: Move containers from fire area if you can do so without risk. Use water spray to keep fire-exposed containers cool.

Special protective equipment for fire-fighters: Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures: Put on protective equipment before entering danger area. See Section 8 of the MSDS for Personal Protective Equipment. Keep unauthorized personnel away. Keep upwind. Ventilate closed spaces before entering them. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.

Methods and material for containment and cleaning up: Neutralize spill area and washings with dilute acetic acid. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Collect in a non-combustible container for prompt disposal. Dike far ahead of larger spill for later recovery and disposal.

Notification Procedures: Dike for later disposal. Prevent entry into waterways, sewer, basements or confined areas. Stop the flow of material, if this is without risk.

Environmental precautions: Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling: Use personal protective equipment as required. Avoid breathing mists or vapors. Avoid contact with eyes, skin, and clothing. Do not taste or swallow. Wash hands thoroughly after handling. Do not eat, drink or smoke when using the product. See Section 8 of the MSDS for Personal Protective Equipment.

Conditions for safe storage, including any incompatibilities: Do not store in metal containers. Keep container tightly closed. Store in a well-ventilated place. Store in a dry place.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values	Source
SODIUM HYDROXIDE	Ceiling	2 mg/m3	US. ACGIH Threshold Limit Values (2011)
	Ceil_Time	2 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	PEL	2 mg/m3	US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)
	Ceiling	2 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)

Appropriate engineering controls No data available.

Individual protection measures, such as personal protective equipment

General information: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Eye/face protection: Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection

Hand protection: Chemical resistant gloves

Other: Wear suitable protective clothing.

Respiratory protection: In case of inadequate ventilation use suitable respirator.

Hygiene measures: Provide eyewash station and safety shower. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state: Liquid

Form: Liquid

Color:	Colorless
Odor:	Odorless
Odor threshold:	No data available.
pH:	14
Melting point/freezing point:	1 - 12 °C
Initial boiling point and boiling range:	115 - 140 °C
Flash Point:	Not applicable
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Relative density:	1.44 (20 °C)
Solubility(ies)	
Solubility in water:	Soluble
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.

10. Stability and reactivity

Reactivity:	Reacts violently with strong acids.
Chemical stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur.
Conditions to avoid:	Avoid contact with oxidizing agents. Reacts violently with strong acids.
Incompatible materials:	Oxidizing agents. Acids. Maleic Anhydride Halogens. Nitromethane. Contact with metals may evolve flammable hydrogen gas.
Hazardous decomposition products:	Sodium oxides

11. Toxicological information

Information on likely routes of exposure

Ingestion:	May cause burns of the gastrointestinal tract if swallowed.
Inhalation:	May cause damage to mucous membranes in nose, throat, lungs and bronchial system.
Skin contact:	Causes severe skin burns.
Eye contact:	Causes serious eye damage.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral
Product: ATEmix (): 317.07 mg/kg

Dermal
Product: ATEmix (): 3,292.68 mg/kg

Inhalation
Product: No data available.

Repeated dose toxicity
Product: No data available.

Skin corrosion/irritation
Product: Causes severe skin burns.

Serious eye damage/eye irritation
Product: Causes serious eye damage.

Respiratory or skin sensitization
Product: Not a skin sensitizer.

Carcinogenicity
Product: This substance has no evidence of carcinogenic properties.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro
Product: No mutagenic components identified

In vivo
Product: No mutagenic components identified

Reproductive toxicity
Product: No components toxic to reproduction

Specific target organ toxicity - single exposure
Product: May cause respiratory irritation.

Specific target organ toxicity - repeated exposure
Product: None known.

Aspiration hazard
Product: No data available.

Other effects: None known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product: No data available.

Specified substance(s):

SODIUM HYDROXIDE — LC 50 (Western mosquitofish (Gambusia affinis), 96 h): 125 mg/l Mortality

Aquatic invertebrates

Product: No data available.

Specified substance(s):

SODIUM HYDROXIDE — EC 50 (Water flea (Ceriodaphnia dubia), 48 h): 34.59 - 47.13 mg/l Intoxication

Chronic hazards to the aquatic environment:

Fish

Product: No data available.

Aquatic invertebrates

Product: No data available.

Toxicity to Aquatic Plants

Product: No data available.

Persistence and degradability

Biodegradation

Product: There are no data on the degradability of this product.

BOD/COD ratio

Product: No data available.

Bioaccumulative potential

Bioconcentration factor (BCF)

Product: No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)

Product: No data available.

Mobility in soil: The product is water soluble and may spread in water systems.

Other adverse effects: Harmful to aquatic organisms. The product may affect the acidity (pH-factor) in water with risk of harmful effects to aquatic organisms.

13. Disposal considerations

Disposal instructions: Discharge, treatment, or disposal may be subject to national, state, or local laws.

Contaminated packaging: Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number:	UN 1824
UN proper shipping name:	Sodium hydroxide solution
Transport hazard class(es)	
Class(es):	8
Label(s):	8
Packing group:	II
Marine Pollutant:	No

IMDG

UN number:	UN 1824
UN proper shipping name:	SODIUM HYDROXIDE SOLUTION
Transport hazard class(es)	
Class(es):	8
Label(s):	8
EmS No.:	F-A, S-B
Packing group:	II
Marine Pollutant:	No

IATA

UN number:	UN 1824
Proper Shipping Name:	Sodium hydroxide solution
Transport hazard class(es):	
Class(es):	8
Label(s):	8
Marine Pollutant:	No
Packing group:	II

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

SODIUM HYDROXIDE Reportable quantity: 1000 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

[X] Acute (Immediate) [ ] Chronic (Delayed) [ ] Fire [ ] Reactive [ ] Pressure Generating

SARA 302 Extremely hazardous substance

None present or none present in regulated quantities.

SARA 304 Emergency release notification

Chemical identity	RQ
SODIUM HYDROXIDE	1000 lbs.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity
SODIUM HYDROXIDE	500 lbs

SARA 313 (TRI reporting)

None present or none present in regulated quantities.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

SODIUM HYDROXIDE Reportable quantity: 1000 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

None present or none present in regulated quantities.

US state regulations

US. California Proposition 65

No ingredient regulated by CA Prop 65 present.

US. New Jersey Worker and Community Right-to-Know Act

SODIUM HYDROXIDE Listed

US. Massachusetts RTK - Substance List

SODIUM HYDROXIDE Listed

US. Pennsylvania RTK - Hazardous Substances

SODIUM HYDROXIDE Listed

US. Rhode Island RTK

SODIUM HYDROXIDE Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory
Japan (ENCS) List:	On or in compliance with the inventory
China Inv. Existing Chemical Substances:	Not in compliance with the inventory.
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe
COR: Corrosive

Issue date:	05-10-2014
Revision date:	No data available.
Version #:	1.0
Further information:	No data available.
Disclaimer:	THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED "AS IS," AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION, WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE. THIS MSDS/SDS IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PROPERLY TRAINED PERSON USING THIS PRODUCT, AND IS NOT INTENDED TO BE COMPREHENSIVE AS TO THE MANNER AND CONDITIONS OF USE, HANDLING, STORAGE, OR DISPOSAL OF THE PRODUCT. INDIVIDUALS RECEIVING THIS MSDS/SDS MUST ALWAYS EXERCISE THEIR OWN INDEPENDENT JUDGMENT IN DETERMINING THE APPROPRIATENESS OF SUCH ISSUES. ACCORDINGLY, AVANTOR PERFORMANCE MATERIALS ASSUMES NO LIABILITY WHATSOEVER FOR THE USE OF OR RELIANCE UPON THIS INFORMATION. NO SUGGESTIONS FOR USE ARE INTENDED AS, AND NOTHING HEREIN SHALL BE CONSTRUED AS, A RECOMMENDATION TO INFRINGE ANY EXISTING PATENTS OR TO VIOLATE ANY FEDERAL, STATE, LOCAL, OR FOREIGN LAWS. AVANTOR PERFORMANCE MATERIALS REMINDS YOU THAT IT IS YOUR LEGAL DUTY TO MAKE ALL INFORMATION IN THIS MSDS/SDS AVAILABLE TO YOUR EMPLOYEES.

ATTACHMENT D

JOB SAFETY ANALYSES AND

DAILY SITE SAFETY CHECKLISTS

Job Safety Analysis (JSA)

JSA Title: Groundwater Sampling - Bailer

Date Developed: 2/8/2005	**Revised Date:** 8/8/2016
Initial Development Team: Scott Martin, Case Manager	
Latest Revision by: Julius Pachy, RHSSE	
Quality Review by: Lisa Leclair, LLHSO	

Revision #: 006

This JSA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JSA.

REQUIRED PPE: ☒Air Purifying Respirator; ☐Ear Muffs; ☐Ear Plugs; ☐Face Shield; ☐Fire Retardant Clothing; ☒Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); ☐Goggles; ☐Hard Hat; ☒Safety Glasses; ☒Safety-toed Boots; ☒Shirt (Highly-Visible Short/Long Sleeve); ☐Tychem Suit; ☐Tyvek Suit; ☐Vest (Highly Visible Reflective Striped); ***Other:*** Enter other required PPE.

TASK-SPECIFIC TOOLS AND EQUIPMENT: Click here to enter tools and equipment.

Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
Please ensure that all necessary JSAs associated with your work scope have been identified and reviewed.		
A. Locate and Open Onsite Well 1. Locate wells	**1a.** Hand and arm fractures or contusions as a result of tripping and falling when walking or working on uneven surfaces **1b.** Fractures /contusions due to contact with moving vehicles.	**1a.** Inspect the work area and look for uneven areas that may create a tripping hazard. ➢ Plan walking path through work area to avoid the uneven areas ➢ If the path of travel is obstructed (lighting, over growth, clutter...) utilize a walking stick and probe ahead, walk slowly and use caution. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements. **1b.** Utilize cones/barricades/safety fence to establish the work zone – Comply with GES Traffic Control program. ➢ Position work vehicle between work area and on-coming traffic. ➢ Do not permit access to work zone by non-essential personnel. ➢ Inform facility personnel of work (restricted) area. ➢ Use "spotter" to warn personnel of approaching vehicles in high traffic areas. ➢ Don high visible sleeved shirt or outerwear, such as high visible traffic vests or clothing. ➢ If working alongside an active roadway, where vehicular traffic is heavy, dawn/dusk hours, or if weather if overcast or rainy, high visible outwear with reflective stripping must be worn.
2. Open wells	**2a**. Cuts or contusions to the hands, fingers, arms or other body parts due to contact with sharp edges of well, well lid or well box **2b.** Back/body sprain/strain from lifting, moving well lids/covers **2c.** Shoulder/body sprain/ resulting from using a socket wrench to loosen and remove bolts from the lid **2d.** Cuts, contusions to knees or legs when kneeling on hard surfaces when opening well.	**2a.** Remove well / manhole covers so that they do not pinch fingers. ➢ Keep body parts (hands, fingers) out from between the lid and well opening. ➢ Use a crowbar/prybar to remove the lid or cap. ➢ Don Level II cut resistant gloves **2b.** Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area **2c.** Ensure your wrists are straight when using a wrench. ➢ Be sure that the opening of the socket is in full contact with the bolt before you apply pressure. ➢ Pull, don't push. Use a slow, steady motion. If the bolt cannot be loosened with normal force, contact office to discuss options. ➢ Kneel on a solid surface with one foot planted firmly on the floor and don't lean into the work. ***Note:*** *Never use hand sockets with power or impact wrenches. Replace sockets showing cracks or wear.* **2d.** Inspect and eliminate any debris found on the ground prior to kneeling. ➢ If possible, avoid kneeling on ground or hard surface instead crouch down bending at the knees. ➢ Use kneeling pads when kneeling on hard surfaces.
B. Conduct Liquid Gauging 1. Insert interface probe into well and record liquid level reading in site log book	**1a.** Respiratory or skin irritation/inflammation, headache, nausea, dizziness, caused by exposure to site contaminants / organic	**1a.** Do not splash purged water on clothing or skin. ➢ Discuss and implement monitoring and action levels requirements stated in the HASP ➢ If organic vapors are present, replace the well cap and do not proceed until a PID is obtained to scan the atmosphere ensuring that concentrations are below the HASP action levels. ➢ If respirator upgrade is required, contact office LHSO, Site Operations/Project Management before proceeding. ➢ Don required PPE (safety glasses, long pants, nitrile sampling gloves, sleeved shirts).

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	vapors	***Note:*** *Be aware that there may be elevated levels of gasoline or product vapors in the wells.*
C. Purge Monitoring Well 1. Set up of equipment; insert bailer into monitoring well and purge water into container at surface NOTE: The use of utility and / or personal knives (i.e., Stanley knives, box cutters, pocket knives) is STRICTLY PROHIBITED.	**1a.** Respiratory or skin irritation/inflammation, headache, nausea, dizziness, caused by exposure to site contaminants/ organic vapors. **1b.** Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of cutting tools while cutting bailer string **1c.** Back/body sprain / strain from bailing purge water **1d.** Back/body sprain / strain from lifting cooler other equipment	**1a.** Monitor work area with PID and comply with action levels document in HASP table 1 if organic vapors are present. ➢ Read and Comply with all requirements stated in the SDS/MSDS ➢ Do not splash purged water on clothing or skin. ➢ Don required PPE (safety glasses, long pants, nitrile sampling gloves, sleeved shirts). **1b.** Ensure the cutting instrument(s) used are the approved tool for the job, ➢ Individual is trained on the safe usage and are equipped with "self-retracting" blades that CANNOT be overridden by the user (i.e. held out or locked open) or blades that are guarded and do not allow the blade to come in contact with the user. ➢ Ensure blades are sharp and all guards are in place before starting a cut. ➢ Inspect the cutting equipment prior to start of cut. ➢ Cut away from your body and keep hands out of the path of cutting tools. ➢ Don Kevlar Level II Cut Resistant Gloves. **1c.** Take frequent breaks as needed to prevent fatigue to shoulder and arm muscles caused by bailing water. ➢ Be aware of the signs and symptoms of repetitive stress injuries and report all symptoms immediately **1d.** Determine whether the items must be lifted - can it be left in place or pushed/pulled into place? ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist. ➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area
D. Conduct Groundwater Sampling 1. Insert disposable bailer into monitoring well to collect water	**1a.** Irritation or burns to hand, arms and other body parts that result from skin contact with site contaminants	**1a.** Do not splash purged water on clothing or skin. ➢ Don required PPE (safety glasses, long pants, nitrile sampling gloves, sleeved shirt)
2. Collect groundwater in sampling container	**2a.** Irritation or burns to eyes, hand, arms and other body parts that result from skin contact with site contaminants and preservatives **2b.** Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of glassware	**2a.** Do not splash purged water on clothing or skin. ➢ Sample preservative may have leaked from a container or multiple containers; sample preservatives consist of various types of acids that include HCL, HNO3, and H2SO4 – hand and skin protection is necessary ➢ Where handling preservatives, review MSDS/SDS and understand signs/symptoms of exposure and first aid measures. ➢ Don PPE (safety glasses, long pants, nitrile sampling gloves, sleeved shirt) **2b.** Ensure glassware is free of sharp edges and is not broken prior to filling sample. ➢ If glassware is broken, discard. ➢ Ensure threads of vial do not contain small pieces of silt or sand. ➢ When securing cap on vial, do not over tighten or vial could break. ➢ Don cut resistant gloves.
E. Decontamination 1. Soak/spray durable equipment to prevent cross-contamination between multiple well locations	**1a.** Irritation or burns to hand, arms, eyes and other body parts that result from skin contact with decontamination materials	**1a.** Avoid splashing decontamination material or purge water on clothing or skin. ➢ When cleaning equipment do not spray decontamination material into the wind or near face/eyes. ➢ Don required PPE (safety glasses, long pants, nitrile sampling gloves, sleeved shirt)
F. Replace Well Cap and Cover 1. Replace well cap and cover	**1a.** Cuts or contusions to the hands, arms or other body parts due to contact with sharp edges of well, well lid or well box	**1a.** Replace manhole covers so that they do not pinch fingers. ➢ Keep body parts (hands, fingers) out from between the lid and well opening. ➢ Use a screwdriver or crowbar to remove the lid or cap. ➢ Use kneeling pads when kneeling on hard surfaces. ➢ Don cut resistant gloves
On-site edits:		

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

Job Safety Analysis (JSA)

JSA Title: Operation and Maintenance (O&M)

Date Developed: 3/8/2005	**Revised Date:** 12/31/2015
Initial Development Team: Rob Butler, Project Engineer / J. Pachy RHSSE, Karen Harris, Sr. PM / Lisa Leclair, LHSO	
Latest Revision by: Rob Butler	
Quality Review by: J. Pachy, LLHSO	

Revision #: 009

This JSA has been fully reviewed with all staff members and all activity job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on this JSA.

REQUIRED PPE: ☒Air Purifying Respirator; ☒Ear Muffs; ☒Ear Plugs; □Face Shield; □Fire Retardant Clothing; ☒Gloves (Chemical Resistant, Cut Resistant, Leather, Nitrile, Other); □Goggles; □Hard Hat; ☒Safety Glasses; ☒Safety-toed Boots; ☒Shirt (Highly-Visible Short/Long Sleeve); □Tychem Suit; □Tyvek Suit; □Vest (Highly Visible Reflective Striped); ***Other:*** Enter other required PPE.

TASK-SPECIFIC TOOLS AND EQUIPMENT: Lockout/tagout kit; PID; CGI/O2 or LEL meter

Activity/Sequence of Job Tasks	Potential Hazards	Risk Control Measures
Please ensure that all necessary JSAs associated with your work scope have been identified and reviewed.		
A. Unlock and Open System Enclosure/Compound 1. Sample atmosphere of enclosure	**1a**. Respiratory irritation/inflammation, headache, nausea, dizziness, caused by exposure to hazardous atmosphere.	**1a**. Open system doors, let system air out, and do not enter until monitoring has taken place and it is verified no atmospheric hazards exist. ➢ Eliminate hazardous atmosphere by venting or degassing the area ➢ Monitor work area with PID and comply with HASP action levels. Note: HASP action levels are based on benzene in gasoline; other contaminants will require different actions levels - consult HSSE/CHSSE for guidance. ➢ If hazardous atmosphere can't be eliminated with engineering controls, respirator upgrade may be necessary. Only those enrolled in a Medical Monitoring Program and with a current fit test (w/i past 12 months) may don a respirator. ➢ If respirator upgrade is required, contact office LHSO, Site Operations/Project Management before proceeding
B. Perform O&M Activities 1. Lockout/tagout system components as needed	**1a**. Electrocution/ burns to hands/ skin resulting from contact with energized electrical equipment	**1a**. Follow required GES Lock Out/ Tag Out (LO/TO) procedure. ➢ Warn affected personnel of LOTO. ➢ Ensure all stored energy has been identified and reached "zero energy" state. ➢ Install locks/ tags on charging equipment (i.e. spring winding mechanism). ➢ Test equipment for isolation by attempting to start. Complete maintenance/repair. ➢ Don gloves that are electrically rated for task. ➢ Don safety boots with electrical safety rating that comply with GES requirements.
2. Perform O&M activities ***Note:*** *Review P&ID – look for missing/mislabeled Critical Safety Devices (CSDs) and report findings*	**2a** Respiratory irritation/inflammation, headache, nausea, dizziness, caused by exposure to hazardous atmosphere. **2b**. Hand and arm contusions due to airline leaks / breaks under pressure. Note: pressurized air lines when broken can be an "injection" route of entry to body. **2c**. Back/body sprain/strain from lifting, moving or carrying equipment	**2a**. If using hazardous/toxic chemical for process that will emit vapors, evaluate substituting with less hazardous chemical. ➢ Monitor work area with PID and comply with HASP action levels. Note: HASP action levels are based on benzene in gasoline; other contaminants will require different actions levels - consult HSSE/CHSSE for guidance. ➢ If hazardous atmosphere can't be eliminated with engineering controls, respirator upgrade may be necessary. □ Only those enrolled in a Medical Monitoring Program and with a current fit test (w/i past 12 months) may don a respirator. ➢ If respirator upgrade is required, contact office LHSO, Site Operations/Project Management before proceeding ***Note:*** *Be aware that there may be elevated levels of gasoline or product vapors in oil/water separators and other related system equipment.* **2b**. Ensure all air lines and couplings, utilize whip checks, are inspected for damage or ware before engaging equipment / tools. ➢ Ensure air lines are rated for specific pressure (PSI) when running. ➢ Ensure air lines meet manufactures requirements for specific use on equipment / tools (right line for right use). ➢ Keep all body parts, including face from any area where air lines are under pressure. ➢ Don Safety glasses, safety shoes, hi-visible clothing and Nitrile over leather gloves. ***Note:*** *Be aware of elevated temperatures in piping and surfaces of compressed air systems, heed warning labels, and do not contact elevated temperature system elements without heat-resistant PPE (e.g., gloves rated for the temperature present).* **2c**. Determine whether the item must be lifted - can it be left in place or pushed/pulled into place? ➢ Ensure path is level and clear of debris/obstacles. ➢ When lifting, bend at the knees; not the waist, keep back and torso straight; don't twist.

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

	/materials **2d**. Hand and arm fractures or contusions as a result of tripping and falling when walking, working, or entering remediation enclosures and vehicles **2e**. Fractures or muscular injuries as a result from falls from ladder **2f**. Hearing loss caused by excessive noise during operation of system and / or equipment	➢ When carrying, keep load close to the body. ➢ Items over 50 lbs. or large/awkward items require team lift or mechanical assistance. ➢ Minimize distance over which items must be carried/pushed/pulled by placing equipment/material storage w/in 15' of work area. **2d**. Inspect the work area and look for uneven areas that may create a tripping hazard. ➢ Plan walking path through work area to avoid the uneven areas ➢ If the path of travel is obstructed (lighting, over growth, clutter...) utilize a walking stick and probe ahead, walk slowly and use caution. ➢ If entering a system that has stairs ensure use of hand rails. ➢ Place items in elevated area first so hands are free for 3 point mount/dismount. ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements. **2e**. ***Contact CHSSE if working at heights above 6 feet*** ➢ Review and comply with GES' Fall Protection Program and working at heights requirements ➢ Stairs should be constructed if passage to an elevated work area is required for any length of time and to minimize the necessity for the use of ladders. ➢ Inspect the ladder prior to use ensuring steps are clean to prevent accumulation of materials that might destroy non-slipping properties, and all metal fittings should be carefully checked. ➢ Ladders will be placed on stable surfaces to prevent slipping. ➢ Maintain 3-pints of contact when using ladder ➢ Ensure correct ladder (height and material) and utilize a 4:1 pitch ➢ Don safety boots with skid / puncture resistant soles that comply with GES requirements. **2f**. Create an exclusion zone around the work area so that third parties are not exposed to hazardous noise levels. ➢ Hearing protection should be worn if noise levels exceed 85 dBA as per this policy or if noise level is unknown (e.g., measurement device is not available or has not been pre-determined) ➢ Don ear plugs and/or ear muffs. ➢ Double hearing protection (ear plugs and ear muffs) may be necessary if levels are found to be above 100 db.
C. System Start-up 1. Replace equipment guards, secure hose fittings	**1a**. Amputation/cuts to hand or fingers as a result of being caught in moving/ rotating parts of system / equipment	**1a**. Do not place hands/fingers near moving/rotating parts. ➢ All equipment must be inspected prior to use to ensure all safety shut down switches are working. ➢ Have all bystanders keep a minimum of 3 feet away from moving/rotating parts ➢ Never operate equipment without guards in place to prevent contact with moving parts. ➢ Ensure all body parts are not exposed to areas of moving parts or sharp edges and all loose clothing secured from being caught on equipment / moving parts ➢ Don leather gloves
2. Remove lockout/tagout	**2a**. Electrocution/ burns to hands/ skin resulting from contact with energized electrical equipment **2b**. Hearing loss caused by excessive noise during operation of system and / or equipment	**2a**. Follow required GES Lock Out/ Tag Out (LO/TO) procedure. ➢ Clear work area of all tools/equipment. Remove all locks/ tags. ➢ Follow manufacturers start up procedure. ➢ Don gloves that are electrically rated for task. ➢ Don safety boots with electrical safety rating that comply with GES requirements. **2b**. Create an exclusion zone around the work area so that third parties are not exposed to hazardous noise levels. ➢ Hearing protection should be worn if noise levels exceed 85 dBA as per this policy or if noise level is unknown (e.g., measurement device is not available or has not been pre-determined) ➢ Don ear plugs and/or ear muffs. ➢ Double hearing protection (ear plugs and ear muffs) may be necessary if levels are found to be above 100 db.
On-site edits:		

Hazard Categories: Exposure, Caught (in, under, between, by), Strain/Overexertion, Contact, Falls, Energy Sources

GES DAILY SITE SAFETY CHECKLIST

Site Name: _____
Address: _____

Task, Name, and date of entry: _____ _____

This checklist is to be completed on a daily basis. The date should be noted in the space provided. The employee completing the checklist should verify that each item is correct and initial in the last space provided.

Date of field work:						
1. Proper training certificates have been obtained from all onsite personnel.						
2. The site-specific HASP has been reviewed and signed by GES employees and GES-hired subcontractors.						
3. The daily site-safety meeting has been conducted.						
4. Applicable JSAs are onsite, reviewed by staff to ensure all tasks/jobs are covered, and site specific JSA modifications occur when needed.						
5. Fire extinguishers are available for use and are fully charged.						
6. A fully-stocked first aid kit & eye wash bottle is readily available.						
7. Any potential tripping hazards have been removed from site.						
8. All vessels containing flammable or corrosive material are properly labeled.						
9. Proper personal protective equipment is being used for present conditions.						
10. Equipment onsite is checked and in safe working order.						
11. Safety cones and flags or barricades have been utilized to mark out work area along with all required signage (No Smoking, No Trespassing, Work Area...).						
12. No person onsite has the appearance of being under the influence of motor skill altering substances.						
13. All workers onsite are clothed in an appropriate manner (highly visible clothing, no tank tops, muscle shirts or shorts).						
14. Electrical power-operated tools shall be properly grounded and used with a Ground-Fault Circuit Interrupter (GFCI).						
15. All required permits (GES and/or client) are completed by an authorized individual.						
16. When working alone, has a phone call been placed to the PM to discuss site conditions, review the Scope of Work, LPS requirements, and coordinate communications for the day? Note: The frequency/ amount of additional calls from the field should be established during the PM's discussion with the individual. A call must always occur prior to leaving the site. **(FILL IN OFFICE COMMUNICATION TIME)**	TIME	TIME	TIME	TIME	TIME	TIME
17. Prior to leaving the site for the day, the GES site supervisor has conducted a meeting with onsite staff to review worker conditions (possible injuries), JSA revisions, discuss possible Near Losses/ Losses, and activities scheduled for the next day.						
18. All health and safety concerns have been communicated to the Local Health and Safety Officer and Project Manager						
I verify and initial that the above information is correct by initialing in the boxes to the right:						

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18. All health and safety concerns have been communicated to the Local Health and Safety Officer and Project Manager						
I verify and initial that the above information is correct by initialing in the boxes to the right:						

ATTACHMENT E

WORK PERMITS

ATTACHMENT F

PRE-ENTRY MEETING NOTES

PRE-ENTRY MEETING NOTES/ATTENDANCE

(Include date, length of meeting, names of personnel in attendance, topics of discussion, comments and concerns, etc.)

PRE-ENTRY MEETING NOTES/ATTENDANCE

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ATTACHMENT G

SITE-SPECIFIC DECONTAMINATION PLAN

DECONTAMINATION PLAN

1. Personnel Decontamination

   Section 7 lists the specific levels of protection required. Consistent with the levels of protection required, step by step procedures for personnel decontamination for each Level of Protection are attached.

2. Levels of Protection Required for Decontamination Personnel

The levels of protection required for personnel assisting with decontamination will be:

☐Level B ☐Level C ☐Level D

Modifications include:

3. Disposition of Decontamination Wastes

(Provide a description of daily, weekly, and end of project waste disposition including identification of storage area, hauler, and final disposal site if applicable.)

4. Equipment Decontamination

A procedure for decontamination steps required for non-sampling equipment and heavy machinery follows:

5. Sampling Equipment Decontamination

Sampling equipment will be decontaminated in accordance with the following procedure:

LEVEL C DECONTAMINATION PROCEDURES

(if required)

[Check indicated Functions or add steps as necessary]:

STEP	FUNCTION	DESCRIPTION OF PROCESS, SOLUTION AND CONTAINER
	Segregated equipment drop	
	Boot cover and glove wash	
	Boot cover and glove rinse	
	Tape removal - outer glove/boot	
	Boot cover removal	
	Outer glove removal	
----------HOT-LINE----------		
	Suit/safety boot wash	
	Suit/boot/glove rinse	
	Safety boot removal	
	Suit Removal	
	Inner Glove Wash	
	Inner Glove Rinse	
	Face piece removal	
	Inner glove removal	
	Inner clothing removal	
----------CRC/SAFE ZONE BOUNDARY----------		
	Field Wash	
	Redress	

ATTACHMENT H

TRAFFIC CONTROL POLICIES AND PROCEDURES

ATTACHMENT I

INJURY CASE MANAGEMENT FLOWCHART

GES PROJECT INJURY CASE MANAGEMENT

If an incident/injury occurs on-site to a GES or a subcontractor employee, the incident/injury must be immediately reported to the GES Onsite Supervisor. If a subcontractor is injured also notify subcontractor management.

DOES THE INJURY REQUIRE EMERGENCY MEDICAL ATTENTION?

Yes

Response 1

1. *Call 911!!!!*
2. Provide support/First Aid to Injured Person (IP) until Emergency Management Services (EMS) arrives.
3. Following the 911 call, notify:

a) GES Project Manager (PM) or GES Regional HSSE Manager (RHSSEM) *(If a subcontractor is injured, follow the same approach and notify subcontractor management as well)*

b) GES PM or GES RHSSEM to notify GES Site Operations Manager (SOM)

c) GES PM or GES RHSSEM to notify Vice President of Health and Safety (VP of HSSE) Tom Baylis at 610-587-1124 *(Tom's back up is Basith Mohammed 954-304-7043)*

d) Tom Baylis (or his backup) notifies GES Program Manager (PGM)

e) GES PGM or GES PM will notify the Client

4. Lead GES person to accompany GES IP to emergency room (ER). If GES IP is alone then a member of management would meet at ER, if subcontractor IP then subcontractor management would meet at ER.
5. Ensure that the IP receives the necessary support and medical care.
6. GES RHSSEM will begin incident investigation per LPS guidance.
7. GES PM will initiate and complete any client required forms.

Note: VP of HSSE will notify Work care, Inc. regarding IPs condition and to obtain injury case management support

No

DOES THE INJURY REQUIRE TREATMENT?

No

Response 3

Continue to monitor IP's condition and report incident to GES PM

Yes

CAN THE INJURY BE TREATED WITH ONLY FIRST AID?

No

Response 4

Provide First Aid/ Support and THEN...

1. Provide Notifications according to Response 1 (items 3a to 3e).
2. GES PM with support from VP of HSSE's will schedule appointment at GES contracted Occupational Clinic (OC), (or for subcontractor injury, a subcontractor chosen OC).
3. IP will be taken to OC for an evaluation at the IP's request or the decision of VP of HSSE.
4. Lead GES person will accompany IP to OC *(If GES IP is alone then a member of GES management would meet at OC)*. If a subcontractor IP then subcontractor manager will accompany to OC.
5. GES RHSSEM will begin incident investigation per LPS guidance.

Note: VP of HSSE will notify Work care, and obtain injury case management support and facilitate the appropriate /suitable treatment and care.

Yes

Response 2

Provide First Aid

(GES Site Supervisor certified in CPR/FA will evaluate IPs condition and provide first aid)

Then follow notification requirements from Response 1 (Items 3a to 3e)

Always Remember

It is extremely important to report incidents immediately to the GES onsite supervisor.

Even if the injury is minor or if there is no initial injury and you feel it is not worth reporting, the incident must be managed and documented. Minor injuries may worsen over time.

Last Update: October 21, 2015

GES Health, Safety, Security & Environment (HSSE): An unwavering commitment to safeguard people, property, and the environment!

ATTACHMENT J

SIGN OFF SHEET

SITE SAFETY AND HEALTH PLAN COMPLIANCE AGREEMENT

All project personnel, including visitors, must follow the requirements of this Site Safety Plan. In order to document individual agreement with this requirement, all personnel must complete this "Site Safety and Health Plan Compliance Agreement." These agreements will be kept in this Site Safety Plan and will become part of the permanent project record upon completion of site activities.

By signing below, I have read the Site Health and Safety Plan (HASP), or I have been verbally advised of its contents. I understand, and I agree to comply with all of its provisions. I understand that I could be prohibited from working on the project, and I may be subject to disciplinary actions for violating any of the health and safety requirements specified in the HASP.

Name	Signature	Date	Time	LPS Card	OSHA Card

Name	Signature	Date	Time	LPS Card	OSHA Card

Name	Signature	Date	Time	LPS Card	OSHA Card

Name	Signature	Date	Time	LPS Card	OSHA Card

Name	Signature	Date	Time	LPS Card	OSHA Card

APPENDIX F

VENDOR AND EQUIPMENT CATALOG CUTS AND SPECIFICATIONS

SECTION 01650

FACILITIES STARTUP

PART 1 GENERAL

1.01 Summary

A. Except as specifically noted in individual technical Sections, this Section governs the requirements for facilities and system startup.

B. Exceptions in an individual technical Section modify only the individual Article and topic; other topics and Articles in this Section remain in force unless specifically deleted by the technical Section.

C. Section Includes:

1. Section 01300 - Submittals.
2. Section 01310 - Progress Schedule.
3. Section 01400 - Quality Assurance andQuality Control.
4. Section 01700 - Project Closeout.

1.02 Definitions

A. Acceptance: The act of the Engineer in receiving submittals and finding no obvious reason for its rejecting, but not to indicate certification that Contractor's estimated performance can be achieved.

B. Approve: To accept and to certify.

C. Certify: After ascertaining the facts and making oneself informed, to guarantee the accuracy of the facts according to the requirements of the Conditions of the Contract.

D. Component: An individual item, piece of equipment, or equipment group as specified in a single Section.

E. Facilities Startup Plan: A single and complete plan incorporating all requirements of this Section.

F. Subsystem: A series of components that can be tested together to assure specified performance.

G. System: The complete dynamic components, and associated passive components, of the Work.

H. Validate: To support, substantiate, and authenticate specified operation on a sound or authoritative basis.

1.04 System Description

A. Design Requirements:

1. Design temporary connections and utility lines to meet the specified design requirements of the component, subsystem, and system to which they are connected.
2. Include required restraints.
3. Do not place structural loads on permanent facility clements beyond their design load capacity.

4. Provide dielectric unions on temporary connections wherever dissimilar metals connect.
5. Provide safety valves and similar safety devices on temporary connections wherever they would be required if the connections were permanent.
6. Divide subsystems according to the P&ID ladder diagrams wherever practical.

B. Performance Requirements:

1. Performance requirements for components, subsystems, and the system are specified in individual Sections.

1.05 Submittals

A. Provide submittals according to Section 01300.

B. Facilities Startup Plan:

1. Provide a Facility Startup Plan for acceptance not less than 10 days prior to startup, incorporating the requirements of this Section.
2. The Facilities Startup Plan is the responsibility of the Contractor who is solely responsible for its means, methods, techniques, sequences, procedures, coordination, completeness, accuracy, and validity.
3. Individual sections of the Startup Plan may be accepted by Engineer, with Engineer's prior approval, but must be incorporated into the final accepted Startup Plan.
4. Rejection of individual sections of the Startup Plan by Engineer is not a cause for a claim of delay.
5. Identify each person or organization who will have a functional part in the startup, and identify their duties and responsibilities.
6. Provide for contingencies on validation failure.

C. Temporary Connections:

1. Provide complete information on temporary connections in the form of shop drawings or a complete written description or a combination of both.
2. Provide separate drawings or descriptions, or both for each item or subsystem identified in the startup plan.

D. Validation procedures:

1. Provide a complete written description of each test, simulation, and startup, including:
   a. Schedule.
   b. Listing of components included.
   c. Listing of individuals or organizations involved, and assigned responsibilities.
   d. Test equipment required, accuracy, and calibration information.
   e. Detailed listing of procedures necessary to demonstrate compliance with performance requirements specified in technical Sections.

E. Validation reports: Provide validation reports indicating compliance with performance requirements in technical Sections for Engineer's certification.

1.06 Quality Assurance

A. Qualifications:

1. Provide complete foremen's qualifications for Owners approval, indicating 3 years of experience operating and maintaining this type of equipment, or academic and factory training to operate and maintain this type of equipment, or another acceptable combination of relevant training and experience. Owner reserves the right to reject foremen who, in their sole opinion, are not qualified by experience and training to operate and maintain the equipment.

B. Regulatory Requirements:

1. Include information relating to regulatory requirements for operation and maintenance of equipment.

C. Certifications:

D. Pre-Installation Conference:

1. Arrange for a pre-installation conference scheduled not less than 10 days prior to training.

2. Conference to be attended by Owner, Engineer, Contractor, Contractor's startup and installation foremen, and other responsible parties.

3. Prepare an agenda for approval prior to conference, to include as a minimum:

a. Startup and demonstration schedule.

b. Facilities examination.

c. Problem resolution.

1.07 Sequencing and Scheduling

A. Facilities Startup Schedule:

1. Provide as a sub-schedule of the main project schedule.

2. After acceptance, submit Facilities Startup Schedule updates at same interval required for the main project schedule in Section 01310.

3. Include submittal, and approval of submittals required for components.

4. Address each subsystem individually.

1.08 Maintenance

A. Provide maintenance on components through completion of the Reliability Demonstration.

PART 2 PRODUCTS

2.01 Temporary Connections

2.02 Chemical and Operating Fluids

A. Provide chemicals and operating fluids required for validation and Reliability Demonstration. These are in addition to chemicals and fluids required to be provided to Owner separately under the Specifications.

B. Provide maintenance and replacement parts required during the Reliability Demonstration.

PART 3 EXECUTION

3.01 Component Validation

A. Validate each component by one or more of the following procedures, as approved:

1. Testing to show compliance with specifications.
2. Simulation of actual operation by a method certified as acceptable and valid by both the component manufacturer and the Engineer.
3. Certification by an independent testing laboratory that the component type meets a specified industry standard.
4. Where procedures are specified in individual Sections, substitute procedures will not be accepted without prior written approval.

B. Validate components at component or subsystem level prior to system startup and testing.

C. Component validation must include:

1. Full range of operation of each component.
2. Emergency procedures.
3. Normal start-up and shutdown procedures.
4. Out-of-parameter correction.
5. Validate components individually and as part of a subsystem test.

3.02 Examination

A. Prior to validating components or subsystems, verify that:

1. Startup submittals have been accepted.
2. Manufacturers' have certified component installations wherever required.
3. Coordination with manufacturers' representatives for required field services is completed.
4. Facility is enclosed weather-tight.
5. Auxiliary systems are in proper operation.
6. No safety defects remain unresolved.
7. Provisions have been made for disposal of solids and liquids generated.
8. Both hand and automatic operation of equipment is operational.
9. Equipment is lubricated and serviced, and is ready for continuous operation.

3.03 Preparation

A. Protection:

B. Temporary connections:

1. Provide temporary connections as indicated on approved submittals.
2. Test temporary connections by the same method that would be required if the connections were permanent.

C. Effluent collection, removal, and disposal:

3.04 Testing Requirements

A. Conduct tests using non-process, clean fluids prior to process fluid testing.

B. Effluent from testing not meeting specified system effluent quality are the property of Contractor, who is responsible for legal disposal.

3.05 Testing of System

A. Validate subsystems and components before beginning system validation.

B. Perform system tests only to certify system, not to certify components or subsystems.

C. System performance is based on specified component performance and system output boundary conditions.

3.06 Reliability Demonstration

A. Operate and maintain the system for not less than 5 days continuously and at full capacity to demonstrate that the system performs according to specifications.

B. Any system operation outside of specified operating boundary conditions requires a restart of the Reliability Demonstration period for a time specified by the Engineer up to the original time period.

C. Document actions taken and procedures developed that are not covered in the operations manuals, and provide as an appendix to the operating manuals.

D. Where required in individual specification Sections, at the end of the Reliability Demonstration, replace or clean filters, replace fluids, and perform other replacement and adjustment requirements.

3.07 Field Quality Control

A. Tests:

1. Calibrate test equipment used to validate compliance immediately prior to testing.
2. Check calibration of testing equipment immediately after validation tests.
3. Revalidation, including the requirements of this Article, is required whenever test equipment is out of calibration at the completion of the validation testing.

B. Inspection:

C. Manufacturer's Field Service:

3.08 Adjusting and Cleaning

A. After the successful completion of the demonstration period, perform the following:

1. Lubricate and service dynamic equipment in accordance with manufacturer's instructions.
2. Clean facility surfaces to a "like-new" condition.
3. Clean equipment inside and out to a "like-new" condition. Dynamic equipment in the process stream such as screw conveyors, pumps, and valves do not require the interior to be cleaned.
4. Preform other cleaning, adjusting, and replacement requirements included in other sections of these specifications.

--END OF SECTION 01650--

FLOWLINE

Smart Trak™ Mounting System
LM10 Series
Owner's Manual

Version 1.0

Manual #LM900001

Table of Contents

Unpacking and Inspection:

One Smart Trak kit (LM10-1201, 1401, or 1601) includes the following parts (illustrated on page 9):

1 Track
1 Locking pin
1 Top compression fitting
1 Wire gasket
1 2" NPT fitting
1 Track end cap
2 Wire retainer clips
1 Instruction Manual
1 Warranty Card (please fill out and return the LM10 series warranty card immediately to Flowline, Inc.)

One sensor car kit (included) consists of the following parts:

1 Sensor car
1 Locking screw
1 Locking bolt
1 O-ring
1 Bayonet adapter

Part Number Information:

Part #	Track Material	Size
LM10-1201	PP	2' L x 1" sq. W
LM10-1401	PP	4' L x 1" sq. W
LM10-1601	PP	6' L x 1" sq. W

Safety Precautions

About this Manual:

PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on three different models of Smart Trak: LM10-1201, LM10-1401, and LM10-1601. The units are identical except for the length of the track.

User's Responsibility for Safety:

Flowline manufactures a wide range of liquid level sensors, controllers, and mounting systems. It is the user's responsibility to select components that are appropriate for the application, install them properly, perform tests of the installed system, and maintain all components. The failure to do so could result in property damage or serious injury. The symbol on the left appears in the manual to call special attention to instructions that affect the safe installation and use of the product.

Proper Installation and Handling:

Use a proper sealant with all installations. Never overtighten the components. Always check for leaks prior to system startup.

Material Compatibility:

The track, end cap, wire retainer clips, bayonet adapter and sensor car of LM10 models 1201, 1401, and 1601 are made of PP (Polypropylene, a polyolefin), glass filled for extra strength. The sensor car locking bolt and screw are made of PCTFE (polychlorotrifluoroethylene, a fluoroplastic), the top compression fitting and 2" NPT fitting are made of PP, and the O-ring is made of Viton (a fluorocarbon). Make sure that the application liquids are compatible with the materials that will be wetted. To determine the chemical compatibility between the components and its application liquids, refer to the Compass Corrosion Guide, available from Compass Publications (phone 619-589-9636).

Temperature and Pressure:

Smart Trak is designed for use in application temperatures up to 90 degrees C (194° F). It is not designed for pressurized applications due to the wiring that must travel through a gasket at the head.

Wiring and Electrical:

Electrical wiring of any liquid level control system should be performed in accordance with all applicable national, state, and local codes. **Take care not to cut or break the outer insulation jacket of wiring that may be immersed while routing cables in the Smart Trak system.** Such breaks of the liquid seal of the sensor system may lead to component failure. The symbol on the left appears next to passages in the manual that affect the safe electrical operation of this product.

Flammable, Explosive and Hazardous Applications:

Smart Trak may be used within flammable or explosive applications only if the associated components are rated intrinsically safe for such use. In hazardous applications, use redundant measurement and control points, each having a different sensing technology.

Safety Precautions

Specifications:

Mounting method:	2" NPT tank adapter or flange (user-supplied) or Flowline LM50 series side mount bracket
Side mount bracket mounting method:	Bolted or welded to the side wall of the tank
Mounting orientation:	Vertical
Wetted materials:	Polypropylene (PP) and PCTFE See page 5.
Max. temperature rating:	90 degrees Celsius (194° Farenheit)
Mixer rating:	Radial velocities up to 1.5 feet per second
Max. number of sensors:	Up to four (one per side of track)
Adjustability:	Along the entire length of Smart Trak
Dimensions:	1" square wide, 2', 4' or 6' long

Introduction

About Smart Trak™

Flowline's Smart Trak™ is an adjustable mounting system for installing up to four liquid level sensors vertically within a tank. Smart Trak's totally new mounting concept allows simple installation and adjustment of sensor position, making process changes affordable and uncomplicated. Mounted through a single point at the top of the tank, up to four different sensors can be located at any depth on Smart Trak. Flowline's LC05 terminal housing, and LC10 or LC11 controllers are designed to be mounted directly to the 3/4" NPT fitting at the top of the assembly. Smart Trak mounts vertically through a standard 2" NPT tank adapter, or on a side mount bracket (such as the LM50-1001). Unlike prefabricated "trees" or pipes, Smart Trak allows you to experiment with sensor position to account for variations in the point of actuation of each sensor during process testing.

Smart Trak Components

The Smart Trak system consists of the following components:

Track

The track itself is approximately 1" square, and is from 2' to 6' (0.61 to 1.83 meters) long depending on model. The track may be cut to length if desired. Four separate grooves run the length of the track, one on each side of the square. These grooves hold the *sensor cars* that attach to Flowline sensors, and also serve to

Assembly

Step One: Attach the sensor(s) the the sensor car(s)

1. Thread the sensor wire through the bayonet to 3/4" NPT adapter, making the approach from the threaded side.

2. Screw the bayonet adapter onto the sensor until the cap of the sensor seats against the lip inside the adapter.

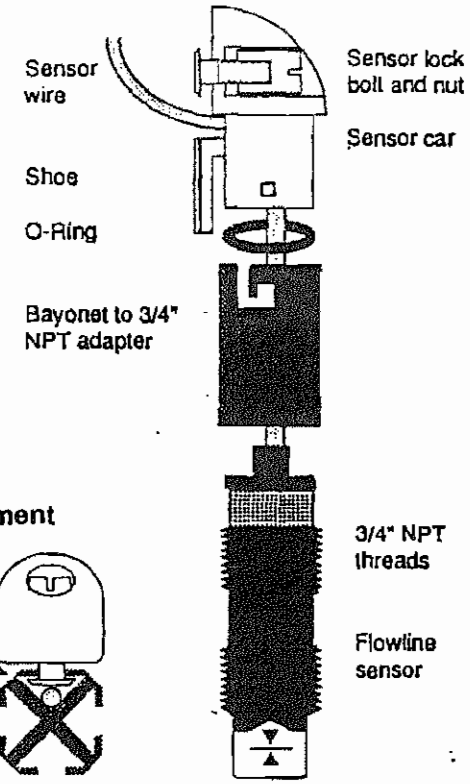
3. Thread the black O-ring onto the sensor wire and push it into the bayonet side of the bayonet adapter, seating it firmly into the adapter.

4. Thread the sensor wire into the sensor car and out through the hole between the sensor car shoe and the locking bolt.

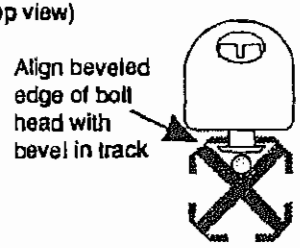
Note: The sensor wire insulation is made from polypropylene or perfluoroalkoxy to ensure chemical compatibility. This makes it stiffer than conventional wire. **Take care not to bend the wire too sharply to the point where the insulation is broken.** Such a break could cause liquid to enter the wiring, damaging the sensor.

5. Pull the sensor wire through the hole while pushing the sensor and bayonet towards the sensor car until the bayonet is in position. Align the slots on the bayonet with the pins on the sensor car, and firmly push the two together. When

Sensor car assembly
Model LM30-1001



Sensor lock bolt alignment
(top view)



contain the sensor wire. The bottom of the track is capped with an *end cap*. About 3/8" from the top of the track is a hole for a *locking pin* that holds the track in position in the top fitting.

Sensor car and bayonet adapter

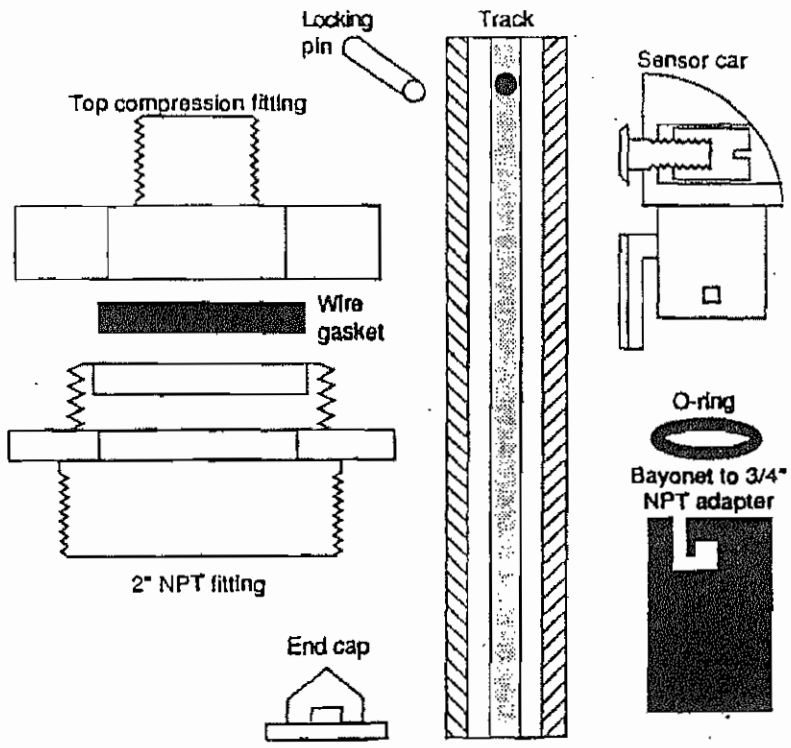
The *sensor car assembly* is the heart of the Smart Trak system. It slides in the grooves of the track, and is locked into position by a plastic bolt and screw. The *bayonet to 3/4" NPT adapter* has a female 3/4" NPT fitting on one end where the sensor (not included) will screw in, and a bayonet fitting on the other end that attaches it onto the sensor car with a slight turn, with an O-ring inbetween to provide tension for the push-and-turn connection.

2" NPT to Smart Trak fitting

The track slides into the square center of a large fitting which has coarse threads on the top, and 2" NPT-standard threads on the bottom. A slot inside the fitting mates with the locking pin to hold the track in position.

Top compression fitting and wire gasket

Once the track is in the 2" fitting, the wires pass through a thick rubber gasket, and the assembly is held firmly in place by a top compression fitting that screws onto the coarse threads. The top fitting has a 3/4" NPT threaded outlet for connecting to conduit or for direct mounting of a Flowline LC05 terminal strip housing, LC10, or LC11 series controller.



the pin is in the correct position, turn the bayonet until it is in the locked position.

Step Two: Slide the first sensor car into the track

1. Place the sensor car locking bolt (with the square tapered head) through the hole on the flat side of the sensor car, and place the slot-head nut through the other side. Screw them together several turns, but do not tighten them all the way yet.

2. One end of the track has a hole drilled horizontally through it. This is the top of the track. Slide the shoe (the lower end closest to the sensor) of the sensor car into the track at this end. Just before the locking bolt is ready to slide into the track, turn the bolt head so that the beveled edges are aligned with the beveled edges of the track (see illustration previous page).

   Alternatively, you may slide the sensor car into the bottom of the track by removing the end cap from the track and inserting the sensor car locking bolt first.

3. Slide the sensor to the desired position/depth. Tighten the sensor car lock screw with a screwdriver. Do not overtighten. Route the wire inside the track. Slide wire clips into the track to hold the wire in the track. Do not cut the wire to length yet.

Procedure for two or more sensors:

If more than one sensor will be installed on the track, repeat the procedures above for each sensor. However, don't mount the sensors too closely together because two sensors on different sides of the track cannot fit through a 2" NPT fitting at the top of the tank. If adjacent mounting is necessary you may need to install the other sensors in temporarily staggered positions, sliding them into the correct position after Smart Trak has been mounted in the tank.

Step Three: Connect the track to the top fitting

1. Thread the sensor wire(s) through the bottom of the 2" NPT to Smart Trak fitting. The bottom of the fitting is the side with the smaller threads (2" NPT); it should be nearest the sensors.

2. Before actually sliding the fitting onto the track, note the position of the horizontal hole through the track, and orient the fitting so that the slot in the top of the fitting will be aligned with the hole. Slide the fitting onto the track, a few inches down from the top.

3. Insert the locking pin into the hole in the track.

   If there are wires in either or both of the two tracks the locking pin passes through, make sure the wires are pinned into the inside of the slot by the locking pin(see illustration).

Assembly

Hint: Start by inserting the locking pin into the top of the track vertically, parallel with the wire; then when its end nears the alignment hole, push the pin in, prying the wire into the edge of the slot as you do.

4. Pull the fitting up to the top of the track until the locking pin is seated firmly in the slot and the top of the track is flush with the fitting.

5. Thread the wires through the slots in the wire gasket. Push the gasket down until it seats into the top of the 2" fitting.

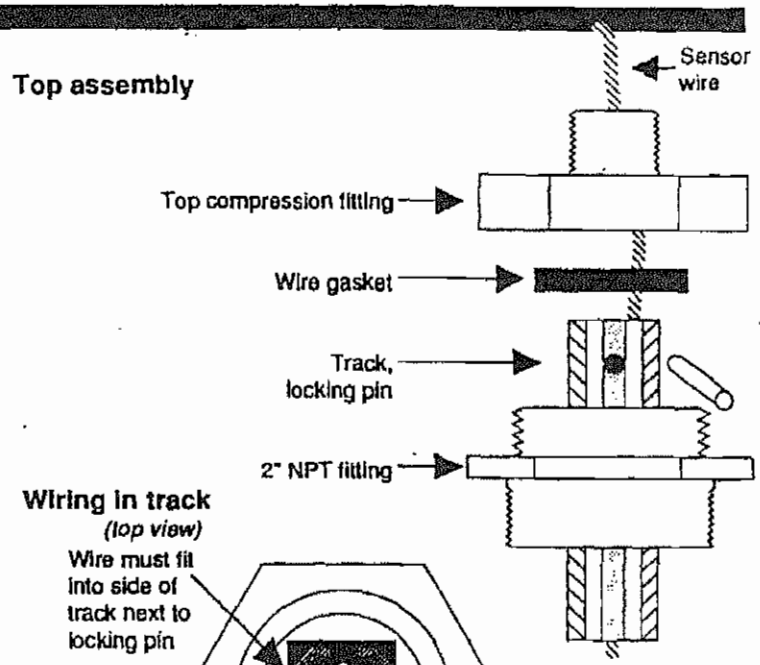
6. Thread the wires through the 3/4" NPT opening of the top compression fitting, with the approach made from the large threaded side.

7. Screw the top compression fitting onto the 2"-to-Smart Trak fitting until hand-tight.

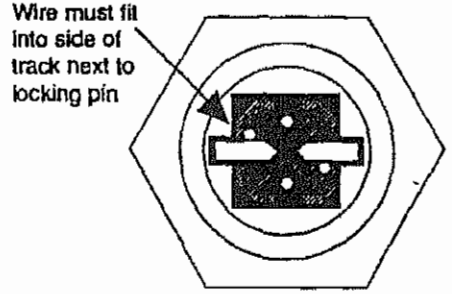
Step Four: Attach the termination hardware

At this point, a terminal strip housing (Flowline model LC05) or Smart Trak Mount Controller (Flowline model LC10 or LC11) may be screwed onto the top of the assembly, and wiring attachments made following the instructions in its manual.

Top assembly



Wiring in track
(top view)



Determine the proper wire length:

Don't make the mistake of trimming the sensor wires too short before the process is tested. If the sensors might need to be lowered in the future, leave sufficient slack in the wires to allow for future adjustment. This extra wire may be stored in the bottom of the terminal strip housing, or elsewhere above the compression fitting.

In-Tank Mounting

Selecting a location

Smart Trak should be mounted vertically at a point in the tank where it will not be exposed to excessive stress (such as radial mixing velocities in excess of 1.5 feet per second). When mounting in a tank with a mixer, mount Smart Trak close to the tank wall where velocities are lowest. Choose a mounting location where the sensors will function correctly (away from inlet pipes that may spray on the sensors causing false readings) and where the sensor technologies function best (for example, it may be better to mount an optical sensor away from intense ambient light).

It is the user's responsibility to identify the proper placement and method of installation for the specific application.

Tank top mounting:

1. Install a standard 2" NPT tank adapter through the top of the tank at the desired location. If the tank top is not flat, use a 2" NPT rotational tank adapter. Make sure the threads of the adapter are not damaged or worn. If damaged, use a new adapter.

2. Insert the assembled Smart Trak through the tank adapter. If several sensors are too close together to fit through the tank adapter, slide them to different locations so that only one sensor is going through the adapter at a time.

3. To ensure a proper seal, apply an appropriate sealant to the threads of Smart Trak. Screw the Smart Trak assembly into the tank adapter.

4. Make adjustments as required to the sensor position.

5. Connect the external wiring and conduit to the terminal strip or controller, following the instructions in that manual.

Side Mount Bracket Mounting:

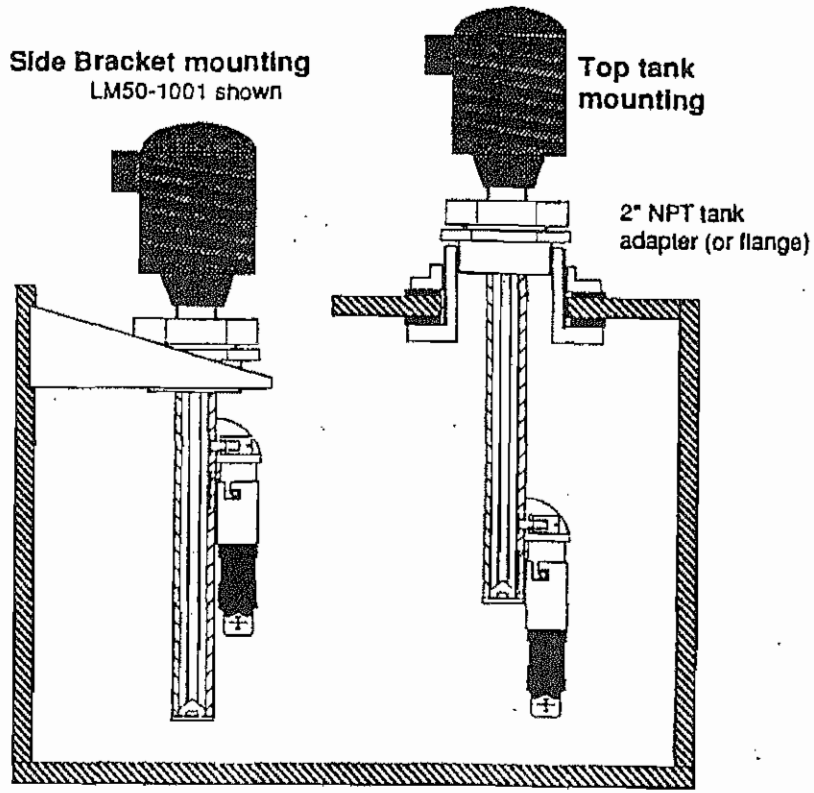
1. Install the side mount bracket (Flowline model LM50-1001) at the desired location. Make sure the threads of the bracket are not damaged or worn. If damaged, use a new bracket.

2. Insert the assembled Smart Trak into the bracket. If several sensors are too close together to fit through the hole in the bracket, slide them to different locations so that only one sensor is going through the adapter at a time.

3. Screw the Smart Trak assembly into the bracket.

4. Make adjustments as required to the sensor position, and to the bracket tilting arm.

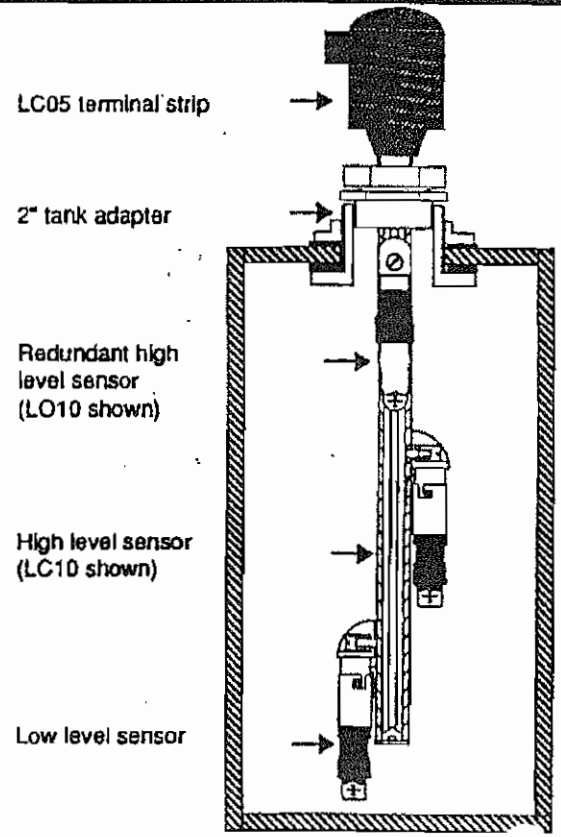
5. Connect the external wiring and conduit to the terminal strip or controller, following the instructions in that manual.



Application Example

On the facing page is an illustration of a Smart Trak fitted with three sensor cars and three sensors. Two of the sensors are ultrasonic (Flowline LU10 series); one near the bottom of the tank, and one in the middle. These two are connected via a terminal strip (Model LC05) to the A and B inputs of a three-input DIN rail controller (Model LC42), and control an automatic fill or empty operation. At the top of the track is an optical sensor (Flowline LO10 series) which is connected to the third input of the controller, controlling a separate relay which will sound an alarm if liquid reaches this point.

This is shown for example only. For further details, consult the manual for the controllers and sensors.



Warranty

Flowline warrants to the original purchaser of its products that such products will be free from defects in material and workmanship under normal use and service for a period which is equal to the shorter of one year from the date of purchase of such products or two years from the date of manufacture of such products.

This warranty covers only those components of the products which are non-moving and not subject to normal wear. Moreover, products which are modified or altered, and electrical cables which are cut to length during installation are not covered by this warranty.

Flowline's obligation under this warranty is solely and exclusively limited to the repair or replacement, at Flowline's option, of the products (or components thereof) which Flowline's examination proves to its satisfaction to be defective. FLOWLINE SHALL HAVE NO OBLIGATION FOR CONSEQUENTIAL DAMAGES TO PERSONAL OR REAL PROPERTY, OR FOR INJURY TO ANY PERSON.

This warranty does not apply to products which have been subject to electrical or chemical damage due to improper use, accident, negligence, abuse or misuse or products which are damaged during shipment back to Flowline's factory or designated service center or are returned without the original casing on the products. Moreover, this warranty becomes

(continued next page)

immediately null and void if anyone other than service personnel authorized by Flowline attempts to repair the defective products.

Products which are thought to be defective must be shipped prepaid and insured to Flowline's factory or a designated service center (the identity and address of which will be provided upon request) within 30 days of the discovery of the defect. Such defective products must be accompanied by proof of the date of purchase.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE OF THIS WARRANTY. This warranty and the obligations and liabilities of Flowline under it are exclusive and instead of, and the original purchaser hereby waives, all other remedies, warranties, guarantees or liabilities, express or implied. EXCLUDED FROM THIS WARRANTY IS THE IMPLIED WARRANTY OF FITNESS OF THE PRODUCTS FOR A PARTICULAR PURPOSE OR USE AND THE IMPLIED WARRANTY OF MERCHANTABILITY OF THE PRODUCTS.

This warranty may not be extended, altered or varied except by a written instrument signed by a duly-authorized officer of Flowline, Inc.

Warranty Service and Repair:

To register your product with the manufacturer, fill out the enclosed warranty card and return it immediately to:

Flowline Inc.
3010 Old Ranch Parkway, Suite 250
Seal Beach, CA 90740-2750.

If for some reason your product must be returned for factory service, contact Flowline Inc. to receive a **Return Material Authorization number (RMA#)** first, providing the following information:

1. Part Number, Serial Number
2. Name and telephone number of someone who can answer technical questions related to the product and its application.
3. Return Shipping Address
4. Brief Description of the Symptom
5. Brief Description of the Application

Once you have received a Return Material Authorization number, ship the product prepaid in its original packing to:

Flowline Inc.
Factory Service Dept.
1178 E. Valencia Dr.
Fullerton, CA 92631

To avoid delays in processing your repair, write the RMA# on the shipping label. Please include the information about the malfunction with your product. This information enables our service technicians to process your repair order as quickly as possible.

FLOWLINE

Addendum to Owner's Manual

FLOWLINE
3010 Old Ranch Parkway, Box 250
Seal Beach, CA 90740-2750
(310) 598-3015 / Fax (310) 431-8507

Version 1.0

Part # LP900003

Flowline's new FET Switching output:

All Flowline DC powered sensors now come standard with Flowline's unique FET (Field Effect Transistor) output.

The following are updates to your present manual which reflect these new features.

Specifications:

FET switch rating:	36V, 0.1 Amps maximum
FET switch polarity:	Normally closed (dry) if power is wired + to red, - to

Electrical Installation

FET switching allows the sensor to switch a small current or voltage on or off directly, using all three wires. Model LXXX-XXX2 is an NPN type switch, which switches the negative side of the load; model LXXX-XXX3 is a PNP type switch for applications where the switch must be on the positive side of the load. In both FET models, the normally-open/normally-closed status is set by the polarity of the voltage feeding the red and black wires, and the white wire connects to the load.

Wiring direct to a load, Normally Closed operation:

LXXX-XXX2 (NPN model) only:

1. Connect the red wire to the positive (+) terminal of a 12 to 36 VDC sensor power supply, and the black wire to the negative (-) terminal.

2. Connect the white wire to the negative side of the load (maximum load 0.1 amps).

3. Connect the positive side of the load directly to its (+) power supply.

4. Connect the negative terminals of the two power supplies. (See illustration)

This method will turn the load off when the sensor is wet, by cutting the negative supply to the load.

Wiring direct to a load, Normally Closed operation:

LXXX-XXX3 (PNP model) only:

1. Connect the red wire to the positive (+) terminal of a 12 to 36 VDC sensor power supply, and the black wire to the negative (-) terminal.

2. Connect the white wire to the positive side of the load (maximum
load 0.1 amps).

3. Connect the negative side of the load directly to its (-) power supply.

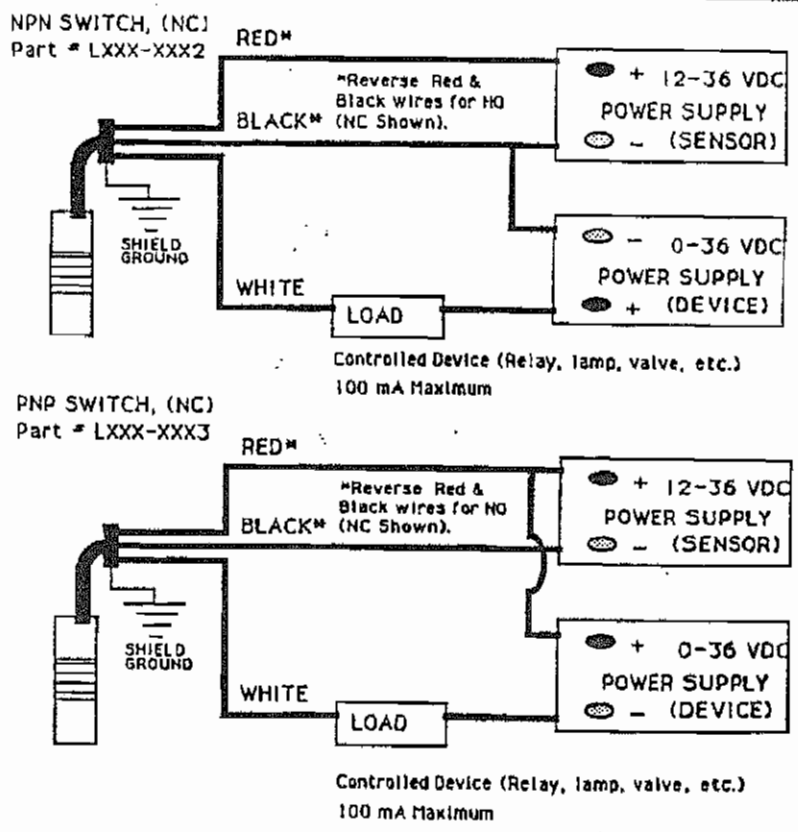
4. Connect the positive terminals of the two power supplies. (See illustration)

This method will turn the load off when the sensor is wet, by cutting the positive supply to the load.

Wiring direct to load, Normally Open operation:

LXXX-XXX2 and -XXX3 (FET models) only:

This is the same as the wiring for Normally Closed operation, except the polarity of the red and black connections to the sensor is reversed. Connect the red sensor wire to the negative (-) terminal ot its supply, and the black wire to the positive (+) terminal. Other connections remain the same; the sensor and device power supplies remain tied in the same polarity as before.



Ultrasonic Level Switch

Features

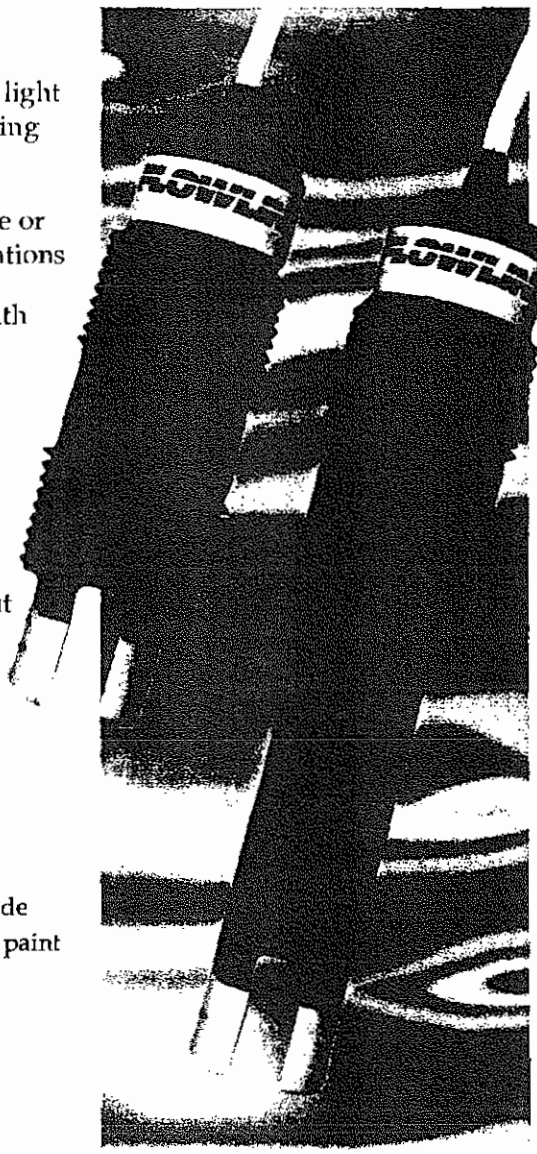
- ☑ Reliable level detection of light to medium coating or scaling type liquids
- ☑ Offered in general purpose or intrinsically safe configurations
- ☑ All plastic construction with PP or PFA materials for corrosive environments
- ☑ Probe and cable rated IP68 or NEMA 6 for submersible operation in tanks and sumps
- ☑ Reliable FET switch output for interface with PLC or relay control devices
- ☑ Selectable normally open or closed output states

Application

Industrial liquid examples include printing ink, lubricating oil and paint

	Variable	Yes	No
Liquid	Foam	✔	
	Bubbles		✔
	Conductive	✔	
	Non-conductive	✔	
	Translucent	✔	
	Opaque	✔	
	Clean	✔	
	Dirty	✔	
	Turbulent	✔	
	Non-coating	✔	
	Light coating	✔	
	Medium coating	✔	
	Heavy coating		✔
Tank	Metallic	✔	
	Non-metallic	✔	
	Hazardous*	✔	

**Intrinsically safe configuration*

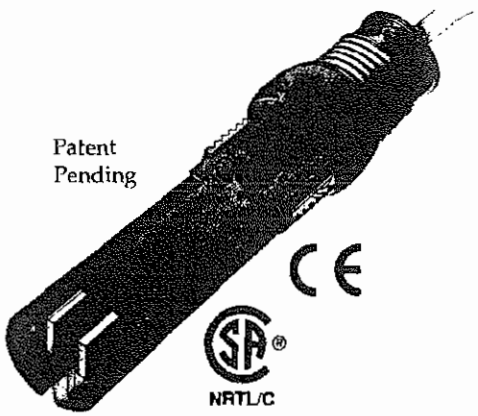


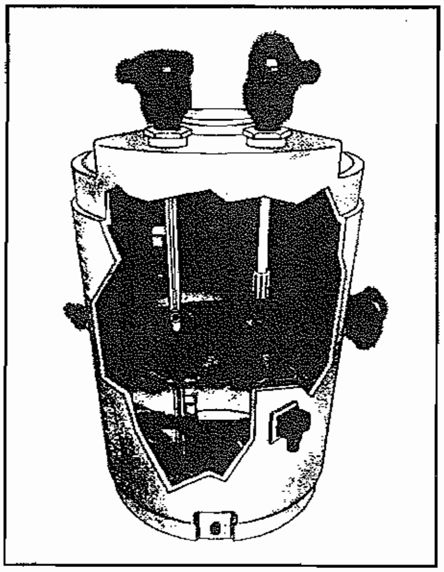
Technology

Two piezolectric crystals are separated by an air gap in the fork shaped tip of the probe. One crystal vibrates at a nominal frequency of 1.5 MHz. and transmits an acoustic signal into the center of the gap. As the probe tip becomes immersed in liquid, the crystals acoustically couple and the FET switch changes state.

Specifications

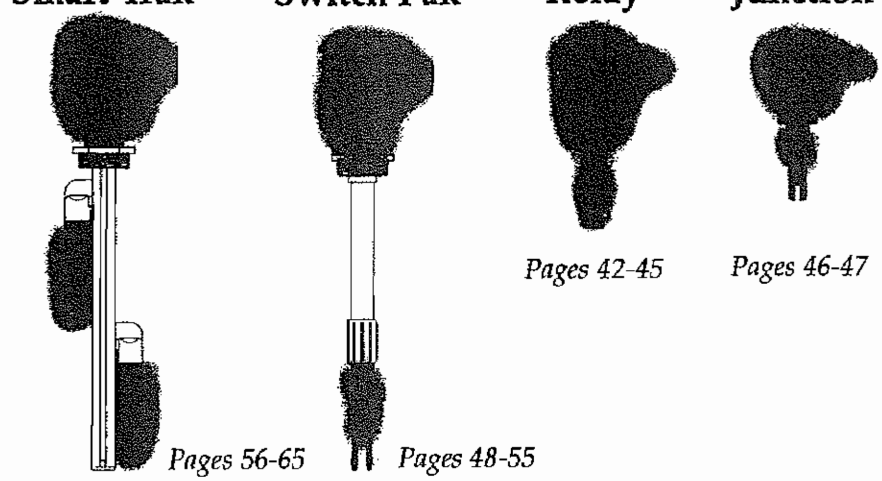
Accuracy:	± 1 mm in water
Repeatability:	± .5 mm in water
Frequency:	1.5 MHz.
Supply voltage:	12-36 VDC
Consumption:	Dry: 5 mA Wet: 19 mA
FET switch voltage:	36 VDC max.
FET switch current:	100 mA max.
FET switch output:	Selectable NO or NC states
Temperature range:	F: -40°to 194° C: -40° to 90°
Pressure range:	150 psi (10 bar) @ 25°C., derated @ 1.667 psi (.113 bar) per °C. above 25° C.
Probe material:	PP or PFA
Probe rating:	NEMA 6/IP68
Mounting threads:	3/4" NPT
Cable type:	8 ft., 3-wire, 22 gauge with ground, shield & PP or PFA jacket
Certificate number:	LR 79326-4



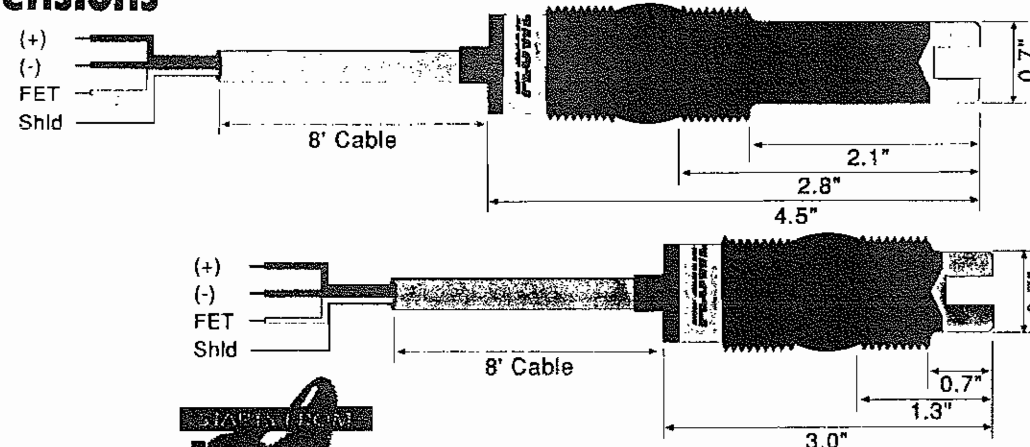


Packages

The switch is also available in the following packages.



Wiring and Dimensions



Ordering Information

Part Number	Select the Length, Material and Output: Description (1) (2)	Length	Material	Output	Price From
LU10-1302	Ultrasonic Switch	Short	PP	FET (N-Channel)	$250.00
LU10-1303	Ultrasonic Switch	Short	PP	FET (P-Channel)	$250.00
LU10-2302	Ultrasonic Switch	Short	PFA	FET (N-Channel)	$350.00
LU10-2303	Ultrasonic Switch	Short	PFA	FET (P-Channel)	$350.00
LU10-1402	Ultrasonic Switch	Long	PP	FET (N-Channel)	$260.00
LU10-1403	Ultrasonic Switch	Long	PP	FET (P-Channel)	$260.00
LU10-2402	Ultrasonic Switch	Long	PFA	FET (N-Channel)	$360.00
LU10-2403	Ultrasonic Switch	Long	PFA	FET (P-Channel)	$360.00

(1) [illegible] cable length. Longer cable lengths may [illegible] ordered [illegible] cable, add $[illegible] for PP or $47.00 for PFA switches; 50' cable, add $31.00 for PP or $[illegible] for PFA switches; 75' cable, add [illegible] or $185.00 for PFA switches; 100' cable, add $69.00 for PP or $260.00 for PFA switches.

(2) The above mentioned prices are based on the general purpose switch configuration. To order the CSA approved intrinsically safe configuration, place CSA at the end of the part number (example: LU10-1302-CSA) and add $40.00. The intrinsically safe switch is rated for use in Class I, Groups A, B, C and D; Class II, Groups E, F and G; Class III. To order the CE approved switch configuration, place CE at the end of the part number (example: LU10-1302-CE) and add $20.00. The CE approved configuration complies with EN50081-2(1992) emission and EN50082-2 (1995) immunity standards.

FLOWLINE®

Din Rail and Panel Mount Isolation Controller LC90 Series Owner's Manual

Version 1.0
Manual # LC900010

Table of Contents

Unpacking and Inspection:

The following items are included in this package:

- One LC90, LC91, or LC92 controller
- Instruction Manual
- Warranty Card

Please fill out and return the warranty card immediately to Flowline, Inc.

Part Number Information:

Part #	Description
LC90-1001	One sensor input, one relay
LC91-1001	Two sensor inputs, one relay
LC92-1001	Three sensor inputs, two relays

LR79326-4

Associated Equipement/Appareillage Connexe [Exia]

Outputs suitable for use in Hazardous Locations:

Class I Groups A, B, C & D
Class II Groups E, F and G
Class III

Entity Parameters:

V_{oc} = 17.47 VDC
I_{sc} = 0.4597 A
C_a = 0.494 µF
L_a = 0.119 mH

Volt/Ohm Parameters:

17.5 V 40 Ohms

Power rating: 5.0 Watts max.

See Instruction Manual for Installation Information

Warning: substitution of components may impair Intrinsic Safety

Avertissement: la substitution de composants peut compromettre le Securite Intrinseque

Controller must be installed per drawing LCD1

P/N: XXXX-XXXX
S/N: XXXXXX

Safety Precautions

About This Manual:

PLEASE READ THE ENTIRE MANUAL PRIOR TO INSTALLING OR USING THIS PRODUCT. This manual includes information on three different models of DIN and Panel Mount Isolation Controllers from Flowline. Many aspects of installation and use are similar between the three models. Where they differ, the manual will note it. Please refer to the part number on the controller you have purchased as you read.

User's Responsibility for Safety:

Flowline manufactures several controller models, in different mounting and switching configurations. It is the user's responsibility to select a controller model that is appropriate for the application, install it properly, perform tests of the installed system, and maintain all components. The symbol on the left appears in the manual to call special attention to instructions that affect the safe installation and use of the product.

Safety Precautions

Improper installation, modification, or use of the LC90 in an installation requiring intrinsically safe equipement may cause property damage, bodily injury or death. Flowline, Inc. will not be responsible for any liability claims due to improper installation, modification, repair or use of the LC90 series by other parties.

Electrical Shock Hazard:

It is possible to contact components on the controller that carry high voltage, causing serious injury or death. **All power to the controller and the relay circuit(s) it controls should be turned OFF prior to working on the controller. If it is necessary to make adjustments during powered operation, use extreme caution and use only insulated tools.**

The symbol on the left appears in the manual next to passages that affect the safe electrical operation of this product. Wiring should be performed by qualified personnel in accordance with all applicable national, state, and local electrical codes.

Install In a Dry Location:

The controller housing is not designed to be immersed. It should be mounted in such a way that it does not come into contact with liquid. Its case is made out of PP (polypropylene). Refer to an industry reference such as the Compass Corrosion Guide to ensure that compounds that may splash onto the controller housing will not damage it. Such damage is not covered by the warranty.

Relay Contact Rating:

The relay is rated for a **10 amp** resistive load. Many loads (such as a motor during startup or incandescent lights) may have an inrush current characteristic that may be 10 to 20 times their steady-state load rating. The use of a contact protection circuit or a stepper relay may be necessary for your installation if the 10 amp rating does not provide an ample margin for such inrush currents.

Safety Precautions

Make a Fail-Safe System:

Design a fail-safe system that accommodates the possibility of relay or power failure. If power is cut off to the controller, it will de-energize the relay. Make sure that the de-energized state of the relay is the safe state in your process. For example, if controller power is lost, a pump filling a tank will turn OFF if it is connected to the Normally Open side of the relay.

While the internal relay is reliable, over the course of time relay failure is possible in two modes: under a heavy load the contacts may be "welded" or stuck into the energized position, or corrosion may build up on a contact so that it will not complete the circuit when it should. In critical applications, redundant back-up systems and alarms must be used in addition to the primary system. Such back-up systems should use different sensor technologies where possible.

While this manual offers some examples and suggestions to help explain the operation of Flowline products, such examples are for information only and are not intended as a complete guide to installing any specific system.

Specifications

Voltage Rating:	Selectable, 120 or 240 volts AC, 50-60 Hz. 5 Watts
Max. current consumption:	.25 amps
Relay output:	Isolated single pole double throw (SPDT) relay. Form C
Switching mode:	Selectable. NO or NC
Relay Rating:	250 VAC. 10 Amps. 1/2 hp

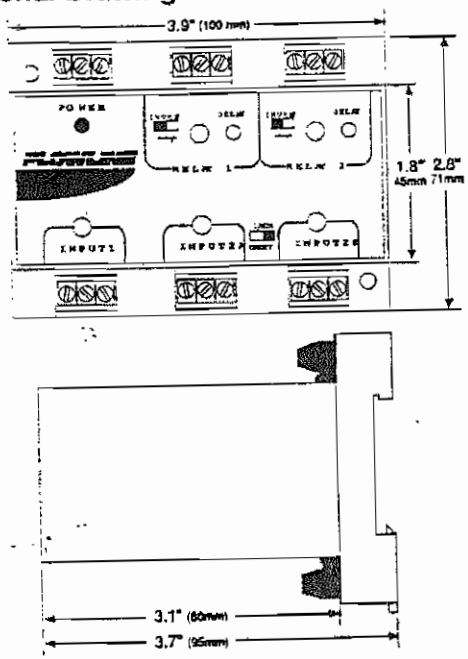
Provides intrinsically safe outputs with entity parameters per channel when installed in accordance with drawing No. LCD1 as follows:

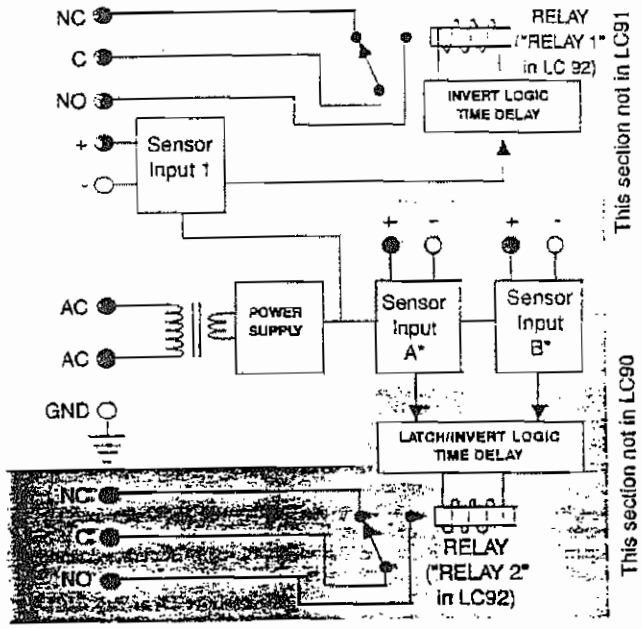
	V_{oc} = 17.47 VDC
	I_{sc} = 0.4597A
	C_a = 0.494 µf
	L_a = 0.119mH
Contact resistance	30 milliohms initially (at rated current voltage drop method)
Time delay:	Adjustable from 0.15 to 60 seconds
Sensor voltage supply:	Nominal 13.5 volts DC, 27 mA maximum
Sensor trigger point:	11 to 13 mA
Enclosure mounting:	EN 50 022 standard 35 mm DIN rail, or panel mount
Enclosure material:	Polypropylene, flame retardant (U.L. 94VO)
Dimensions:	100mm x 70mm x 85mm(3.9" x 2.8" x 3.7"). See drawing p. 12.

For U.L. or other agency-approved routes, contact Flowline Inc. or your distributor.

Specifications

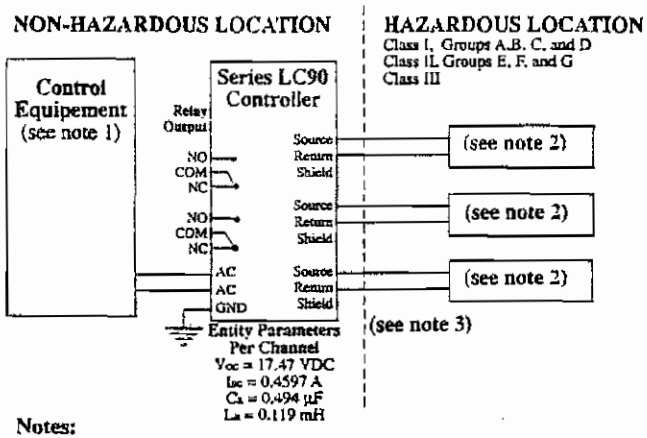
Dimensional Drawing





*Labeled "INPUT 1A, 1B" in LC91; "INPUT 2A, 2B" in LC92

Specifications



Notes:

1. Control equipment connected to series LC90 controller must not use or generated more than 250V.
2. CSA certified equipment with entity parameters connected in accordance with manufactures instrucrions or switches, thermocouples, LEDs, or RTDs.
3. Separation must be maintained between wiring of separate channels.
4. Installation should be in accordance with CEC Part I.

Controller Drawing: LCD1
Rev. No Change 6-13-94

Introduction

DIN Rail and Panel Mount controllers

The Flowline LC90 series of DIN rail and panel mount controllers is designed for use with standard DC-powered liquid sensors. There are three different models in the series:

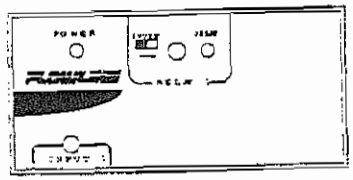
- **LC90-1001:** One input, one relay: a single point switch typically used for high/low level alarms
- **LC91-1001:** Two inputs, one relay: with a latching capability allowing an automatic fill or automatic empty operation
- **LC92-1001:** Three inputs, two relays: both of the above combined in one housing

All are similar in that they receive signals from one or more liquid sensors, indicating whether the sensor is wet or dry. In response, the controller turns one or more controlled devices (such as valves, pumps, or alarms) on or off, depending on the logic of the system.

The controller is typically mounted on a panel or DIN rail system at some distance from the sensors themselves. A system may consists of many different controllers receiving signals from different sensors and controlling a variety of processes.

Introduction

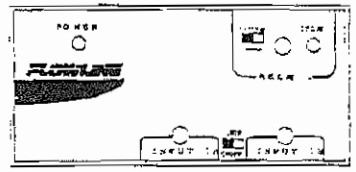
Features of the LC90 Single Input Controller



The Flowline LC90-1001 controller is designed to receive a signal from a single liquid sensor. It turns its internal relay ON (or OFF, as set by the invert switch) in response to the presence of liquid, and changes the relay status back again when the sensor is dry. The relay is a single pole, double throw type; the controlled device can be connected to either the normally open or normally closed side of the relay. A time delay from 0.15 to 60 seconds can be set before the relay responds to the sensor input.

Typical applications for a single input controller are high level or low level switch/alarm operations (opening a drain valve whenever liquid level rises to a sensor point, sounding an alarm when a leak is detected, etc.).

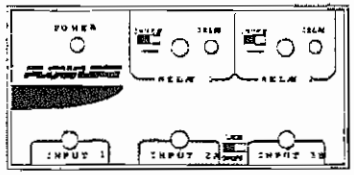
Features of the LC91 Dual Input Controller



The Flowline LC91-1001 controller has all the features of the LC90, plus a second sensor input for a latching capability. The inputs are labeled "1A" and "1B". When LATCH is OFF, the relay will be energized in response to input A alone, just like the single input controllers. When LATCH is ON, it will change and hold the relay in the energized or de-energized state only when **both** inputs sense the same condition (for example, both dry = pump ON, both wet = pump OFF). With this feature, the LC91 can control an automatic fill or empty operation.

Introduction

Features of the LC92 Two Relay, Three Input Controller



The Flowline LC92-1001 controller combines an LC90 and an LC91 in the same housing. This provides a latching automatic fill or automatic empty operation controlled by two sensors, with an additional high level or low level switch/alarm responding to a third sensor.

Guide to Controls

WARNING: Hazardous voltages are present at the terminal strips and within the controller housing. **Turn off all power to the controller and controlled device(s) before installation or servicing.**

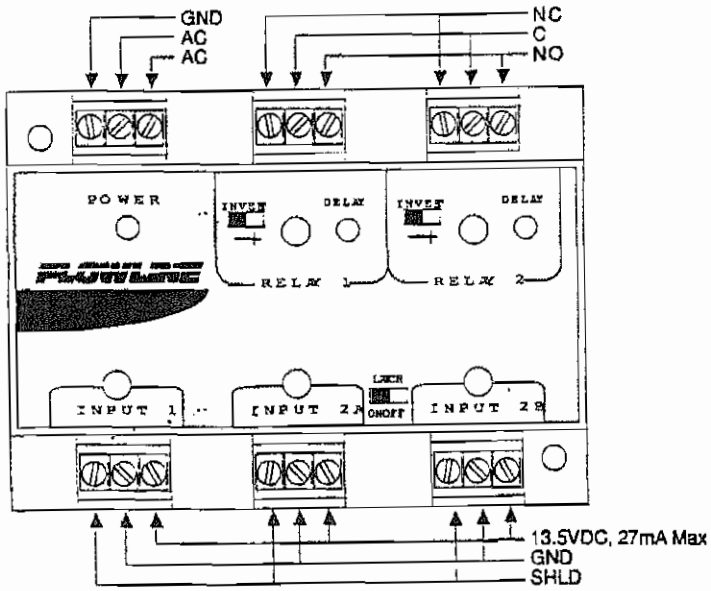
Power indicator: This green LED lights when AC power is ON.

Relay indicator: This red LED will light whenever the controller energizes the relay, in response to the proper condition at the sensor input(s) and after the time delay.

Relay 2 indicator (LC92 only): This red LED will light whenever the controller energizes the relay, in response to the proper condition at the sensor inputs and after the time delay.

AC Power terminals: Connect 120 VAC power to two of the terminals of this strip. The setting for voltage is marked under the terminal strip and may be changed to 240 VAC if desired (see p. 31). Polarity (neutral and hot) does not matter. Connect any ground wire to the GND terminal on the strip.

Guide to Controls



Relay terminals (NC, C, NO): Connect the device you wish to control (pump, alarm etc.) to these terminals: supply to the C (COM) terminal, and the device to the NO (normally open) or NC (normally closed) terminal as required. The switched device should be a noninductive load of not more than 10 amps; for reactive loads the current must be derated or protection circuits used. When the Red LED is ON and the relay is in the energized state, the NO terminal will be closed (connected to C) and the NC terminal will be open.

Time Delay: After the input(s) change(s) state, this control sets a delay from 0.15 to 60 seconds before the relay will respond. This keeps the controller from responding to temporary conditions (splashing, foaming etc.), or allows time for other processes to take place before the relay opens or closes. Use a small insulated screwdriver to make the adjustment. Turn full counter-clockwise for no delay and full clockwise for maximum delay.

Guide to Controls

Input indicator(s): The bi-color LED(s) will light Orange whenever the sensor attached to the corresponding sensor terminals detects liquid, and will turn Green when it is dry. If the wiring in the sensor loop is disconnected, the LED will be off. The input electronics are current sensing; the LED will be off if current is less than 3.5 mA, Green from 3.5 mA to 12 mA, and Orange above 12 mA.

Invert switch(es): This switch reverses the logic of the relay control in response to the sensor(s): conditions that used to energize the relay will make it turn off and vice versa. INVERT is ON in the "+" position (to the right). INVERT is OFF in the "-" position (to the left).

In the single input controllers, when INVERT is OFF the RELAY LED status will match that of the INPUT LED; when the input is Orange (typically, when the sensor is wet), the relay is energized. When INVERT is ON, the relationship between the input and the relay is reversed: the relay is energized when the sensor INPUT LED is Green (dry).

The operation of INVERT in the dual input controllers is shown in the chart on the next page.

Latch switch (LC91 and 92 only): This switch determines how the relay will be energized in response to the two sensor inputs designated A and B. When LATCH is OFF, the relay responds to the "A" input only; when LATCH is ON, the relay will turn on or off only when both sensors (A and B) are in the same condition (wet or dry). The relay will remain latched until both sensors change states.

For example: When both A & B inputs are wet (INPUT LEDs orange), the relay will be energized (Red LED on) after the adjustable time delay. After that, if one sensor becomes dry, the relay will remain energized. Only when both A and B sensors become dry (both INPUT LEDs green) will the controller de-energize the relay. The relay will not energize again until both sensors are wet.

Note that in the LC92, LATCH affects RELAY 2 only.

Logic Tables for two-input relay status

(LC91 and LC92 Only)

Invert Off, Latch Off:

INPUT A	INPUT B	RELAY
ON	No Effect	ON
OFF	No Effect	OFF

INVERT ON, Latch Off:

INPUT A	INPUT B	RELAY
ON	No Effect	OFF
OFF	No Effect	ON

Invert Off, LATCH ON:

INPUT A	INPUT B	RELAY
ON	ON	ON
OFF	ON	No Change
ON	OFF	No Change
OFF	OFF	OFF

INVERT ON, LATCH ON:

INPUT A	INPUT B	RELAY
ON	ON	OFF
OFF	ON	No Change
ON	OFF	No Change
OFF	OFF	ON

Input terminals: Connect the wiring from the sensors to these terminals. Note the polarity: "+" is a 13.5 VDC power supply (to be connected to the Red wire of a Flowline sensor), and "-" is the return path from the sensor (to be connected to the black wire of a Flowline sensor). If polarity is reversed, the sensors will not work.

Relay (not shown): Inside the housing, the relay itself is a plug-in type designed for easy field replacement if necessary.

Input power jumpers (not shown): On the internal PCB are jumpers allowing the input AC voltage to be changed from 120 VAC to 240 VAC. (See p. 31)

Installation

All power to the system must be off before installing the controller.

Step One: Mount the base on a DIN rail or panel

The following procedure should be used when mounting the controller on an approved 35 mm DIN rail compatible with the EN 50 022 standard.

Hang the top groove in the base on the top of the rail while the bottom is slightly away from the rail. Pull the unit down until the latch catches behind the bottom of the rail.

Panel mounting

Hold the controller in the desired position and make a mark through the two mounting holes (upper left and lower right). Remove the controller and drill pilot holes as required. Screw the controller to the panel, using a screw no larger than .16" diameter and an appropriate washer as required.

Step Two: Connect the sensor input wires

Note: Wires leading to sensors in hazardous areas must be installed in accordance with national and local codes, using required methods to separate the hazardous area where the sensor is installed from the non-hazardous area where the controller is installed.

The following instructions assume the sensor has already been properly installed, with a length of wire approaching the controller.

1. Using a 10 gauge wire stripper, strip the white outer layer of insulation from the last 1-1/4" of the sensor wire. Trim off and discard the exposed foil shield flush with the insulation jacket. The shield wire may be attached to a grounding terminal, or trimmed off flush with the insulation as well.

2. Using a 20 gauge wire stripper, strip the last 2/10" of insulation from the Red and Black signal wires.

3. Using a small screwdriver, loosen the small terminal screws. Check your system design to see which inputs each sensor should be connected to. Insert the Red wire into the "+"

terminal on the side of the terminal strip, and tighten its terminal screw. Attach the Black wire to the "-" terminal in the same way. Connect other sensor wires to the other inputs if the installation requires it. The White wire on the Flowline sensors (models LP10, LP50, LU10 & LO10) will not be used with the LC90 series of controllers.

If the installation requires wiring other devices in series with the sensor, they must present a very low resistance for proper operation. The total resistance including wire should be less than 60 ohms. **Such other devices must also be rated intrinsically safe.**

Step Three: Connect the controlled device(s) to the relay(s)

The controlled device must have its own power connection and neutral; the controller relay merely serves as a switch on the hot lead in the circuit.

Before making connections, make sure all power to the controller and to all controlled devices (motor, valve, alarm etc.) is OFF with a safety lockout on the circuit breaker.

1. Strip 2/10" of insulation from the ends of the two wires. If it is a two-relay unit, check the system design to see which device connects to which relay.

2. Loosen the terminal screws (C, NC, or NO).

3. Insert the hot (supply) wire (usually Black) to the C terminal of the RELAY block. Insert the switched lead (connecting to the motor or alarm, etc., usually colored) to either the NO or NC terminal, as required for your installation (see "Design a Fail-Safe System" in Safety Precautions). **Do not connect any device or supply to the unused terminal** unless you are sure that doing so will not cause an overvoltage situation in case of relay failure.

4. Tighten the terminal screws.

NOTE: In some cases, additional user-provided components may need to be attached to the relay terminals. See "About Relay Loads" on page 33.

Step Four: Connect the AC power

Warning: The input AC power to the controller should not exceed 120 or 240 VAC, as specified. All wiring must be performed by qualified personnel in accordance with applicable national and local electrical codes, in addition to recommendations by Underwriter's Laboratories and other agencies. **All connections must be made with power off, and a safety lockout at the circuit breaker.**

1. Strip 2/10" of insulation from the ends of the incoming AC power wires.

2. Insert the bare ends of the wires into the two AC terminals. Polarity does not matter. If there is a Green safety ground wire, it may be connected to the GND terminal.

3. Tighten the terminal screws.

120/240 VAC setting

WARNING: Alterations or improper repair of the LC90 series could compromise its rating for intrinsically safe applications and create a danger to life and property. Only persons familiar with intrinsically safe design should preform the following procedure.

If it is necessary to change the input AC voltage of the controller from the factory setting of 120 VAC to 240 VAC, follow this procedure:

1. **If the controller has already been installed, turn off all AC power to the controller and controlled device.** Remove the controller from the panel or rail. Disconnect the AC, relay, and sensor input cables. Place the unit bottom down on a table. **Make sure the sensor cables do not contact any live circuit by taping the ends with insulating tape.** Place the unit bottom down an a table.

2. Remove the two Philips head screws from the back of the base that hold the housing to the base. Remove the base.

3. The two circuit cards are in tracks in the housing. Gently slide them both out, while holding the housing down if necessary. You may need to tip the housing toward you and press gently on the switches on the front panel. Do not disconnect or break the wire loom that attaches the two cards. Turn one card over so they both lie flat on the table, not on each other.

4. Towards the bottom of the circuit card that holds the power transformer are two black jumpers (labeled JWB and JWC on the circuit card). Remove both jumpers.

5. For 240 VAC operation, place one of the jumpers across the pins marked JWA only. The other jumper is not used.

For 120 VAC operation, the jumpers should be across JWB and JWC.

6. **For reinstallation,** slide the circuit cards back into the tracks in the housing. Make sure the cards are in the right alignment (the relay and AC terminals should be on the top) and are in the tracks, with the proper controls facing the openings at the front of the housing. Reverse steps 1-3 above.

About relay loads and protection circuits

The relay in the controller is rated for a noninductive load without a startup surge. Other types of load may be connected to the relay if a proper protection circuit is used to minimize arcing and the effects of inrush currents on the relay. This typically involves placing user-provided components (capacitator, resistor, diode, varistor, etc.) across the load or switch. Refer to an industry reference or to the manual of the controlled device for more information about such circuits.

Operation

Testing

1. If possible, turn OFF AC power to the controlled device (motor, alarm circuit). Turn ON AC power to the controller at the switch or circuit breaker. The Green Power LED should light.

2. Immerse the sensor(s). The INPUT LED(s) should turn turn from Green to Orange immediately when liquid is sensed.

3. Turn the TIME DELAY pot full counterclockwise for immediate response from the relay. Depending on the setting of the INVERT switch (and the LATCH switch if applicable), the red relay LED should come on at the desired sensor conditions. You can hear a slight click when the relay is turned on and off.

4. Turn on power to the controlled device (motor, etc.) and test to make sure that the relay circuit performs as expected.

Maintenance

Flowline controllers require no periodic maintenance except cleaning as required. The longevity of the internal relays depend upon the frequency of use and the relay load.

Testing sensor inputs

If the controller is not responding to a sensor, a simple test will allow you to determine whether the sensor or the controller is at fault. Disconnect any sensors from the controller; the INPUT LED should turn OFF. Connect the two sensor terminals with a jumper wire to see if the INPUT LED turns Orange. If it doesn't, the fault must lie with the controller.

Application Examples

The following examples are offered to help you understand the basic principles behind the installation and operation of the controllers. Your installation may vary.

Warning: Any system should be designed by qualified personnel and should include active and passive fail-safe backup systems (such as overflow tubes, etc.) as needed. Any applications that can cause damage to persons or property must use redundant measurement and control points. Secondary systems should use a sensing technology that is different from the primary system but still compatible with the application liquid in order to provide that added safety of different failure modes. Such backup systems are not shown in the following examples for clarity.

The relay is a single pole, double throw type. The two terminals NO and NC (normally open and normally closed) will be used in different applications. Remember that the "normal" state is when the relay coil is de-energized and the red relay LED is OFF. To avoid confusion, we use "energized" and "de-energized" to describe the state of the relay instead of "ON" and "OFF". This is because the relay may be energized to turn OFF a device attached to its NC terminal.

Low-Level Alarm (LC90)

The goal is to make sure that the liquid level does not fall below a certain point. If it does, an alarm is supposed to sound, alerting the operator of a low-level condition.

A sensor is installed "outside-in" through the tank wall using a standard 3/4" NPT tank fitting. The controller is mounted on a panel nearby.

Connecting to the proper relay terminal

If power is accidentally cut to the controller, the sensor's ability to notify the operator of a low-level condition could be lost. The system must alert the operator not only to low fluid level, but to controller power loss.

To do this, connect the hot lead of the alarm to the NC (Normally Closed) side of the relay terminal of the controller. If power is lost, the relay will be de-energized, and the alarm will sound (if there is still power to the alarm circuit itself). The alarm circuit should have a non-interruptible power supply or some other indicator or back-up alarm to warn of a power failure in the alarm circuit.

Setting the INVERT switch

In this application, the normal status of the sensor at the bottom of the tank will be wet, and the relay will be energized holding the alarm circuit open. Both the red relay LED and orange input LED will be on simultaneously, so for this application, INVERT should be set to the OFF position.

High Level Alarm

In the same manner, a sensor and controller can be used to sound an alarm when fluid reaches a high level, with just a change in the location of the sensor and the setting of the INVERT switch.

- The alarm is still connected to the NC side of the relay to allow for a power failure alarm.
- The sensor is normally dry. In this dry condition, we want the relay to be energized so the alarm does not sound: i.e., the red relay LED should be on whenever the Input LED is Orange. So we turn INVERT ON. If the fluid level rises to the high sensor point, the sensor goes on, the relay de-energizes, and the alarm sounds.

Automatic Fill or Automatic Empty Operation (LC91, 92)

This application uses two sensors as inputs to a controller, to control the filling of a tank. Note that typically other components, not under control of the controller are involved, such as mixers, heaters, valves, drains etc. Your application will probably differ, but the principles should be similar.

Automatic Fill

This system consists of a tank with a high level sensor, a low level sensor, and a pump that is controlled by the controller. When the pump is on, it pumps fluid from an outside source into the tank, making this an *active fill* operation in which the tank will not overflow if power is lost to the pump.

Application Examples

Connecting the pump to the proper relay terminal

Part of a proper fail-safe design for this particular system is that if power is lost to the controller for any reason, the pump filling the tank must be turned off. Therefore, we connect the pump to the Normally Open side of the relay. When the relay is energized, the pump will turn on and fill the tank. The relay indicator will correspond directly to the on/off status of the pump.

NOTE: If the pump motor load exceeds the rating of the controller's relay, a stepper relay of higher capacity must be used as part of the system design.

Determining the settings of LATCH and INVERT

This is the way the system must operate:

- When both the high and low sensors are dry, the pump should turn ON, starting to fill the tank.
- When the low sensor gets wet, the pump should stay ON.
- When the high sensor gets wet, the pump should turn OFF.

LATCH: In any two-sensor control system, LATCH must be ON.

INVERT: Referring to the logic chart on p. 25, we look for the setting that will de-energize the relay (turn off the pump) when both inputs are wet (indicators on). In this system, INVERT should be ON.

Caution: Some sensors may have their own inverting capability, i.e., when they are wet they send an OFF signal. This will change the logic of the invert switch. Check your system design.

Determining A or B input connections

When LATCH is ON, there is no effective difference between Input A and B, since both sensors must have the same signal in order for status to change.

When wiring any two-input relay section, the only consideration for connecting a particular sensor to A or B is if LATCH will be OFF. In this example, the high sensor is the "trigger" that would be used to turn the pump on and off (since the lower sensor is more often immersed), so it would be typically connected to input A. In this case, the high sensor will still turn the pump on and off if desired (with INVERT ON, it will turn the pump OFF when liquid is sensed, and the moment it is dry it will turn the pump back on).

Application Examples

Automatic Empty

Note that a similar system logic can be used for an automatic empty operation simply by controlling a pump that pumps fluid out of the tank instead of into it. However, note the importance of fail-safe design. If the tank is being passively filled, and a pump must be used to actively empty it, a power failure to either the controller or the pump circuits will cause overflow.

Alternatively, an electrically-controlled drain valve could be used. In this case, the valve should be a type that will automatically open if power is lost: in other words, power must be used to hold it closed. The valve would be connected to the Normally Open side of the relay—if power is lost to the controller, the relay de-energizes, the valve loses the power that was holding it shut, and fluid will drain from the tank into some other safe containment until power is restored. In this system, whenever the Red relay LED of the controller is ON, the drain is closed, allowing fluid to rise.

In this case, INVERT should be ON: when both sensors are wet, the relay de-energizes, the switch to the valve opens, and the tank will drain.

Automatic Fill/Empty Operation with High Level Alarm (LC92 only)

This system is exactly like the previous one, except an additional sensor is mounted higher in the tank, and wired to Input 1, controlling Relay 1 whose NC terminal is wired to an alarm, and whose NO terminal acts as a secondary power cutoff to the pump. INVERT of Relay 1 is set to ON, so that the relay will be energized (holding the alarm relay open and keeping power to the pump) as long as the high level sensor stays dry. Under normal operating conditions, this sensor never gets wet, so it will only be activated if the system below it malfunctions. At this higher level, scaling and coating will not be a factor to cause sensor failure. Note that if power is lost to the controller, the pump will stop and the alarm will sound, even if the fluid level is not at the high sensor, because the pump is wired to the NO terminal of its relay and the alarm is wired to the NC terminal.

Note: that the alarm circuit and the pump loads and voltages must be of a type that will not cause an overvoltage condition inside the relay, to avoid relay failure.

Warranty

Flowline warrants to the original purchaser of its products that such products will be free from defects in material and workmanship under normal use and service for a period which is equal to the shorter of one year from the date of purchase of such products or two years from the date of manufacture of such products.

This warranty covers only those components of the products which are non-moving and not subject to normal wear. Moreover, products which are modified or altered, and electrical cables which are cut to length during installation are not covered by this warranty.

Flowline's obligation under this warranty is solely and exclusively limited to the repair or replacement, at Flowline's option, of the products (or components thereof) which Flowline's examination proves to its satisfaction to be defective. FLOWLINE SHALL HAVE NO OBLIGATION FOR CONSEQUENTIAL DAMAGES TO PERSONAL OR REAL PROPERTY, OR FOR INJURY TO ANY PERSON.

This warranty does not apply to products which have been subject to electrical or chemical damage due to improper use, accident, negligence, abuse or misuse. Abuse shall be assumed when indicated by electrical damage to relays, reed switches or other components. The warranty does not apply to products which are damaged during shipment back to Flowline's factory or designated service center or are returned without the original casing on the products. Moreover, this warranty becomes immediately null and void if anyone other than service personnel authorized by Flowline attempts to repair the defective products.

Products which are thought to be defective must be shipped prepaid and insured to Flowline's factory or a designated service center (the identity and address of which will be provided upon request) within 30 days of the discovery of the defect. Such defective products must be accompanied by proof of the date of purchase.

THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE OF THIS WARRANTY. This warranty and the obligations and liabilities of Flowline under it are exclusive and instead of, and the original purchaser hereby waives, all other remedies, warranties, guarantees or liabilities, express or implied. EXCLUDED FROM THIS WARRANTY IS THE IMPLIED WARRANTY OF FITNESS OF THE PRODUCTS FOR A PARTICULAR PURPOSE OR USE AND THE IMPLIED WARRANTY OF MERCHANTABILITY OF THE PRODUCTS.

This warranty may not be extended, altered or varied except by a written instrument signed by a duly-authorized officer of Flowline, Inc.

Warranty

Warranty Service and Repair:

To register your product with the manufacturer, fill out the enclosed warranty card and return it immediately to:

Flowline Inc.
3010 Old Ranch Parkway, Suite 400
Seal Beach, CA 90740-2750.

If for some reason your product must be returned for factory service, **contact Flowline Inc. to receive a Material Return Authorization number (MRA#) first,** providing the following information:

1. Part Number, Serial Number
2. Name and telephone number of someone who can answer technical questions related to the product and its application.
3. Return Shipping Address
4. Brief Description of the Symptom
5. Brief Description of the Application

Once you have received a Material Return Authorization number, ship the product prepaid in its original packing to:

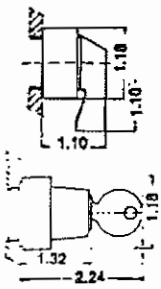
Flowline Inc.
Factory Service Dept.
1178 E. Valencia Dr.
Fullerton, CA 92631

To avoid delays in processing your repair, write the MRA# on the shipping label. Please include the information about the malfunction with your product. This information enables our service technicians to process your repair order as quickly as possible.

selector switches non-illuminated with 3 positions

22mm
miniature
oiltight & watertight

round operating heads
collar* chrome-plated ABS



(square operating heads)

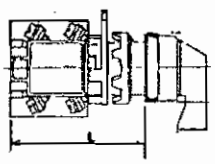
POSITIONS	Black knob handle**	Black lever handle**	Ronis key 1424 A or 455 withdrawable in position O
			 key withdrawable in other positions on request
	REFERENCE	REFERENCE	REFERENCE
2x45°	V11MA03	V11MR03	V11NA00
	V11MB03	V11MS03	V11NB00
45°+ 45° with spring return	V11MC03	V11MT03	V11NC00
2x45° with spring return	V11MD03	V11MU03	V11ND00
2x90°	V11MK03	V11MW03	V11NK00
			Key withdrawable in 3 positions 1-0-2 ▲
LIST PRICE	$11.31	$12.08	$32.16

square operating heads
collar* black ABS

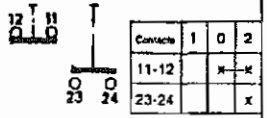
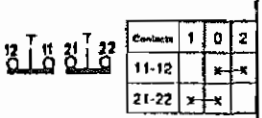
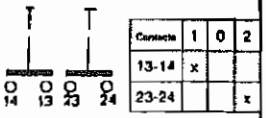
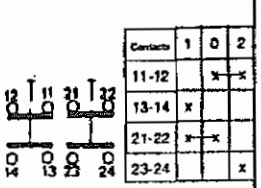
Black knob handle**	Black lever handle**	Ronis key 1424 A or 455 withdrawable in position O
		 key withdrawable in other positions on request
REFERENCE	REFERENCE	REFERENCE
V42MA03	V42MR03	V42NA00
V42MB03	V42MS03	V42NB00
V42MC03	V42MT03	V42NC00
V42MD03	V42MU03	V42ND00
V42MK03	V42MW03	V42NE00
		Key withdrawable in 3 positions 1-0-2 ▲
$13.19	$13.19	$29.93

* collar, black ABS: reference V12 (instead of V11)
* collar, grey ABS: reference V13 (instead of V11)
* collar, chrome-plated brass: reference V14 (instead of V11)
From V11 to V14 add $3.34 List

** handle, red: end of reference 01 (instead of 03)
** handle, grey: end of reference 08 (instead of 03)



* collar, chrome-plated ABS: reference V41 (instead of V42)
* collar, grey ABS: reference V43 (instead of V42)
**handle, red: end of reference 01
**handle, grey: end of reference 08

					
		REFERENCE	REFERENCE	REFERENCE	REFERENCE
Screw and clamp terminals		M1AB1	M1AA1	M1BB1	M2CC1
Solder terminals 1/4"		M1AB2	M1AA2	M1BB2	M2CC2
Dimensions:		L = 2.0	L = 2.0	L = 2.0	L = 3.0

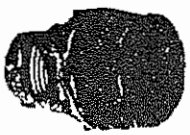
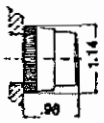
For different contact arrangements, please see page 78-82

SELECTOR SWITCHES From 4-12 Positions Available – see pages 90-93

For full details see BACO Rotary Cam Switch Catalog

22mm
non-illuminated

miniature
oiltight & watertight
round operating heads
"push" function
collar* chrome-plated ABS

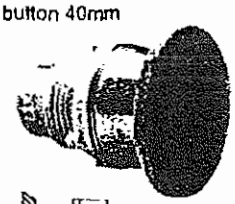
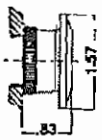
	flush button		projecting button		mushroom-head button 29mm	
	  for non-illuminated buttons with legend insert, use the heads"AJ" on page 48		 		 	
COLOR	REFERENCE	LIST PRICE	REFERENCE	LIST PRICE	REFERENCE	LIST PRICE
Red	V11AA01	$6.21	V11AB01	$6.32	V11AC01	$8.87
Green	V11AA02	6.21	V11AB02	6.32	V11AC02	8.87
Black	V11AA03	6.21	V11AB03	6.32	V11AC03	8.87
Yellow	V11AA04	6.21	V11AB04	6.32	V11AC04	8.87
White	V11AA05	6.21	V11AB05	6.32		
Blue	V11AA06	6.21	V11AB06	6.32		
Orange	V11AA07	6.21	V11AB07	6.32		

*** collar, black ABS: reference V12 (instead of V11)**
*** collar, grey ABS: reference V13 (instead of V11)**
*** collar, chrome-plated brass: reference V14 (instead of V11)**
From V11 to V14 add $3.34 List

FOR DEEP SHROUD CHROME BRASS COLLAR on V11AA series specify V15
see also page 60 WA0202
For V15 add $8.66 List.

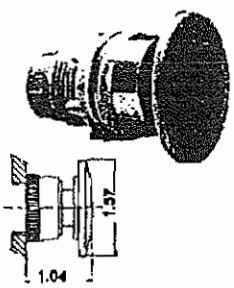
round operating heads
"pull" function
collar* chrome-plated ABS

for use with up to three contact blocks only

	mushroom-head button 40mm	
	 	N.B. these knobs have the following special feature: when operated by pulling, the electrical contacts work in the opposite direction the NC contact works as a NO contact the NO contact works as a NC contact however, to avoid errors of selection, we recommend the systematic use of 1NC+1NO or 2NC+2NO contact blocks.
COLOR	REFERENCE	LIST PRICE
Red	V11BD01	$15.08
Green	V11BD02	15.08
Black	V11BD03	15.08
Yellow	V11BD04	15.08

*** collar, black ABS: reference V12 (instead of V11)**
*** collar, grey ABS: reference V13 (instead of V11)**
*** collar, chrome-plated brass: reference V14 (instead of V11)**

mushroom-head button — "push" function



40mm		70mm (plastic)	
REFERENCE	LIST PRICE	REFERENCE	LIST PRICE
**V11AD01	$9.98	V11AE01	$21.95
V11AD02	9.98		
V11AD03	9.98	V11AE03	21.95
V11AD04	9.98	V11AE04	21.95
		Metallic Red	
		V11AT01	42.13

**Available as "STOP-STOP-STOP," Add S to Ref. #.

ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY

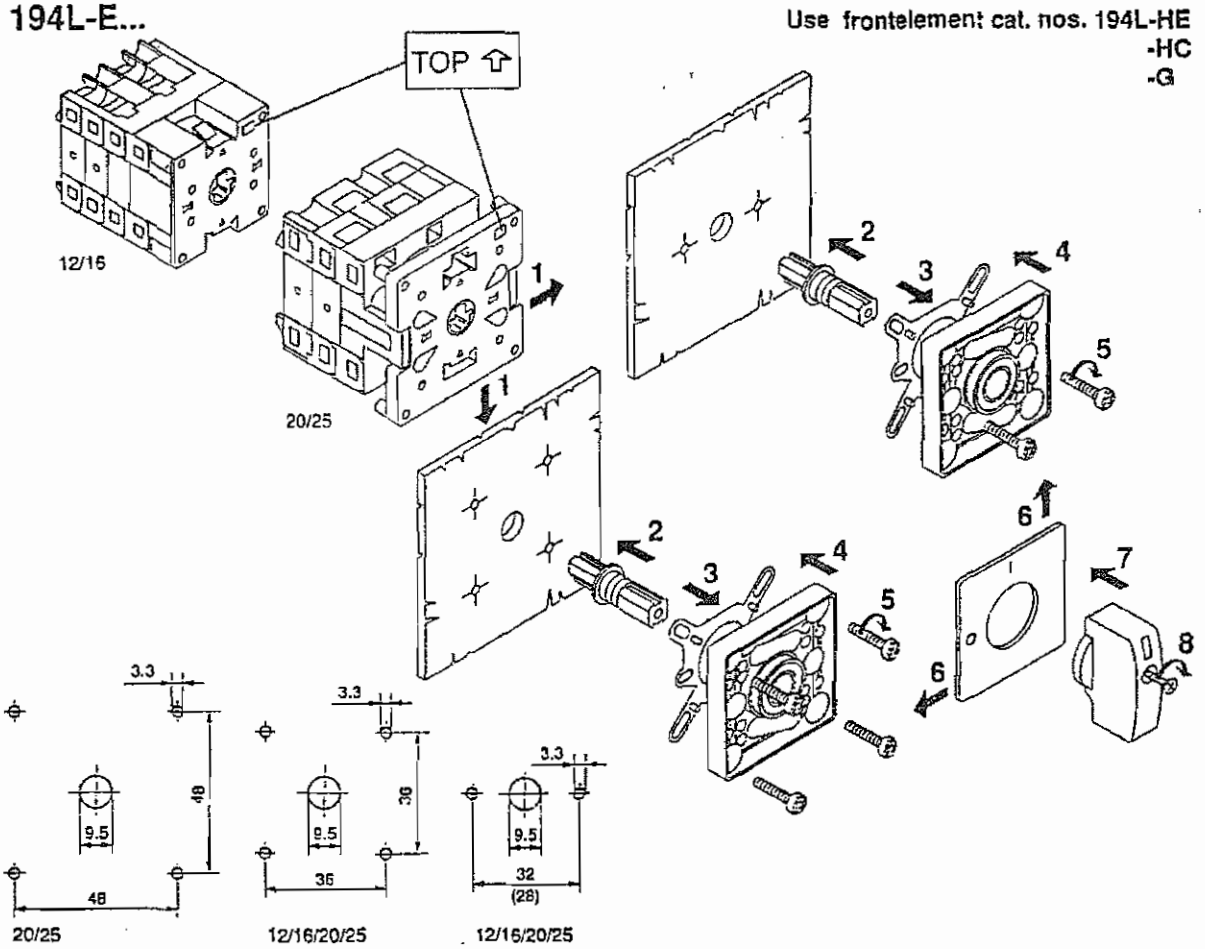
BULLETIN
194L

Montageanleitung
Mounting Instructions

Notice explicative de montage
Istruzioni di montaggio

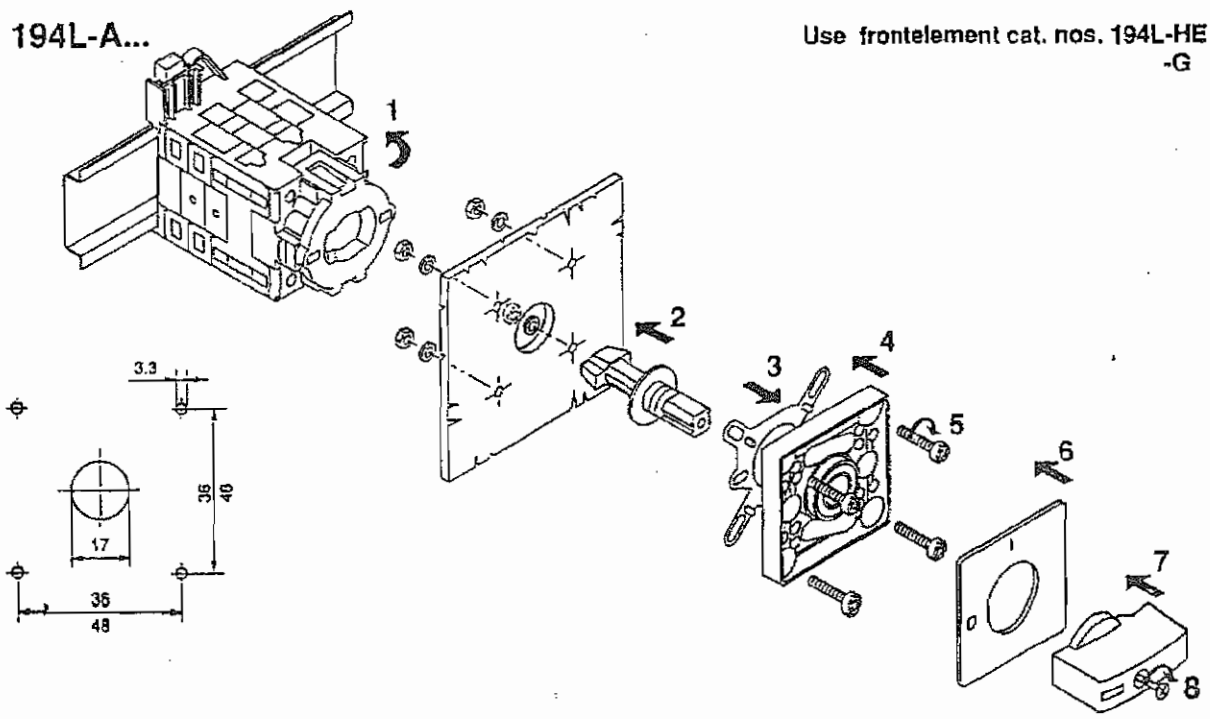
194L-E...

Use frontelement cat. nos. 194L-HE
-HC
-G



194L-A...

Use frontelement cat. nos. 194L-HE
-G



4030 09/93

TYPE 194L	AC2 AC22A	IEC VDE BS	AC3 AC23	CEE 24	GENERAL USE	UL - CSA MOTOR STARTING	MAX FUSE *	TORQUE
-E12 -A12	660V 12A	Ui 660V	V~ 220 380 500 / kV 2.2 4 5.5	12 (8)A 500 Vac	12A 600 Vac	V~ 120 240 480 600 / HP 1 2 5 5 3ph	25A	9 lb-in / 1 Nm
-E16 -A16	660V 16A	Ui 660V	V~ 220 380 500 / kV 3 5.5 7.5	16 (10)A 500 Vac	16A 600 Vac	V~ 120 240 480 600 / HP 1.5 3 7.5 7.5 3ph	30A	
-E20 -A20	660V 20A	Ui 660V	V~ 220 380 500 / kV 4.5 7.5 10	16 (10)A 500 Vac	20A 600 Vac	V~ 120 240 480 600 / HP (FLA) 2(13.6) 4(12.4) 8(11.6) 10(11) 3ph	35A	10.6 lb-in / 1.15 Nm
-E25 -A25	660V 25A	Ui 660V	V~ 220 380 500 / kV 5.5 11 13	20 (10)A 500 Vac	25A 600 Vac	V~ 120 240 480 600 / HP (FLA) 3(19.2) 5(18) 12(17) 15(17) 3ph	45A	

These devices are suitable for use on a circuit capable of delivering not more then 5,000 rms symmetrical amperes, 600V max. when protected by a * RK5 class fuse.

USE Cu WIRE 60/75°C ONLY

ANSCHLUSSPLAN
WIRING DIAGRAMS

SCHEMA DES CONNEXIONS
SCHEMI DI COLLEGAMENTO

ON - OFF
0-1
OFF - ON

90° 1751 1752 1753 1754 1755 1756

CHANGEOVER without 0
1-2

60° 2503 2504

CHANGEOVER with 0
1-0-2
MAN-0-AUT

60° 3503 3504
90° 3753

MULTISTEP without 0

1-2-3 60° 4501 4502 4503

1-2-3-4 60° 4511 4512 4513

1-2-3-4-5 60° 4521

1-2-3-4-5-6 60° 4531

MULTISTEP whit 0

0-1-2 60° 5501 5502 5503

0-1-2-3 60° 5511

60° 5512 5513

0-1-2-3-4 60° 5521 5522 5523

0-1-2-3-4-5 60° 5531

STAR-DELTA
0 - Y - Δ

60° 7503

REVERSING
1-0-2
1>0<2

60° 7543

V-METER-SWITCH
L3 L2 L1 L1 L2 L3
L1 L3 L2 N N N
TR-ST-RS-0-RN-SN-TN

45° 8251

0-RS-ST-TR-0
0-RS-ST-TR

45° 8271

RN-0-RS-ST-TR
L1 L1 L2 L3
N L2 L3 L1

45° 8332

A-METER-SWITCH
0-1-2-3
(3 Curr. Trans.)

90° 8751

90° 8752

0-1-2-3
(4 Curr. Trans.)

90° 8761

0-1
(1 Curr. Trans.)

90° 8771

4030 12/93

C-2000™ Push Buttons

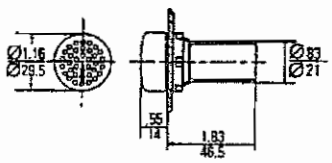
600 Volts Max. AC/300 Volts Max. DC
10 Amps. Continuous AC/2.5 Amps. Continuous DC

Special Operators (continued)

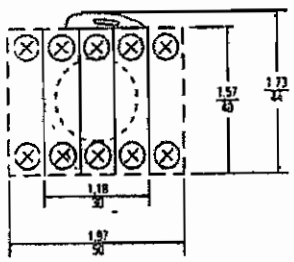
Buzzer (Piezoelectric Transducer)

(85 dB at 1 meter output)

Style	Voltage	Catalog No.
● Round Engineered Plastic	24V AC/DC	P9XBD
	110-240V AC/DC	P9XBM
□ Square Engineered Plastic	24V AC/DC	P9SBD
	110-240V AC/DC	P9SBM



Round Buzzer



Typical Back Side View

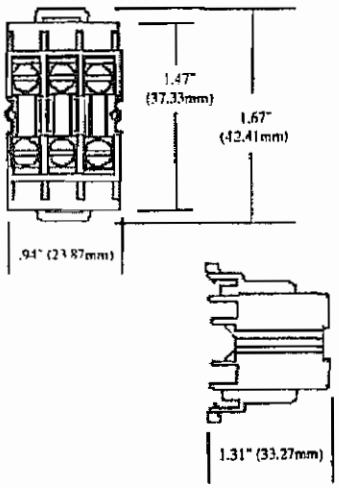
COOPER
USD Products

USD Rail Mounted Terminal Blocks

NDN3

SPECIFICATIONS
Rating: 40A, 600V; UL/CSA
Center Spacing: .300" (7.62mm)
Number of Poles: 3
Circuits Per Foot: 38
Circuit Jumper: JNDN3, 2 circuits
Wire Size: AWG#10-22 CU
Screw Size: #6-32
Mounting Options: 35mm DIN Rail, C-Rail
Marking Tape: MT12.5

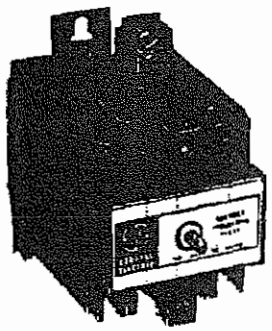
NDN3



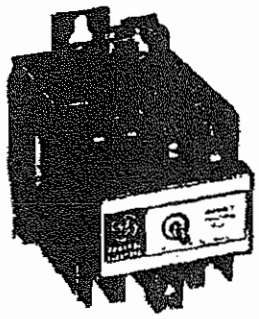
• 35mm DIN Rail Mounting • Compact Design

CR120B Machine-Tool and Industrial Relays

600 Volts
10 Amperes Continuous
60 Hertz



CR120B standard ac relay



CR120BD standard dc relay

Application

The CR120B, CR120BL, CR122B and CR122BT Series A, multi-circuit industrial relays are designed to meet most panel application requirements. They are available as standard, latched, or time-delay relays.

Industrial relays may be ordered as complete devices from the pricing tables with the NO and NC pole combination desired. The relay components may also be purchased separately and assembled in standard, latched, or timer forms (see Standard Components, pages 11-6, 11-7).

All forms of the relay mount on the same base, and in the same small panel-mounting area. Relays may be arranged in any configuration, or modified on a panel without altering the mounting area.

Features

- **Bifuracatad contacts assure positive make**—unique bifurcated contacts assure positive make at all voltages and give excellent fidelity even in harsh environments.
- **Transparent Lexan® contact cartridges**—allows inspection of contacts.
- **Convertible contacts**—allows conversion from normally open to normally closed, or vice versa. Just change the terminal screws and invert the contact module.
- **Quick-change coil**—can be changed without removing any screws.

Ordering Directions

Specify by complete Catalog Number, including coil suffix in place of ** or ††.
Example: For a six-pole relay with four-NC and two-NC poles, a coil operating on 120 Volts, 60 Hertz, order CR120B04202 (complete relay), at **$132.00, GO-10G4**. Or order the following components for customer mounting: CR120B00002 (base relay assembly), at **$48.00, GO-10G4**; CR120BX3 (adder deck), at **$12.00, GO-10G4**; and five CR120BX1 (contacts), at **$12.00 (each), GO-10G4**.

NEMA Type 1 enclosures are available for CR120B relays. For pricing, see page 11-8.

Forms listed in the tables include captive terminal clamps and convertible contact modules.

No. of Poles①			Catalog Number	List Price, GO-10G4
Total	NO	NC		

CR120B Open AC Relays

2	2	0	CR120B020**	$ 72.00
	1	1	CR120B011**	84.00
	0	2	CR120B002**	84.00
3	3	0	CR120B030**	84.00
	2	1	CR120B021**	96.00
	1	2	CR120B012**	96.00
	0	3	CR120B003**	96.00
4	4	0	CR120B040**	96.00
	3	1	CR120B031**	108.00
	2	2	CR120B022**	108.00
	1	3	CR120B013**	108.00
	0	4	CR120B004**	108.00
6	6	0	CR120B060**	120.00
	5	1	CR120B051**	132.00
	4	2	CR120B042**	132.00
	3	3	CR120B033**	132.00
	2	4	CR120B024**	132.00
	1	5	CR120B015**	132.00
	0	6	CR120B006**	132.00
8	8	0	CR120B080**	144.00
	7	1	CR120B071**	156.00
	6	2	CR120B062**	156.00
	5	3	CR120B053**	156.00
	4	4	CR120B044**	156.00
	3	5	CR120B035**	156.00
	2	6	CR120B026**	156.00
	1	7	CR120B017**	156.00
	0	8	CR120B008**	156.00
10	10	0	CR120B100**	168.00
	8	2	CR120B082**	180.00
	6	4	CR120B064**	180.00
	4	6	CR120B046**	180.00
	2	8	CR120B028**	180.00
12	12	0	CR120B120**	192.00
	10	2	CR120B102**	204.00
	8	4	CR120B084**	204.00
	6	6	CR120B066**	204.00
	4	8	CR120B048**	204.00

CR120BD Open DC Relays

2	2	0	CR120BD020††	108.00
	1	1	CR120BD011††	120.00
	0	2	CR120BD002††	120.00
3	3	0	CR120BD030††	120.00
	2	1	CR120BD021††	132.00
	1	2	CR120BD012††	132.00
	0	3	CR120BD003††	132.00
5	5	0	CR120BD050††	144.00
	4	1	CR120BD041††	156.00
	3	2	CR120BD032††	156.00
	2	3	CR120BD023††	156.00
	1	4	CR120BD014††	156.00
	0	5	CR120BD005††	156.00
7	7	0	CR120BD070††	168.00
	6	1	CR120BD061††	180.00
	5	2	CR120BD052††	180.00
	4	3	CR120BD043††	180.00
	3	4	CR120BD034††	180.00
	2	5	CR120BD025††	180.00
	1	6	CR120BD016††	180.00
	0	7	CR120BD007††	180.00
9	9	0	CR120BD090††	192.00
	7	2	CR120BD072††	204.00
	5	4	CR120BD054††	204.00
	3	6	CR120BD036††	204.00
	2	7	CR120BD027††	204.00
11	11	0	CR120BD110††	216.00
	8	3	CR120BD083††	228.00
	6	5	CR120BD065††	228.00
	4	7	CR120BD047††	228.00

**, †† Insert coil number from appropriate suffix table on page 11-3 to complete Catalog Number.
① An additional pole is automatically included in the coil circuit of dc relays.

QUACKENBUSH CO., INC.
MECHANICAL CONTRACTORS
505 Franklin Street, Buffalo, New York 14202
☐Phone 716-886-4355 ☐Fax 716-883-8277

SECTION 7

11302 - OIL WATER SEPARATOR

Supplier: Geoguard
536 Orient St., PO Box 149
Medina, NY 14103

Phone: (800) 393-4773

Fax: (716) 798-0147

Contact: Ms. Debbie Beach

Service: Pan American Environmental
2385 Hammond Dr., #5
Schaumberg, IL 60173

Phone: (847) 882-5855

Fax: (847) 882-5630

Contact: Mr. Scott Spalding

Installation, Operation & Maintenance Manual
For OS Series Oil/Water Separators

Customer: Quakenbush Co., Inc
Project: Cherry Farm Remediation
Tonawanda,NY

System: OS16-F oil/water separator
ES-16 elevation stand

Customer PO# 01674
PAE Job number: 912746

Shipped: 10/11/96

Pan America Environmental
2385 Hammond Dr. Ste 5
Schaumburg, IL 60173
847/882-5855 Fax: 847/882-5630

Installation, Operation &
Maintenance Manual

Equipment Provided:

OS16-F, oil/water separator, fiberglass construction with following options:
- Retpak, secondary coalescing media
- Influent/effluent FF flanges
- 1) 2" sludge valve
- 1) 1" oil reservoir water decant valve
- Oil transfer/sight glass assembly plumbed from oil outlet to oil reservoir fittings
- Tank anchor brackets
- ES16 elevation stand

Installation, Operation & Maintenance Manual

For Models OS2 through OS16
Fiberglass Oil/Water Separators

Pan America Environmental

Oil/Water Separators And Industrial Wastewater Treatment Systems

Manual number: OSF01-1095

Contents

OUR AREA CODE HAS CHANGED
847-882-5855
847-882-5630 FAX

Backcharges

Pan America Environmental will not accept any backcharges for modifications, adjusting, servicing or any other work performed on this equipment that s not been authorized in writing by Pan America Environmental prior to such actions. This authority will only be given when satisfactory proof is submitted and the authority will only be issued providing the price and actions are agreed upon. **ANY BACKCHARGES SUBMITTED CONTRARY TO THIS AGREEMENT WILL BE REJECTED IN TOTAL.**

Inspection On Arrival

Inspect all equipment upon arrival for missing or damaged components during shipping. Record missing or damaged components on Bill of Lading and contact Pan America immediately at: 708-882-5855 Fax: 708/882-5630

Warranty

Pan America Environmental warrants its products to be free of defect in materials and workmanship for a period of one year from the date of shipment.

Service Assistance & Parts

If you need service help or parts, call our local representative for your area or call Pan America Environmental directly.

To order replacement parts

When requesting parts, have the following information ready:

- Equipment model number
- Part name and/or part number

Contact: Pan America Environmental
2385 Hammond Dr #5
Schaumburg, IL 60173
708/882.5855 Fax: 708/882.5630

Equipment Indentification Section

Model Number: _____

Additional Options/Equipment:

_____

_____

_____

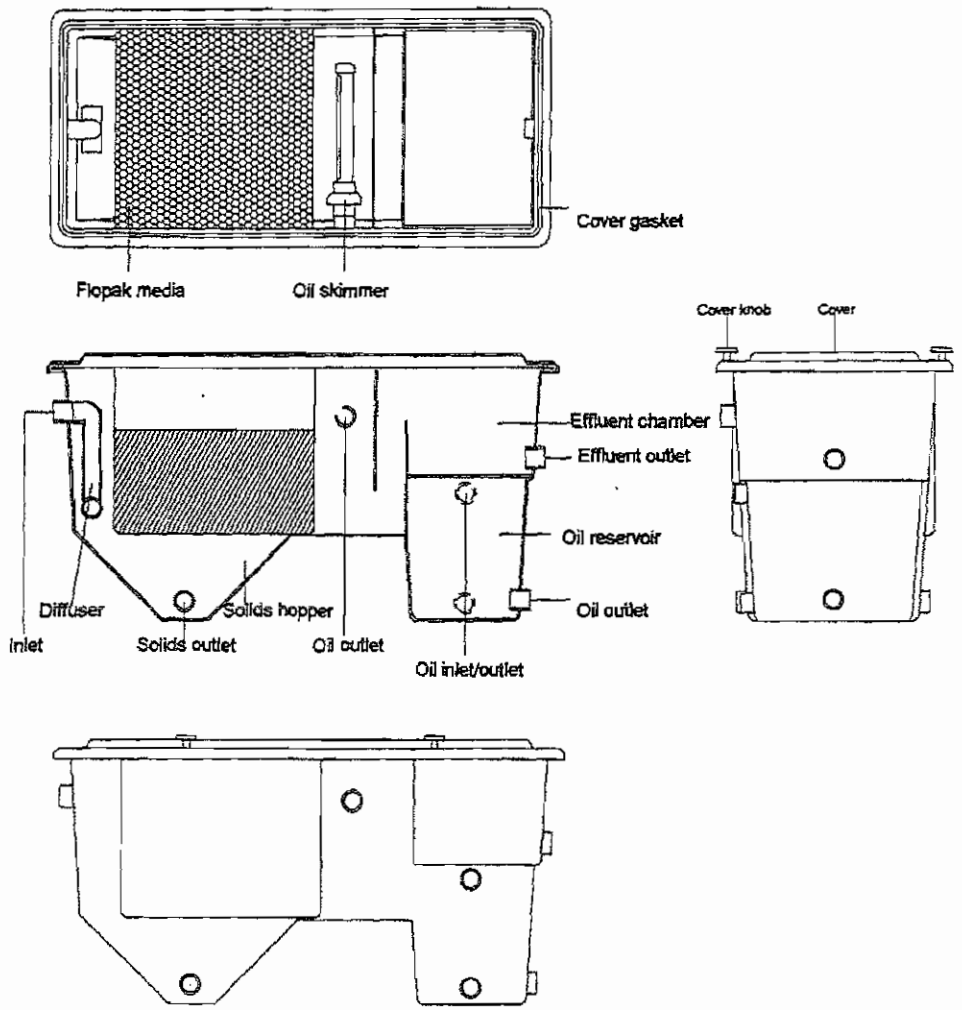
_____

_____

_____

Ship Date: _____

Parts & Features



The above listed parts and features will familiarize you with the design of our fiberglass constructed OS Series oil-water separators. Review this drawing for your reference. When calling for replacement parts refer to this drawing and/or the General Arrangement Drawing in this manual.

If any special modifications were provided on your particular model record those modifications here for your permanent record.

Modifications provided by factory: _____

Storage

If you are not ready to install this equipment after receiving it, store it in an area away from traffic. The ground should be level and free of any sharp objects that might damage the fiberglass or coating. Store the equipment with all factory packing left intact until ready for installation. Store the equipment indoors. If this is not possible make sure the equipment does not fill with water and debris. We recommend you cover the equipment with a tarp. Also, store any pumps and/or any other optional equipment provided within protective areas or structures or according to manufacturer's recommendations.

Equipment Installation/Anchoring

Locate the OS Series oil-water separator on a site that has been properly prepared or designed for the equipment provided. Place the unit on a hard surface.

1. Upon arrival, check tank for damage. Report any damages.

2. Remove tank from the delivery trailer with a crane, fork lift(s) or overhead gantry
WHEN LIFTING WITH THE LIFTING LUGS (if provided) LIFT VERTICALLY FROM THE TOP OF IE LUG (DIRECTLY ABOVE THE LUG). IF YOU LIFT FROM ANY OTHER ANGLE FROM THE LUG YOU MAY CAUSE UNDUE STRESS AND EXCESSIVE LOADING OF THE LIFTING LUGS WHICH MAY LEAD TO TANK DAMAGE.

3. Check site for pebbles or other debris that could puncture the fiberglass tank when filled with water. Set the unit on the site. Locate anchoring holes (if anchor brackets were provided), remove tank, drill holes, insert bolts, relocate tank and tighten hardware. Use 1/2" diameter x 4" minimum wedge bolt or embedded anchor bolts. Local code may also determine proper hold down hardware.

4. Level tank to within **+/- 1/4"** end to end, **+/- 1/64"** per foot from side to side with a maximum of **+/- 1/8"** total. Be sure adjustable water weir(s) are level. Place shim stock under hopper bottom, effluent chamber and anchor brackets footpads if necessary. When shimming be sure a shim is used the full length and width of the tank bottom that contacts the installation surface for max. weight distribution.

5. Check water weir for proper adjustment if your unit was provided with an adjustable water weir (see water weir adjustment for your unit). This weir is adjusted from the factory for your maximum flow rate, but should be checked before or after filling tank.

6. Identify all connections for proper placement of the tank prior to installation. **Refer to tank drawing.**

7 Connect inlet & outlet piping. **See plumbing section.** Leveling procedure is very important due to , need to create a flat water flow over the water weir and proper oil layer creation in the separation chamber for skimming.

Start-up Instructions

Before beginning startup determine which type of oil skimmer configuration was provided with your OS model separator. See General Arrangement drawing for configuration type. You will have one of the following types:

- Fixed oil weir with internal oil reservoir
- Cylindrical, rotating, adjustable skimmer

Adjustment of fixed oil skimmer with oil reservoir

1) Fill tank with clean water until it flows out the effluent outlet.
2) Check the level of the oil skimming weir, making sure that it is level with the water within +/- 1/8" total side to side. If it is not within this dimension the tank was not leveled properly. Perform leveling per the leveling instructions on page 3.
3) The relationship between the oil skimming weir and the effluent water weir is critical to the proper functioning of this piece of equipment

To verify proper water weir adjustment: (for fixed oil weir with internal reservoir)

a) Allow maximum rated flow of clean water to flow through separator.
b) Check the fixed oil skimming weir. Operating water level should be 3/8" maximum, 1/4" minimum below the top of the weir at the separator maximum rated flow. If water level differs from these dimensions you will need to readjust the water weir. If it is below the 1/4" the water weir needs to be lowered, if it is greater than the 3/8" the water weir needs to be raised.
c) Stop flow through the separator
d) Inspect water weir, make sure it is level, within 1/16" from side to side. Readjust this weir by loosening the nuts, moving the weir plate up or down and retightening the nuts.
4) Check all piping for leaks
5) Equipment anchoring should now be performed if it has not already been done. Expansion bolts may be used as anchors per anchoring section on page 3.

Adjustment of cylindrical oil skimmer

Follow 1, 2, 3 & 3a as directed above.
To adjust the water weir with the cylindrical oil skimmer: Adjust the water weir up or down so you have 1" of water above the coalescing media pack. ie.. if Flopak media bundle is 36" high adjust weir plate to 37" from tank bottom (see above directions (3d) for proper weir plate adjustment). **Rotate the cylindrical oil skimmer until you have 1/4" minimum or 3/8" maximum distance from the bottom lip of the skimmer and the top of the operating water level.**

If the water weir is the fixed, non-adjustable type adjust the cylindrical skimmer as directed above.

Equipment Plumbing

PIPING SUPPORT: Do not use the tank fittings as piping support when plumbing the separator as this may lead to tank fatigue and damage. Pan America Environmental can not be held liable for damage caused by using the equipment fittings as pipe supports.

PIPE SIZES: Refer to the General Arrangement drawing provided with this manual for proper fitting purpose and location. Do not reduce the size of the effluent fitting as this may create a backup condition in the separator. We highly recommend a pitch of at least 1/16" per foot in the effluent discharge piping. Do not increase the size of the influent connection as this may create a hydraulic overload condition when faced with flow rates greater than that specified for your separator.

OIL PIPING: Connection of the oil outlet piping: If gravity flowing from the internal oil reservoir or the cylindrical oil skimmer provide sufficient external storage, pipe pitch or pump flow rate to accomodate the anticipated volume of oils to be removed.
Whenever using an internal or external oil storage chamber we recommend provision of a high high level alarm and/or feed pump shutdown function to prevent the overflow of that storage chamber.

SLUDGE PIPING: When plumbing the sludge outlet(s) we recommend the installation of butterfly valves and a tee at the end of the sludge piping to allow ease of cleanout in the event the sludge line becomes clogs with sludge. When plumbing an OS separator with dual sludge chambers we recommend plumbing in the pump to the middle of a manifold connected to both sludge outlets so the pump will draw evenly from either outlet.

PIPE TYPE: Sch. 40 or 80 PVC pipe is an excellent choice for most applications due to it's ease of use, flexibility and cost.
PIPE SEALANT: Use a silicone sealant when plumbing to fiberglass fittings. Teflon tape tears easily due to sharp threads. When handling be careful, fiberglass threads are very sharp.

Sludge Removal

The sludge should be periodically drawn off so it is not allowed to build up and interfere with operation of the **FLOPAK** coalescing media.

Two methods for sludge removal are generally recommended.

- Gravity flow
- Pumpout

The gravity flow method will require a valve on the sludge outlet that will allow you to easily stop/start and finely control the discharge. When using gravity drain you will be using the head pressure existing in the tank to basically "blow" the sludge chamber contents out. This method of course has limits such as distance and height of discharge. Be sure you take into consideration where you have to send the sludge on discharge. Pumpout systems will allow you to discharge wherever you choose.

Sludge Removal cont'd

1) Refer to the General Arrangement drawing provided with this manual to determine the sludge hopper volume, outlet locations and sizes. We recommend plumbing in a short section of clear PVC pipe to allow you to see when the sludge is depleted.
2) After full operation of the system has been established you will need to determine sludge removal frequency. After 3-5 days draw off sludge. If a smaller volume is removed than anticipated then you will be able to wait longer for sludge draw off. If the volume is greater than anticipated increase the frequency.
3) A record should be kept as to time interval and volume of sludge removed.
4) Determine proper disposal of your sludge. You may find dewatering of the sludge may be necessary or advantageous prior to disposal.

Important Sludge Removal Information:
When drawing off the sludge we recommend it be drawn off while the separator is under operation. If the sludge is drawn off while the separator is not operating and the water level in the tank is dropped sufficiently you will run the risk of coating the tank walls with separated product. Once operation is resumed and the oils coat the walls at the end of the separation chamber and in between the oil/water baffles higher concentrations of free product may exit the tank over a period of time. This can show up as continuously higher hydrocarbon discharge levels until the oils have been swept off the tank walls.

Note: Please consult your local city and state regulatory agency regarding specific requirements on the proper disposal of the sludge generated in your process.

If you need assistance with equipment to remove and dewater the sludge from your OS separator please call your local Pan America Environmental (PAE) representative or PAE directly. We will be happy to recommend possibilities and alternatives for the removal and treatment of your sludge.

Cleaning the OS

Over time your unit may accumulate enough solids to interfere with its operation. Use to following for cleaning the tank and Flopak media.

1) stop the flow to the separator and empty the tank. You may or may not need to empty the effluent reservoir as most solids will drop out in the solids chamber.
2) Remove the oil separation media (be careful not to damage it)
3) If the media is plugged clean out the solids with hot or warm water under pressure. Be careful not to use excessive water pressure as it may damage the media. The media can be placed in or sprayed with a detergent solution if it is grimey enough. If a detergent is used thoroughly rinse the media. If the detergent is allowed to stay on the media it may help to emulsify oils that impinge on the media.

The media will function best when it has clean surfaces for the oils to clinge to. By allowing solids or other organic matter to accumulate on the media the separation efficiency may drop. A regular scheduled visual inspection should be peformed.

Pan America Environmental — OS Series Fiberglass Oil-Water Separators

DIMENSIONS & CAPACITIES — *OS Series Fiberglass Oil/Water Separators*

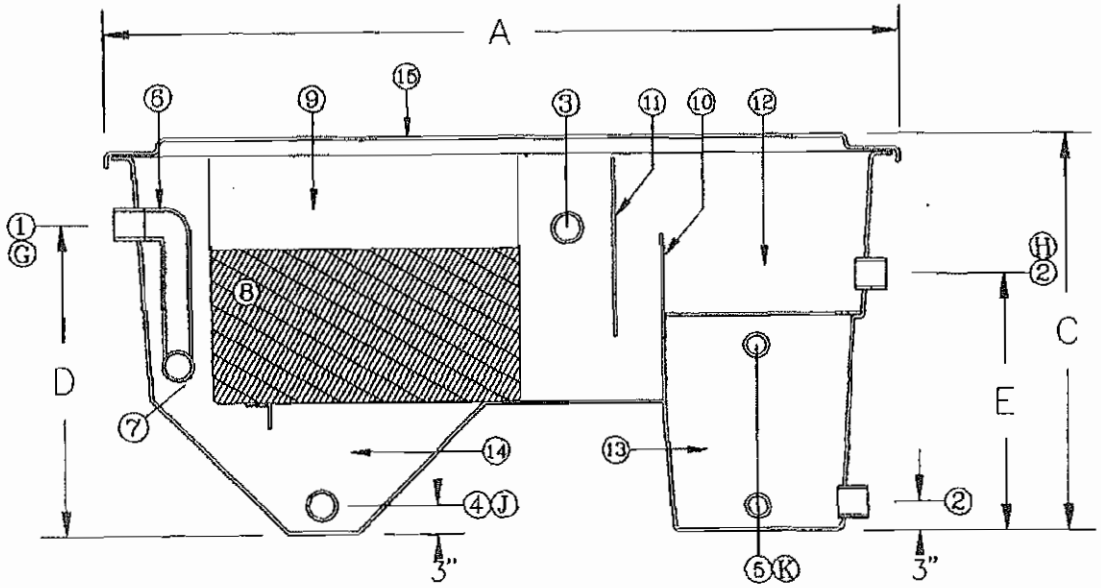
Model	Dimensions (inches) L A	W B	H C	Elevations (inches) D	E	F	Fitting Sizes (inches) G	H	I	J	K	Weight (lbs) Empty	Full	Media Sq. Ft.	Tank Vol Gal	Water Res Vol. Gal.	Oil Res Vol. Gal.	Sludge Volume Gal.	Model
OS-2	62	17	31	24	20	23	2	2	2	2	2	65	428	136	25	12	8	6.5	OS-2
OS-4	62	20	31	24	20	23	2	2	2	2	2	95	930	272	51	36	25	13	OS-4
OS-8	72	29	43	36	28	36	2	2	2	2	2	130	1740	544	125	55	40	13	OS-8
OS-12	72	40	43	36	28	36	3	3	3	3	2	250	2668	816	180	85	60	25	OS-12
OS-16	72	52	43	36	28	36	3	3	3	3	2	330	3590	1088	240	114	80	37	OS-16

ITEM	QTY	DESCRIPTION
1	1	WASTEWATER INLET
2	1	EFFLUENT OUTLET
3	1	OIL OUTLET
4	2	SLUDGE OUTLET
5	2	OIL RESERVOIR INLET/OUTLET

ITEM	QTY	DESCRIPTION
6	1	INFLUENT DIFFUSER
7	1	INFLUENT CHAMBER
8	1	MEDIA BUNDLE
9	1	SEPARATION CHAMBER
10	1	WATER OVERWEIR

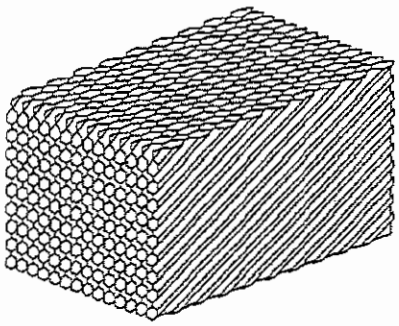
ITEM	QTY	DESCRIPTION
11	1	OIL BAFFLE
12	1	EFFLUENT CHAMBER
13	1	OIL RESERVOIR
14	1	SLUDGE CHAMBER
15	1	COVER

The water reservoir volume shown reflects total expanded volume. To determine unexpanded volume subtract oil reservoir volume from water reservoir volume.



Flopak Coalescing Media Information

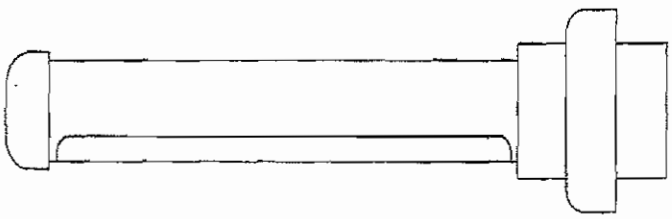
The Flopak coalescing media bundle provided with your OS separator is designed to impede the movement of oil droplets. Due to the nature of the construction materials the oils and the media are attracted to each other. The media can be refered to as oleophilic. Settleable solids are also removed by the media. Once solids are removed they slide down the corrugations in the media and fall into the hopper located under the media.



We can provide different materials of construction PVC, CPVC, polypropylene and stainless steel. The standard media material provided is PVC. The corrugated media plates are bound together via a thermal or adhesive method. When handling the media be careful not to damage the plates. The media is packed into the separator tank in pieces that are generally 12" x 12" x 24"L.

Oil Skimmer Details

Oil removal is accomplished after the oils have accumulated on the water surface by skimming the oil layer that rises higher than the water surface. We have provided a cylindrical, adjustable skimmer for this purpose. To adjust simply rotate the skimmer collar, adjust the bottom lip of the skimmer pipe slot to a 1/4" minimum or 3/8" maximum from the top of the operating water level and while still holding the skimmer pipe retighten the collar. The collar should be hand tight.



The skimmer assembly is made of PVC with a viton o-ring to seal the skimmer head to the collar base. This assembly allows you to remove and replace the skimmer head module quickly and easily for cleaning. The skimmer is located directly after the Flopak media and is horizontally mounted to the inside of the oil outlet coupling.

Oil Reservoir

The fiberglass OS Series separators are designed with a built-in oil reservoir. This oil reservoir can be modified in different ways to accomodate your application needs. By standard, the OS tanks are provided with the oil reservoir configuration as shown in Fig. 2. Depending on the application we may have provided one of the three configuration shown below. Various optional fittings may have been included and should be recorded by you on page 2 of this manual.

Fig. 1

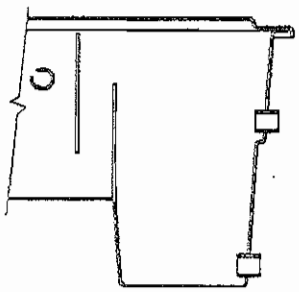
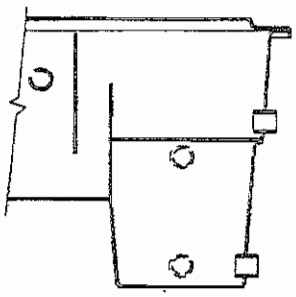


Fig. 2



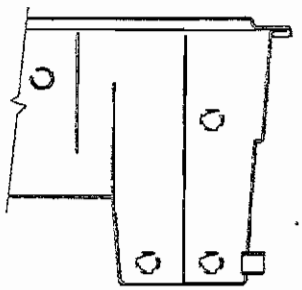


Fig. 3

The drawings shown above show three configurations. **Figure 1:** expanded effluent chamber, generally provided for direct connection of your effluent pump. **Figure 2:** standard design, effluent & oil reservoir with horizontal separation and **Figure 3:** effluent/oil chambers with vertical separation.

Tank Construction

The OS separator tank, cover, baffles and female threaded couplings are all constructed of DION 6694/95/FR resin mixed with fiberglass fiber. The FNPT fittings are integrally bonded to the tank via DION resin to provide a maintenance free, permanent, leak free coupling. The exterior of the tank is coated with a layer of white, ultraviolet stabilized gel coat. If touchup gel coating is needed please contact .E.

Quality of Effluent Troubleshooting Guide

Monitor the quality of the effluent on a regular basis. If the quality declines check the following things for system correction.

1) Has flow rate of separator been exceeded? Reset to rated flow if beyond separator flow rating. Check oil skimmer and water weir adjustment.

2) Is the method of oil removal plugged? Make sure the oil outlet is clear or the oil pump is functioning properly.

3) Is sludge being removed on a regular basis? If the sludge is allowed to build up and interfere with the coalescing media this can reduce water quality. If sludge has plugged the media flush it out. If it can't be flushed you may need to remove the media to clean it.

4) Check the wastestream for chemical emulsifiers and surfactants. If you are pumping into the separator are you using a high shear pump that is emulsifying the oils?

5) Oil is not being skimmed by oil weir: measure operating water level to top of oil weir. If this dimension does not meet criteria indicated in start up section readjust water weir or oil skimmer per instructions.

6) Solids may combine with and carry oils out the effluent. Check for suspended solids in the effluent. If present you may need effluent polishing filtration.

7) Sludge removal: If you pumpout the sludge when the separator is not in operation and you pump a large volume of water you may drop the internal water level sufficiently to coat the tank walls and the space in between the water and oil baffles. If this has occured and you resume operation any oils clinging to the tank walls or baffles may exit the separator. Solution: pumpout/drain sludge while separator is under operation. If this scenerio has taken place shutdown separator, clean, rinse well and place back into operation per startup instructions.

8) Has the oil you are separating been changed to a different type?

If your review of the above listed most common problems does not remedy the situation contact PAE to discuss and correct your problem.

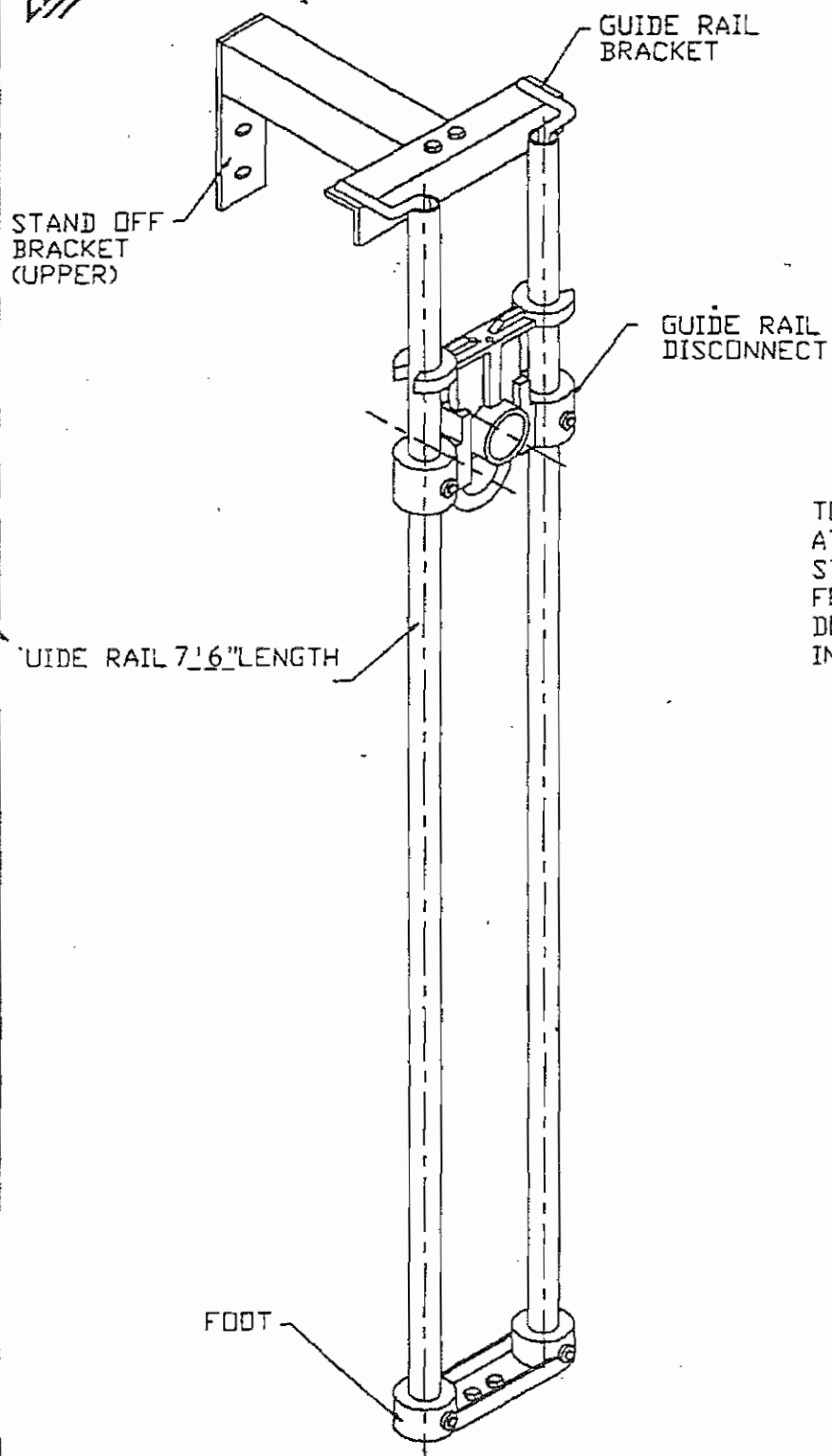
EPG Companies Inc.

List of Equipment

Job # 96-3315

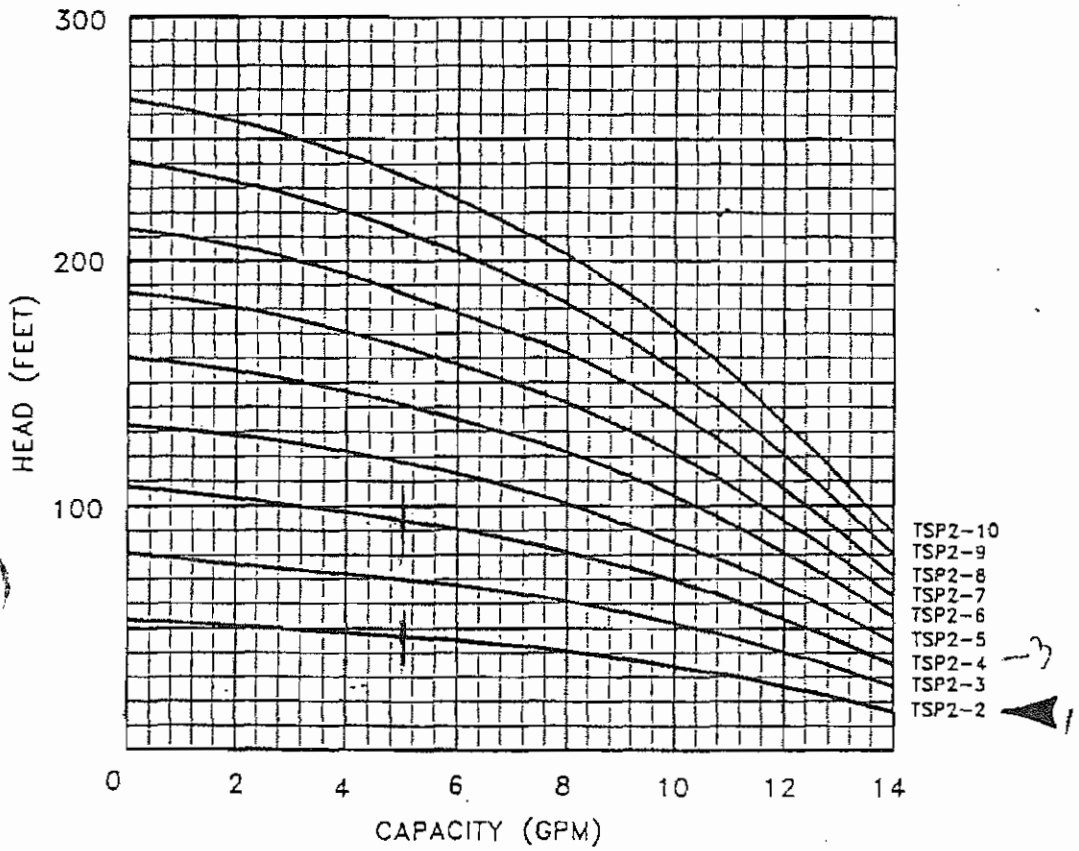
1	TSP2-2 SurePump, stainless steel submersible pump with 1/2HP 460VAC 3Ø motor with 10' jacketed motor lead.
3	TSP2-4 SurePump, stainless steel submersible pump with 1/2HP 460VAC 3Ø motor with 10' jacketed motor lead.
4	Guide Rail System, includes two(2) 3/4" x 7.5' stainless steel guide rails, guide rail foot, stand off bracket and 1.25" SPDS5 electroless nickel plated guide rail disconnect.

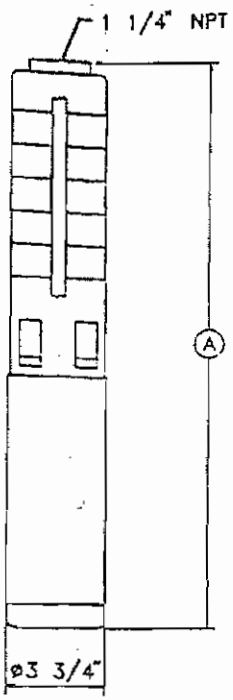
GUIDE RAIL DISCONNECT SYSTEM



TO INSTALL GUIDE RAILS START AT TOP OF SUMP PLACING UPPER STAND OF BRACKET ABOUT 2" FROM TOP OF SUMP. THEN MEASURE DOWN LENGTH OF GUIDE RAIL AND INSTALL FOOT.

TSP2 SurePump™ SUBMERSIBLE PUMP

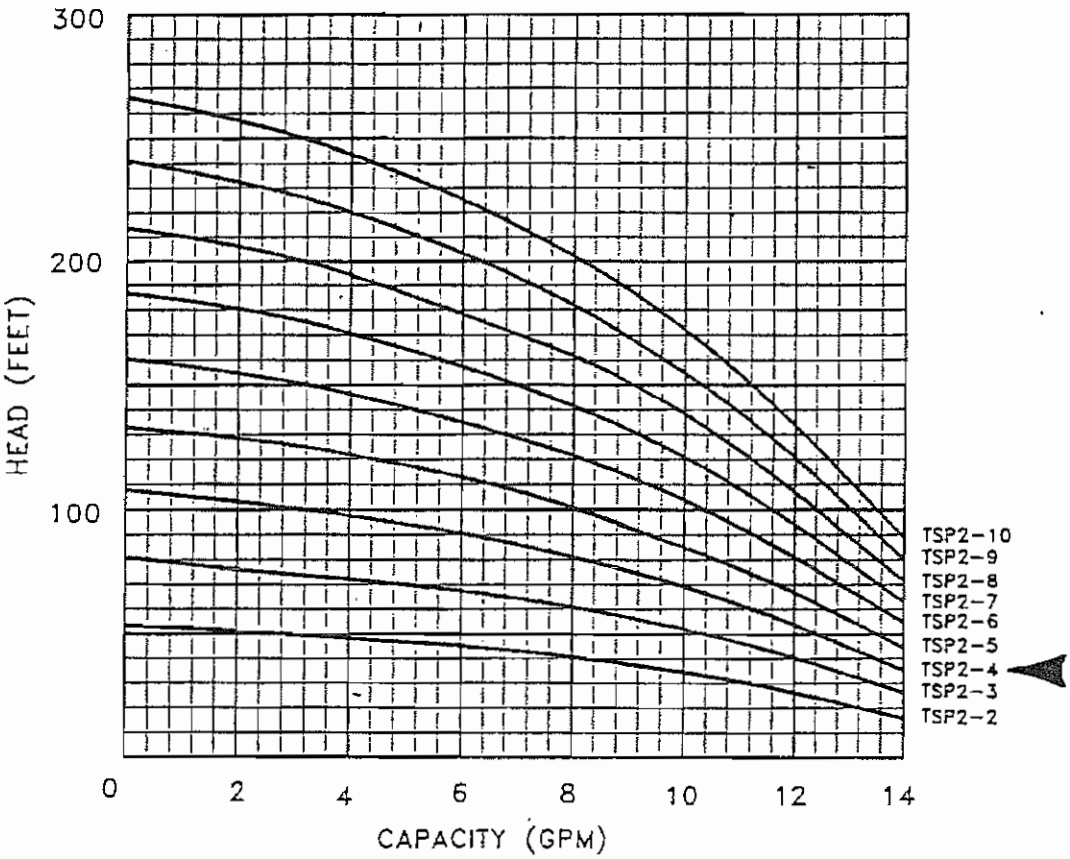


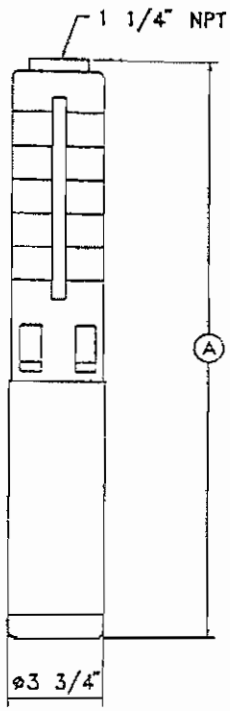


PUMP MODEL	SINGLE PHASE		THREE PHASE		SHIPPING WEIGHT (LBS)	
	MOTOR HP	A (in)	MOTOR HP	A (in)	1ø	3ø
TSP2-2	0.33	16.50	0.50	17.25	25.0	27.2
TSP2-3	0.33	17.50	0.50	18.25	25.9	28.1
TSP2-4	0.33	18.50	0.50	19.25	26.9	29.1
TSP2-5	0.33	19.50	0.50	20.25	27.9	30.1
TSP2-6	0.50	20.50	0.50	21.25	30.2	31.2
TSP2-7	0.50	21.50	0.50	22.25	31.2	32.2
TSP2-8	0.50	22.50	0.50	23.25	32.3	33.3
TSP2-9	0.75	24.25	0.75	24.25	34.1	35.1
TSP2-10	0.75	25.25	0.75	25.25	35.1	36.1

SEE 0663-2 FOR HIGH HEAD MODELS.

TSP2 SurePump™ SUBMERSIBLE PUMP





PUMP MODEL	SINGLE PHASE		THREE PHASE		SHIPPING WEIGHT (LBS)	
	MOTOR HP	A (in)	MOTOR HP	A (in)	1ø	3ø
TSP2-2	0.33	16.50	0.50	17.25	25.0	27.2
TSP2-3	0.33	17.50	0.50	18.25	25.9	28.1
TSP2-4	0.33	18.50	0.50	19.25	26.9	29.1
TSP2-5	0.33	19.50	0.50	20.25	27.9	30.1
TSP2-6	0.50	20.50	0.50	21.25	30.2	31.2
TSP2-7	0.50	21.50	0.50	22.25	31.2	32.2
TSP2-8	0.50	22.50	0.50	23.25	32.3	33.3
TSP2-9	0.75	24.25	0.75	24.25	34.1	35.1
TSP2-10	0.75	25.25	0.75	25.25	35.1	36.1

SEE 0663-2 FOR HIGH HEAD MODELS.

Materials of Construction

EPG SurePump™

	STANDARD
Check Valve Housing	304 Stainless Steel
Check Valve	304 Stainless Steel
Check Valve Seat	Teflon
Diffuser Chamber	304 Stainless Steel
Impeller Seal Ring	Teflon
Impeller	304 Stainless Steel
Motor Adaptor	304 Stainless Steel
Inlet Screen	304 Stainless Steel
Pump Shaft	304 Stainless Steel
Coupling	329/420/431 Stainless Steel
Fasteners	304 Stainless Steel
Bearings	Eglide

FRANKLIN ELECTRIC MOTORS

	1/3 to 2 HORSEPOWER POLLUTION RECOVERY	3 to 10 HORSEPOWER NI-RESIST
End Bell Castings	304 Stainless Steel over Iron	Ni-Resist Type 1-B
Stator Shell	201 Stainless Steel	316 Stainless Steel
Shaft Extention	303 Stainless Steel	17-4 Stainless Steel
Fasteners	316 Stainless Steel	316 Stainless Steel
Seal Cover	Acetal	316 Stainless Steel
Shaft Seal	Viton	Viton, Carbon, Ceramic Face Seal
Diaphragm	Viton	Type 200 Hydrin
Diaphragm Plate	304 Stainless Steel	304 Stainless Steel
Diaphragm Spring	302 Stainless Steel	302 Stainless Steel
Diaphragm Cover	316 Stainless Steel	316 Stainless Steel
Slinger	Viton	Nitrile Rubber
Lead Sleeve	Nickel Plated Brass	316 Stainless Steel
Lead Jam Nut	316 Stainless Steel	316 Stainless Steel
Lead Potting	Epoxy	Epoxy
Lead Bushing	Viton	Viton

3. WARRANTIES

GRS
Groundwater
Recovery Systems, Inc.

WARRANTY

Groundwater Recovery Systems, Inc. (Manufacturer) warrants it's products to be free from defect in material and workmanship under normal use and service, the remedy under this warranty being exclusively limited to making good at Manufacturer's factory any part or parts thereof which shall be returned to it with transportation charges prepaid; and which it's examination shall disclose to it's satisfaction to have been thus defective, provided that such part or parts shall be so returned to it no later than 12 months after delivery of its product to the purchaser. THIS LIMITED WARRANTY IS BEING MADE IN PLACE OF ALL OTHER EXPRESS WARRANTIES AND IN PLACE OF ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS. THIS LIMITED WARRANTY IS IN LIEU OF ALL OBLIGATIONS OR LIABILITIES ON THE PART OF THE MANUFACTURER FOR DAMAGES INCLUDING, BUT NOT LIMITED TO, CONSEQUENTIAL AND INCIDENTAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE USE OF THE PRODUCT.

2998 National Rd., Exton, PA 19341 • 610-524-2790 • FAX 610-524-2795
With offices throughout the United States

LIMITED WARRANTY

This agreement shall be deemed to have been entered into in the State of Minnesota, and shall be construed in accordance with the laws of the State of Minnesota, including Minnesota's enactment of the Uniform Commercial Code. Buyer hereby stipulates and agrees that Hennepin County, Minnesota shall be the proper jurisdiction for adjudicating all claims and controversies arising from this agreement.

Products manufactured by EPG Companies Inc. are warranted for a period of 12 months from date of installation or eighteen(18) months from date of manufacture* to be free from defects of materials and workmanship. It is expressly agreed that the exclusive remedy under this warranty is limited solely to the repair or replacement, at the sole discretion of EPG, of the part that failed. The cost of labor for any field repairs is not covered by this warranty. EPG Companies will not be liable for any damage or wear due to abnormal conditions or improper installation.

Products not manufactured by EPG Companies Inc. are covered by the original manufacturer's warranty, which EPG Companies passes through to the purchaser. Warranty determination will be made by the actual manufacturer.

To have a defective part repaired or replaced, you must return the defective product to EPG Companies. Please call (800)762-8418 or (612) 424-2613 to obtain a Return Goods Authorization (RGA) number. Send defective product (freight prepaid) with RGA #, description of installation, installation data and failure date to EPG Companies Inc., 19900 County Rd. 81, Maple Grove, MN 55311.

EPG Companies will not be held liable for any incidental or consequential damages, losses or expenses incurred from installation, use or any other reason. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF EITHER FITNESS FOR A PARTICULAR PURPOSE OR OF MERCHANTABILITY, WHICH EXTEND BEYOND THOSE SPECIFICALLY LISTED HERE.

If equipment is to be stored for a period greater than six months, proper storage precautions must be taken if the warranty is to be maintained. Please call EPG Companies for specific requirements regarding product storage.

The following is a partial list of items which will void the warranty:

- Opening of a motor for any reason.
- Using undersized electrical wire.
- Making unauthorized circuit changes. Please call EPG Companies before making any changes.
- Operating a three phase submersible motor from single phase power through a phase converter unless 3-leg ambient-compensated quick trip overload protectors are used and complete details are sent in writing to EPG Companies.

* To qualify for the delayed installation warranty you must contact EPG Companies Inc., at (800)762-8418 or (612) 424-2613 within 60 days of purchase.

QUACKENBUSH CO., INC.
MECHANICAL CONTRACTORS
505 Franklin Street, Buffalo, New York 14202
☐ Phone 716-886-4355 ☐ Fax 716-883-8277

SECTION 9

11364 - TANK MIXERS

Supplier: Alsop Engineering Company
c/o K-Tech Associates
1868 Niagara Falls Blvd.
Tonawanda, NY 14150

Phone: (716) 695-1038

Fax: (716) 695-7820

Contact: Mr. John DeLong

Service: K-Tech Associates (same as above)

ALSOP ENGINEERING COMPANY KINGSTON , NY

OPERATING INSTRUCTIONS FOR THE ALSOP PORTABLE MIXERS

WITH CLAMP OR SADDLE PLATE

WARNING: READ INSTRUCTIONS PRIOR TO OPERATING OR WIRING YOUR ALSOP MIXER -- DAMAGE MAY RESULT IF THESE INSTRUCTIONS ARE NOT FOLLOWED.

INSTRUCTIONS

#1 EXAMINE MIXER VISUALLY FOR EVIDENCE OF DAMAGE IN TRANSIT. TAKE CARE NOT TO DAMAGE THE BALANCED PROPELLER AND SHAFT.

#2 CROSS CHECK MOTOR NAMEPLATE WITH THE TYPE OF ELECTRICAL SUPPLY IN YOUR PLANT FOR COMPATABILITY. IF AN AIR MOTOR IS SUPPLIED, SEE ATTACHED INSTRUCTIONS.

#3 VIEW THE FRONT OF THE MIXER BELL HOUSING AND LOCATE THE VERTICAL ACCESS SLOT WHICH APPEARS ON RIGHT HAND SIDE. THIS SLOT WILL HAVE AN ALLEN WRENCH AND A CLAMP NUT WRENCH INSERTED IN IT AND TAPED IN PLACE. REMOVE THE TAPE AND WRENCHES. LOOSEN, BUT TAKE CARE NOT TO REMOVE, THE BOTTOM THREE SET SCREWS ON THE COUPLING INSIDE THE MIXER HOUSING. THIS ALLOWS INSERTION OF THE MIXER SHAFT AS DESCRIBED IN STEP #4.

#4 INSERT THE END OF THE MIXER SHAFT THAT HAS THE FLAT ON IT, THROUGH THE OPENING IN THE BOTTOM OF THE MIXER HOUSING AND INTO THE COUPLING. MAKE CERTAIN THAT THE SET SCREWS WHICH WERE LOOSENED IN THE ABOVE STEP WILL BEAR DOWN ON THE FLAT WHEN TIGHTENED. THE SHAFT SHOULD SLIDE INTO THE COUPLING FOR ABOUT 4½" AND THEN STOP.

#5 TIGHTEN THE SET SCREWS ON THE COUPLING TO BEAR DOWN ON THE FLAT PORTION OF THE MIXER SHAFT WITH THE ALLEN WRENCH SUPPLIED.

#6 POSITION THE PROPELLER ON THE LOWEST POINT OF THE MIXER SHAFT. THE ARROW STAMPED ON THE PROPELLER HUB SHOULD POINT TO THE BOTTOM OF THE TANK. IF TWO PROPELLERS ARE SUPPLIED, LOCATE THE BOTTOM PROPELLER AS DESCRIBED, AND THE TOP PROPELLER APPROXIMATELY 1 TO 2 PROPELLER DIAMETERS ABOVE THE LOWER ONE. IN THE EVENT YOUR UNIT IS SUPPLIED WITH A STABILIZING RING ON THE PROPELLER, MOUNT THIS PROPELLER, WITH THE ARROW POINTING DOWNWARD, AT THE LOWEST POSITION ON THE MIXER SHAFT.

#7 POSITION AND SECURE YOUR MIXER TO THE TANK OR MIXER BRACKET YOU INTEND TO USE, ARRANGING THE MIXER SHAFT IN THE POSITION RECOMMENDED BY THE DIAGRAM ON THE SECOND PAGE OF THESE INSTRUCTIONS. IN MOST CASES, THIS WILL PROVIDE THE BEST DEGREE OF AGITATION. WE DO NOT RECOMMEND EXCEEDING 20° FROM A VERTICAL POSITION.

IF A SADDLE PLATE IS SUPPLIED INSTEAD OF "C" CLAMP, MAKE SURE IT IS SECURELY FASTENED TO BASE COMPONENT AND THAT THE PROPER SHAFT POSITION DESCRIBED BEFORE CAN BE MAINTAINED.

#8 IF YOUR UNIT WAS NOT WIRED AT THE FACTORY, PROCEED TO WIRE THE UNIT AT THIS POINT, INSURING THAT PROPELLER SHAFT ROTATION, AS VIEWED FROM THE MOTOR TOWARD THE PROPELLER, IS CLOCKWISE. THIS STEP IS OF THE UTMOST IMPORTANCE! IMPROPER ROTATION WILL NOT ONLY RESULT IN POOR MIXING ACTION, BUT CAN SERIOUSLY DAMAGE YOUR UNIT. FOR AIR DRIVEN MOTORS, MAKE SURE MOTOR IS PIPED INTO THE SYSTEM TO ASSURE ROTATION AS DEFINED ABOVE.

OPERATING

1) NEVER RUN MIXER WITHOUT FLUID IN THE TANK AS THIS MAY CAUSE EXCESSIVE VIBRATION.

2) AT THIS POINT, OPERATE YOUR MIXER IN THE NORMAL MANNER, CHECK FOR ANY EXCESSIVE SHAFT VIBRATION OR WHIPPAGE, WHICH, REGARDLESS OF SHAFT LENGTH SHOULD NOT OCCUR. IF THIS SITUATION OF EXCESSIVE WHIPPAGE OCCURS, SHUT DOWN THE UNIT, AND RETRACE STEPS 3-5. IF THIS CONDITION PERSISTS, CONTACT YOUR LOCAL ALSOP REPRESENTATIVE OR THE HOME OFFICE.

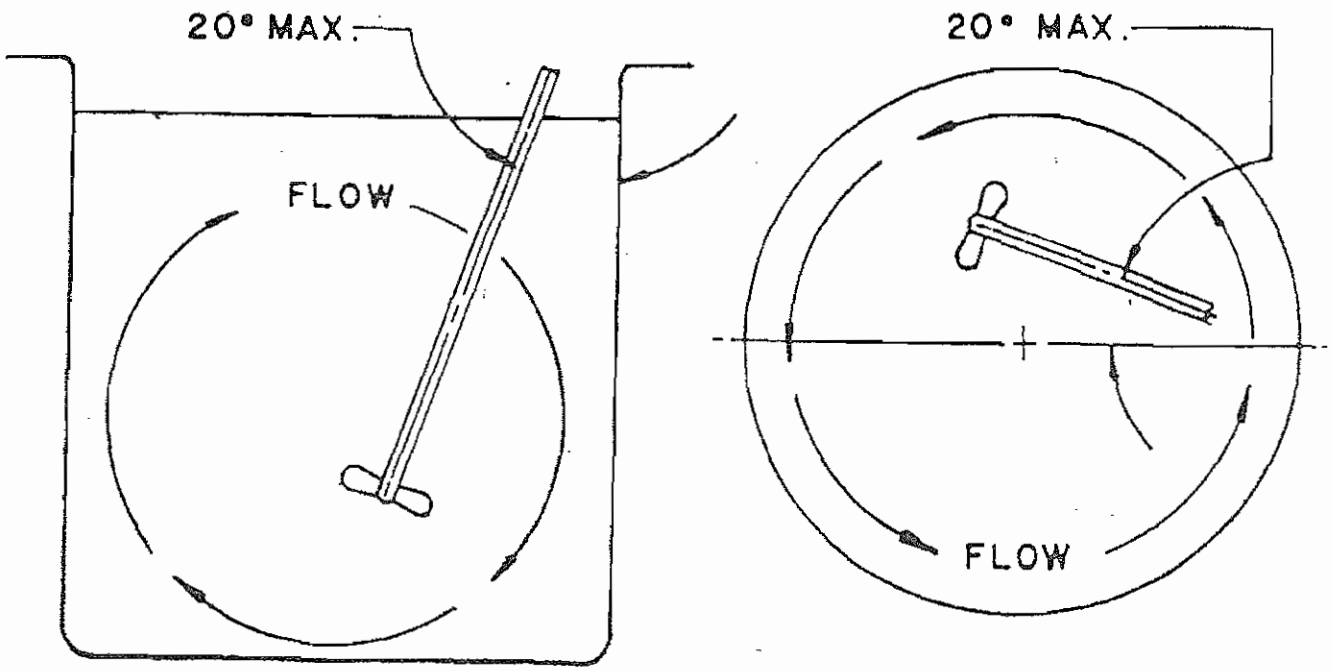
3) LIQUID CIRCULATION SHOULD BE AS SHOWN IN SKETCH BELOW. FOR AVERAGE CONDITIONS, LOCATE THE PROPELLER ABOVE THE TANK BOTTOM A DISTANCE EQUAL TO TWICE THE PROPELLER DIAMETER.

MAINTENANCE

1) ALL MIXERS, WHETHER GEARED OR DIRECT DRIVE, HAVE ALL INTERNAL PARTS PRE-LUBRICATED AND SEALED AT THE FACTORY FOR THE LIFE OF THE UNIT. NO LUBRICATION ON YOUR PART IS NECESSARY.

2) BE SURE TO SAVE AND USE THE LUBRICATING INSTRUCTIONS WHICH ARE ATTACHED TO THE ELECTRIC OR AIR MOTOR.

RECOMMENDED SHAFT POSITION



ALSOP ENGINEERING COMPANY KINGSTON, NY

OPERATING INSTRUCTIONS FOR THE ALSOP PORTABLE MIXERS

WARNING: READ INSTRUCTIONS PRIOR TO OPERATING OR WIRING YOUR ALSOP MIXER -- DAMAGE MAY RESULT IF THESE INSTRUCTIONS ARE NOT FOLLOWED.

INSTRUCTIONS

#1 EXAMINE MIXER VISUALLY FOR EVIDENCE OF DAMAGE IN TRANSIT. TAKE CARE NOT TO DAMAGE THE BALANCED PROPELLER AND SHAFT.

#2 CROSS CHECK MOTOR NAMEPLATE WITH THE TYPE OF ELECTRICAL SUPPLY IN YOUR PLANT FOR COMPATABILITY. IF AN AIR MOTOR IS SUPPLIED, SEE ATTACHED INSTRUCTIONS.

#3 VIEW THE FRONT OF THE MIXER HOUSING AND LOCATE THE VERTICAL ACCESS SLOT WHICH APPEARS ON RIGHT HAND SIDE. THIS SLOT WILL HAVE AN ALLEN WRENCH AND A CLAMP NUT WRENCH INSERTED IN IT AND TAPED IN PLACE. REMOVE THE TAPE AND WRENCHES. LOOSEN, BUT TAKE CARE NOT TO REMOVE, THE BOTTOM THREE SET SCREWS ON THE COUPLING INSIDE THE MIXER HOUSING. THIS ALLOWS INSERTION OF THE MIXER SHAFT AS DESCRIBED IN STEP #5.

#4 POSITION AND SECURE YOUR MIXER TO THE TANK OR MIXER BRACKET YOU INTEND TO USE.

#5 INSERT THE END OF THE MIXER SHAFT THAT HAS THE FLAT ON IT, THROUGH THE OPENING IN THE BOTTOM OF THE MIXER HOUSING AND INTO THE COUPLING. MAKE CERTAIN THAT THE SET SCREWS WHICH WERE LOOSENED IN STEP #3 WILL BEAR DOWN ON THE FLAT WHEN TIGHTENED. THE SHAFT SHOULD SLIDE INTO THE COUPLING FOR ABOUT 4-1/2" AND THEN STOP.

#6 TIGHTEN THE SET SCREWS ON THE COUPLING TO BEAR DOWN ON THE FLAT PORTION OF THE MIXER SHAFT WITH THE ALLEN WRENCH SUPPLIED.

#7 POSITION THE PROPELLER ON THE LOWEST POINT OF THE MIXER SHAFT. FOR AVERAGE CONDITIONS, LOCATE THE PROPELLER ABOVE THE TANK BOTTOM A DISTANCE EQUAL TO TWICE THE PROPELLER DIAMETER. THE ARROW STAMPED ON THE PROPELLER HUB SHOULD POINT TO THE BOTTOM OF THE TANK. IF TWO PROPELLERS ARE SUPPLIED, LOCATE THE BOTTOM PROPELLER AS DESCRIBED, AND THE TOP PROPELLER APPROXIMATELY 1 TO 2 PROPELLER DIAMETERS ABOVE THE LOWER ONE. IN THE EVENT YOUR UNIT IS SUPPLIED WITH A STABILIZING RING ON THE PROPELLER, MOUNT THIS PROPELLER, WITH THE ARROW POINTING DOWNWARD, AT THE LOWEST POSITION ON THE MIXER SHAFT.

#8 IF YOUR UNIT WAS NOT WIRED AT THE FACTORY, PROCEED TO WIRE THE UNIT AT THIS POINT, INSURING THAT PROPELLER SHAFT ROTATION, AS VIEWED FROM THE MOTOR TOWARD THE PROPELLER IS CLOCKWISE. THIS STEP IS OF THE UTMOST IMPORTANCE! IMPROPER ROTATION WILL NOT ONLY RESULT IN POOR MIXING ACTION, BUT CAN SERIOUSLY DAMAGE YOUR UNIT. FOR AIR DRIVEN MOTORS, MAKE SURE MOTOR IS PIPED INTO THE SYSTEM TO ASSURE ROTATION AS DEFINED ABOVE.

OPERATION

1) NEVER RUN MIXER WITHOUT FLUID IN THE TANK AS THIS MAY CAUSE EXCESSIVE VIBRATION.

2) AT THIS POINT, OPERATE YOUR MIXER IN THE NORMAL MANNER, CHECK FOR ANY EXCESSIVE SHAFT VIBRATION OR WHIPPAGE, WHICH, REGARDLESS OF SHAFT LENGTH SHOULD NOT OCCUR. IF THIS SITUATION OF EXCESSIVE WHIPPAGE OCCURS, SHUT DOWN THE UNIT, AND RETRACE STEPS 3, 5, 6, & 7. IF THIS CONDITION PERSISTS, CONTACT YOUR LOCAL ALSOP REPRESENTATIVE OR THE HOME OFFICE.

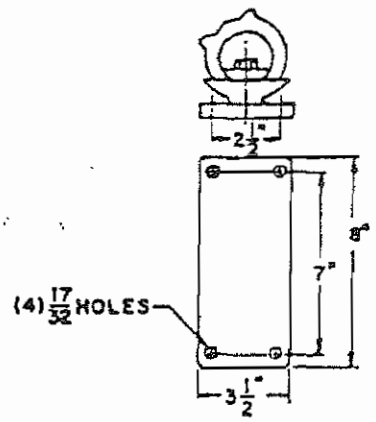
MAINTENANCE

1) ALL MIXERS, WHETHER GEARED OR DIRECT DRIVE, HAVE ALL INTERNAL PARTS PRE-LUBRICATED AND SEALED AT THE FACTORY FOR THE LIFE OF THE UNIT. NO LUBRICATION ON YOUR PART IS NECESSARY.

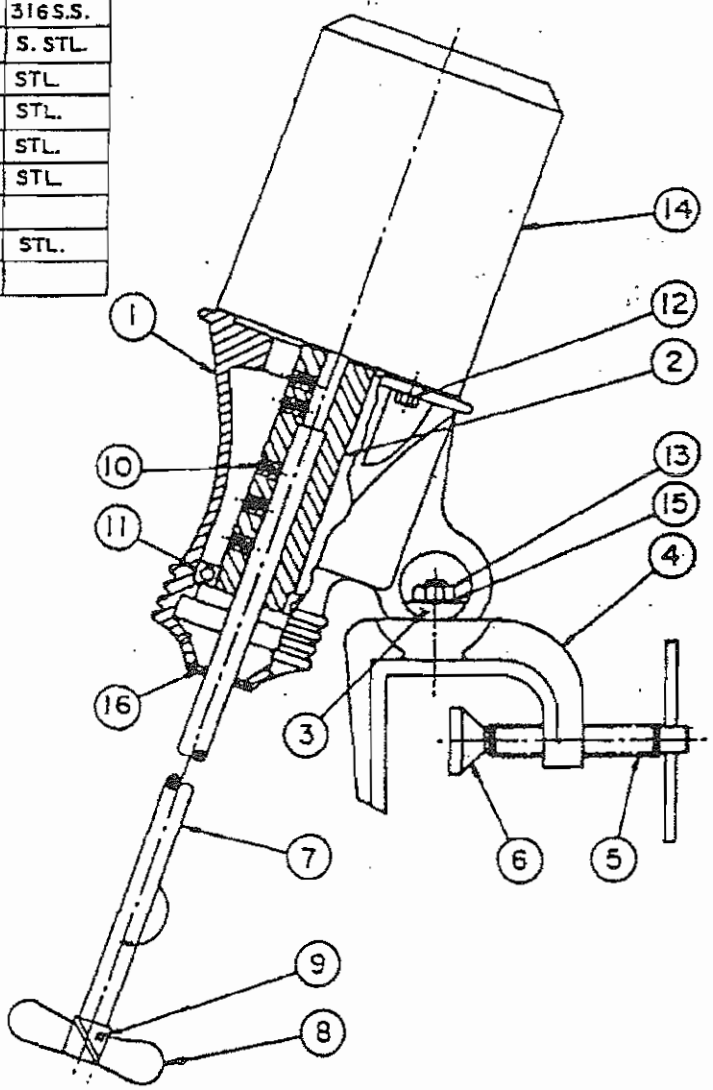
2) BE SURE TO SAVE AND USE THE LUBRICATING INSTRUCTIONS WHICH ARE ATTACHED TO THE ELECTRIC OR AIR MOTOR.

PARTS LIST		
PART NO.	DESCRIPTION	MATL.
1	HOUSING	ALUM.
2	COUPLING	STL. PL.
3	GUIDE	ALUM.
4	CLAMP	C. STL.
5	SCREW AND HANDLE	STL.
6	SWIVEL	STL.
7	SHAFT	316 S.S.
8	PROPELLER	316 S.S.
9	SET SCREW	S. STL.
10	COUPLING SET SCREW	STL.
* 11	BEARING	STL.
12	HEX HEAD SCREW	STL.
13	HEX HD. BOLT & NUT	STL.
14	MOTOR	
15	WASHER	STL.
* 16	LIP SEAL	

WHEN ORDERING PARTS, SPECIFY
SERIAL NUMBER
MODEL NUMBER
PART NO. & DESCRIPTION



OPTIONAL
SADDLE PLATE



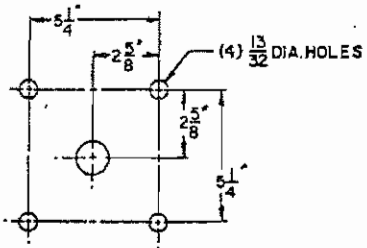
MODEL D D MIXER

* RECOMMENDED SPARE PART.

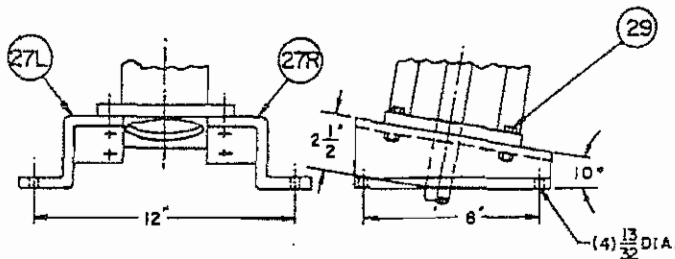
ALSOP ENGINEERING COMPANY KINGSTON, N.Y.

PART LIST		
PART NO.	DESCRIPTION	MAT'L.
1	HOUSING	ALUM.
2	COUPLING	LED LOY
7	SHAFT	316S.S.
8	PROPELLER	316S.S.
9	PROPELLER SET SCREW	S.STL.
10	COUPLING SET SCREW	STL.
* 11	BEARING (SMALL)	STL.
12	HEX HEAD SCREW	STL.
14	MOTOR	
* 16	BEARING (LARGE)	STL.
* 17	DRIVEN GEAR	STL.
* 18	PINION GEAR	STL.
19	GEAR SET SCREW	STL.
20	FLAT HD. MACH. SCREW	S.STL.
21	SEAL INSERT	ALUM.
* 22	LIP SEAL	
23	SNAP RING	STL.
24	DRIVEN GEAR KEY (SQ.)	STL.
25	MOTOR KEY (SQ)	STL.
26	GEAR HOUSING	ALUM.
27R	ANGLE RISER (RIGHT)	ALUM.
27L	ANGLE RISER (LEFT)	ALUM.
29	HEX BOLT & NUT	STL.
30	HEX HEAD SCREW	STL.

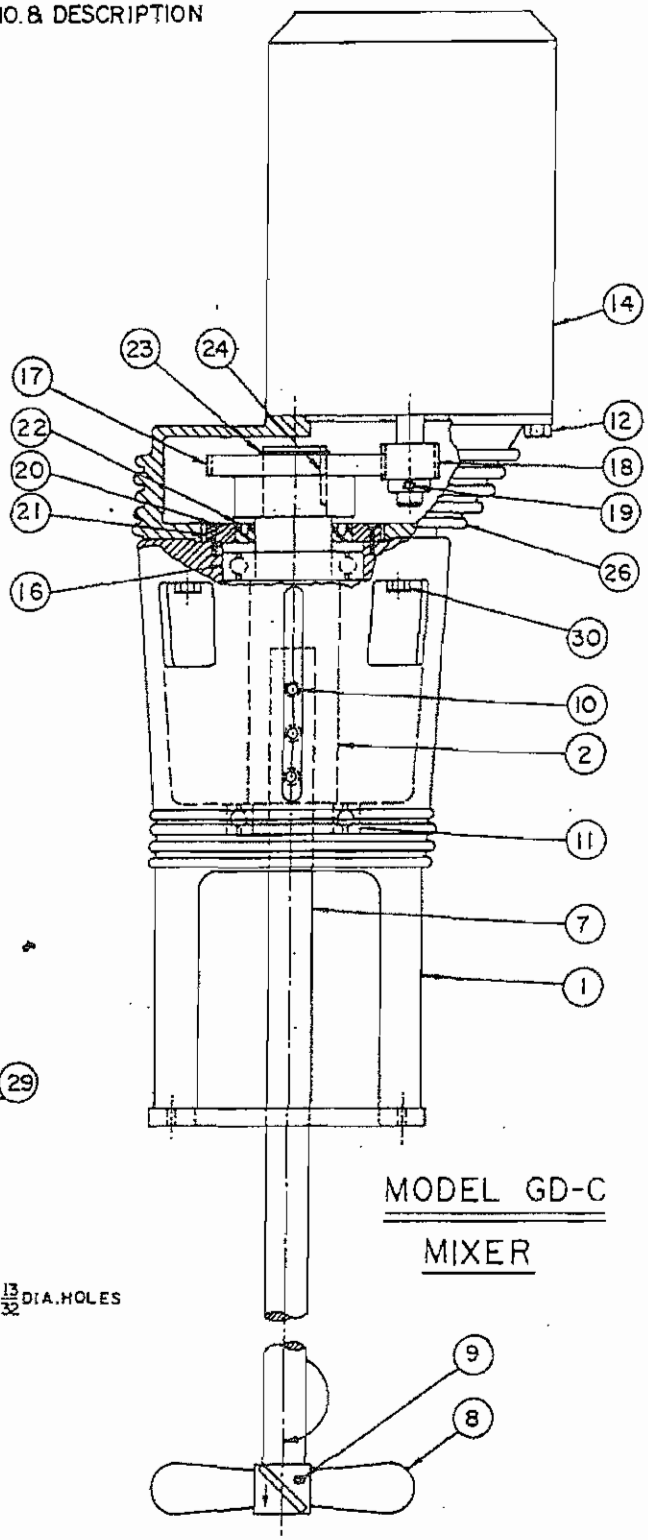
WHEN ORDERING PARTS, SPECIFY
SERIAL NUMBER
MODEL NUMBER
PART NO. & DESCRIPTION



MODEL GD-C
MOUNTING DIM'S.



MODEL GD-CR
WHEN MODEL GD-C IS USED WITH ABOVE RISER, MODEL THEN BECOMES GD-CR



MODEL GD-C
MIXER

* RECOMMENDED SPARE PART.

ALSOP ENGINEERING COMPANY KINGSTON, N.Y.

QUACKENBUSH CO., INC.
MECHANICAL CONTRACTORS
505 Franklin Street, Buffalo, New York 14202
☐ Phone 716-886-4355 ☐ Fax 716-883-8277

SECTION 10

11531 - CHEMICAL FEED PUMPS

Supplier: R.L. Stone Co., Inc.
630 Cleveland Dr.
Buffalo, NY 14225-1098

Phone: (716) 834-2525

Fax: (716) 834-4082

Contact: Mr. Hal Wright

Service: R.L. Stone Co., Inc.

SERIES E7
METERING PUMPS

INSTRUCTIONS
MAINTENANCE
SERVICE

For file reference, please record the following data:

Model No.: _____

Serial No.: _____

Installation Date: _____

Installation Location: _____

_____

When ordering replacement parts for your LMI Metering Pump or accessory, please include the complete model number and serial number of your unit.

LMI
LIQUID METRONICS DIVISION
MILTON ROY

ISO9001 Certified • a unit of Sundstrand Corporation

8 Post Office Square
Acton, MA 01720 U.S.A.
TEL (508) 263-9800
FAX (508) 264-9172

Catalog Sec. 6.0, pg. 1700
Replaces same of 1/94
1718.B 4/96

INSTALLATION

I. UNPACKING

A. Remove tubing, injection check and foot valve from the pump carton. Notify delivery carrier immediately if there are any signs of damage to the metering pump or parts.

II. LOCATION AND MOUNTING

CAUTION

When pumping solutions, make certain that all tubing is securely attached to the fittings. It is recommended that tubing or pipe lines be shielded to prevent possible injury in case of rupture or accidental damage. Always wear protective face shield and clothing when working on or near a chemical metering pump.

⚠ WARNING ⚠

LMI accessories used with the E Series of pumps must be placed in an explosion proof enclosure or located in an area where they will not be subjected to explosion hazard.

A. Locate the pump in an area that is convenient to both solution injection point and electrical supply. LMI E7 Series metering pumps have corrosion resistant housings, but should not be subjected to continuous high temperature (over 122°F or 50°C).

B. Mount pump on a shelf directly above solution tank. Secure pump with 5/16" bolts through the four holes in the pump base. Shelf must be able to support 50 lbs minimum (23 kg).

C. Diagrams (shown below) show typical metering pump installation methods. Note location of injection check valve which is most important. Refer to separate Liquid Handling Assembly Instructions Section A regarding installation of injection check valve.

D. BACK PRESSURE REQUIREMENTS
All electronically controlled magnetically driven pumps maintain maximum velocity on the discharge portion of their stroke regardless of the stroke frequency setting. If there is little or no resistance (back pressure), the velocity of the pumped fluid will be so great as to cause over-pumping. Because of this characteristic, back pressure equal to approximately 25 psi* must be supplied by an anti-syphon/back pressure valve if the system pressure at the injection point is not high enough to provide the needed back pressure.

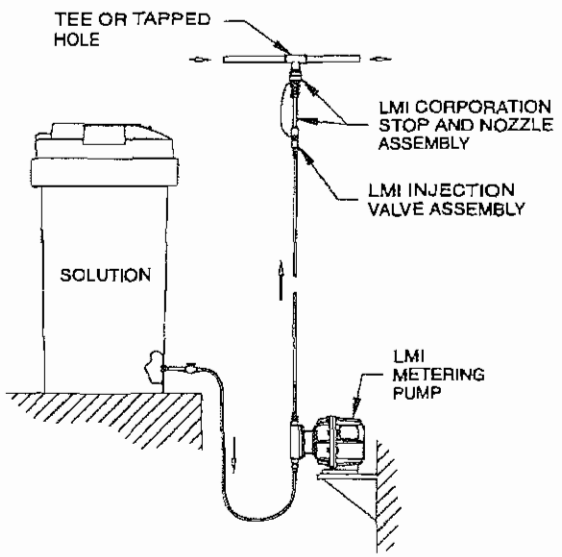
* 10 psi for E74 Series.

CAUTION

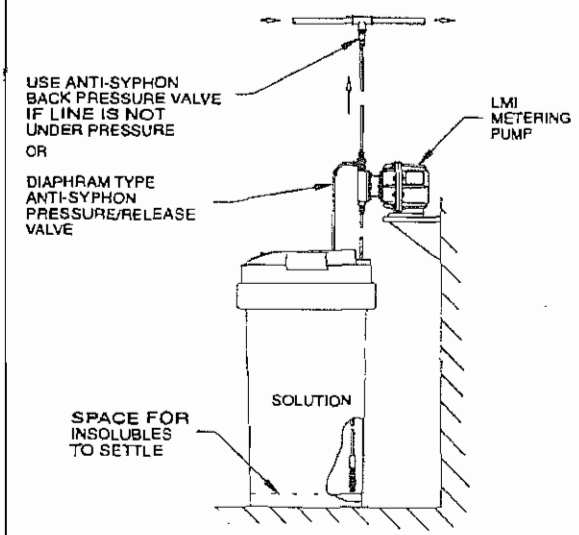
Be sure installation does not constitute a cross connection. Check local plumbing code.

FLOODED SUCTION INSTALLATION

helpful when pumping at very low rates

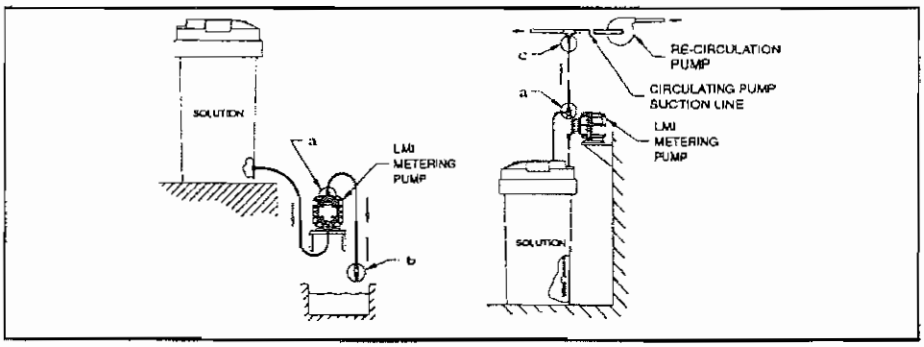


SUCTION LIFT INSTALLATION



PREVENT SYPHONING WHEN PUMPING

"Downhill" or into pump suction. Always use (a) a 4FV at pump discharge and (b) an injection check valve at injection point.

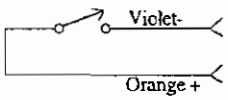


III. ELECTRICAL

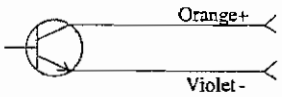
Note: Installation wiring must conform to U.L. listings and local electrical codes

Method of triggering an E-Series pump

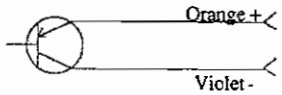
1. Switch Closure
   Switch closing triggers pump



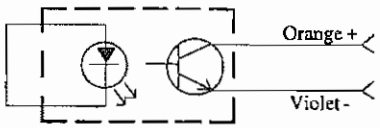
2. NPN Transistor
   Base goes high to trigger pump



3. PNP Transistor
   Base goes low to trigger pump



4. Opto Isolator

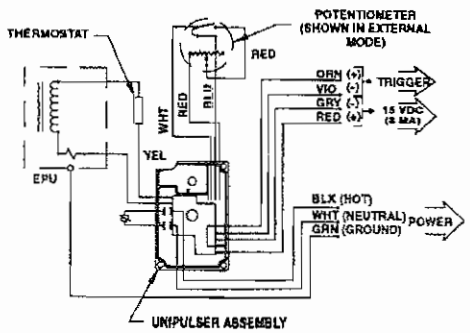


The external trigger circuit is isolated and has the same characteristics as the other LMI Control Code 7 Series metering pumps. Minimum time in low impedance state (on) is 50 milliseconds. Minumum time in high impedance state (off) is 100 milliseconds.

WIRING DIAGRAM

⚠ WARNING ⚠

LMI accessories used with the E Series of pumps must be placed in an explosion proof enclosure or located in an area where they will not be subjected to explosion hazard.



OUTPUT ADJUSTMENT

INITIAL APPROXIMATION

A. Speed control dial is graduated in approximate percent of maximum strokes per minute. Turning this knob clockwise ↻ increases pumping frequeney.

Output Estimate - Total output of pump may be estimated by multiplying stroke frequency (percent of maximum) by stroke length setting (percent of maximum).

For example, if the stroke length knob is set at 100% of maximum and the stroke frequency if 20% of maximum, total pump output will be approximately 20%; if the stroke length knob is set at 30% of maximum and stroke frequency is 20% of maximum, total output will be approximately 6% of the pump's maximum rating. This is .2x.3=.06 or 6%.

B. To determine exact frequency in strokes per minute at any speed knob setting, count number of strokes for one minute.

C. Stroke length adjustment knob is the lower of the control panel knobs. Adjust by rotating to desired setting, while pump is stroking.

D. SETTING—Maximum output of the pump is obtained with stroke frequency knob set at maximum and stroke length knob set at maximum.
If pump is to be used at less than maximum output, best volumetric efficiency will be achieved if stroke length knob is left at maximum, and stroke frequency knob rotated counter-clockwise ↺ to reduce pump output. If morc output reduction is required than can be achieved by reducing stroke frequency, reduce output by turning the stroke length knob counter-clockwise ↺.

E. After installation is complete and an initial approxi-mation setting has been made, the pump should be

calibrated and the stroke frequency and/or stroke length settings adjusted.

F. Nominal output and pressure ratings at 100% settings of stroke frequency and stroke length.

Series	Max. Pressure Rating		Max Output	
	PSI	Bar	gph	lph
E70	300	20.7	1.3	4.9
E71	150	10.3	2.5	9.5
E72	100	6.9	4.0	15.2
E73	60	4.1	9.0	34.0
E74	25	1.7	20.0	76.0

PROCEDURE FOR ON-SITE VOLUMETRIC CALIBRATION E7 IN INTERNAL MODE

A. Make certain speed control knob is turned fully clockwise. Turn off power to pump.

B. With pump primed and discharge tubing connected to the injection point as it would be in normal service, place foot valve and strainer assembly in a graduated container with a volume of 500ml or more (so that the volume displaced by tubing and foot valve assembly is minimal in relation to volume of the solution in the container).

C. Turn pump on, and pump until air is exhausted from the suction line and pump head.

D. Turn pump off, note the solution level in the graduate. Refill graduate if necessary.

F. Turn off pump at the end of the calibration period, note volume pumped during the calibration period, and calculate volume of solution pumped in time unit you choose (minute, hour, day, etc.).

G. Adjust stroke frequency and/or stroke length knobs to your best estimate of required correction, and repeat calibration measurements as a check.

PROCEDURE FOR ON-SITE VOLUMETRIC CALIBRATION OF E7 IN EXTERNAL MODE

A. Since pump output is governed by an external device, only the output per stroke may be calibrated.

B. With pump primed and discharge tubing connected to the injection point as it would be in normal service, turn off pump and place foot valve and strainer assembly in a graduated container with a volume of 500ml or more.

C. Turn pump to internal mode with speed knob set at 100 and operate until air is exhausted from suction line and pump head.

D. Turn pump off and note solution level in graduated container. Refill graduate if necessary.

E. Turn pump on and count the number of strokes for exactly one minute. Then switch pump off.

F. Note volume pumped during the calibration period of one minute. Divide into this, the number of strokes to determine the volume of solution pumped per stroke.

Example: 50ml/100spm=0.5ml per stroke.

Multiply this by your expected stroke rate per minute, per hour or per day and compare with desired output requirements.

G. Adjust stroke length knob (lower knob) to your best estimate of required correction and repeat calibration procedure.

You may elect, for safety and convenienee, to do the first calibration or operating test with water or other non-hazardous solution. If so, make certain the water or test fluid is removed from the Liquid End before pumping solutions that may react with the test fluid or be exothermic, such as sulfuric acid.

The final ealibration adjustment should be made with pumping conditions identical to conditions of normal pumping service. This means that factors such as injection pressure, fluid viscosity, suction lift and others will automatically be accounted for in making the final adjustment of the pump.

TROUBLESHOOTING LIQUID END

I. LOW PUMP OUTPUT:

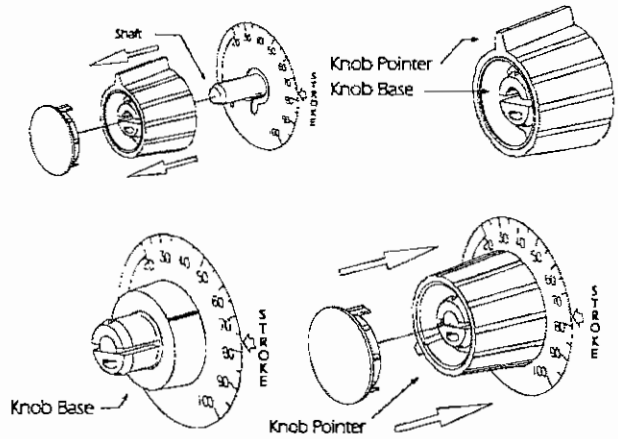
Low pump output can be caused by many things. Some of the more common ones are:

- Very low stroke setting, i.e. red zone setting of knob
- Trapped air in pump head (trapped air in discharge tubing has no effect)
- Air leak through valve seal rings
- Ruptured pumping Liquifram™ (diaphragm)
- Clogged Liquid End, or injection point connection

- Injection into pressure within 25* psi of pump's maximum pressure rating with anti-syphon spring in place (if so supplied)
- Injection into pressure in excess of pump rating-see chart on page 3.

* 10 psi for E74

A. Very low stroke setting - Check position of stroke length knob (lower knob) by rotating it counter-clockwise ↺ until Liquifram® (diaphragm) stops moving with the pump operating. The Liquifram® should not stop reciprocating (moving or clicking) until the knob points to zero. If it stops before zero, reset knob by grasping the knob and pulling it towards you. Pry the yellow cap off of the knob. Place the knob on a flat surface. Using needle nose pliers, squeeze the inner section together while lifting the outer section up (see figure below).



Push the inner section back onto the "D" shaped stroke shaft. With the pump running, zero the pump by turning the inner section of the knob counter clockwise. Position the outer section of the knob so that the pointer aligns with zero on the nameplate. Push down on the outer section of the knob (a snap sound will indicate that parts are locked together). Replace the yellow cap over the outer section of the knob, aligning the tabs on the cap with the slots on the knob.

B. Trapped air in pump head—May be caused by leaks in the suction line, where the suction line joins the suction fitting, or at the seal ring between suction fitting and pump head. It may also be caused by air or gases coming out of solution. Trapped air or bubbles in the discharge line have no effect on the pump's operation. They may be ignored.

To remove trapped air from the pump head, operate the pump with stroke frequency knob and stroke length knob set at 100.

It may be neccessary to pull on both knobs of the 4-FV, if so equipped. Follow "Priming" instructions in the Liquid Handling Assembly Sheet inserted in this instruction book and operate the pump for a few minutes to purge the head and valves of air or gas.

C. Air leak through valve seal rings- usually caused by worn or damaged seal rings or loose fittings. Tighten fittings by hand until they are very snug. If there is no improvement, replace both seal rings in pump head. See enclosed Liquid Handling Assembly Sheet.

D. Ruptured pumping diaphragm—If rupture is severe and pump is injecting into pressure, solution leak will be obvious through the 3/16" (5mm) diameter hole at the bottom of the spacer directly behind the pump head. Replace pumping Liquifram® (diaphragm). If rupture is a small pin hole, there may be oozing of solution through the 3/16" (5mm) diameter hole described above. Replacement of pumping Liquifram® (diaphragm) will be necessary.

E. Clogged Liquid End—will cause low pump output. Purge Liquid End. Disassemble Liquid End. Clean individual parts with water and detergent or appropriate cleaning solution.

F. Injection into excessive pressure—If discharge pressure is within 25 psi* of maximum pump rating, remove spring in injection check valve, if so supplied.

* 10 psi on E74 Series

II. EXCESSIVE PUMP OUTPUT:

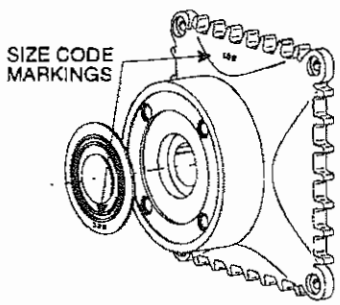
A. Syphoning—If your E Series pump has a Liquid End other than a high viscosity LE, its injection check valve assembly has a chemically resistant anti-syphon spring. Disassemble the injection check valve and check to be sure this spring is in place and undamaged. Replace if necessary. Note that the anti-syphon spring must be removed if injection is into a pressure within 25 psi* of pump's maximum pressure rating. Liquid Ends with a suffix "S" have, in addition, a diaphragm type anti-syphon valve, which prevents syphoning and over pumping.

*10 psi for E74 Series.

B. **Incorrect knob settings**—Check stroke length knob (lower knob) by rotating it counter-clockwise ↺ to zero position. The Liquifram® (pumping diaphragm) should stop reciprocating. If it does not, reset knob and continue counter-clockwise ↺ rotation until motion stops. Reset knob by grasping the knob and pulling it towards you. Pry the yellow cap off of the knob. Places the knob on a flat surface. Using needle nose pliers, squeeze the inner section together while lifting the outer section up (see figure on page 5). Push the inner section back onto the "D" shaped stroke shaft. With the pump running, zero the pump by turning the inner section of the knob counter clockwise. Position the outer section of the knob so that the pointer aligns with zero on the nameplate. Push down on the outer section of the knob (a snap sound will indicate that parts are locked together). Replace the yellow cap over the outer section of the knob, aligning the tabs on the cap with the slots on the knob.

III. CHANGING PUMPING LIQUIFRAM® (DIAPHRAGM):

A. Make sure size code marking (0.9 S.I., 1.8 S.I. or 3.0 S.I.) on spacer and Liquifram® (diaphragm) are the same. Liquifram® and spacer size code must match in order for the pump to function. The E74 Liquifram® size code is 6.0 S.I., (spacer is 3.0 S.I., but there is a large black spacer adapter).



Always wear protective clothing, gloves and face shield when working on or near chemical metering pumps.

B. Depressurize discharge line following steps outlines on the supplement "Liquid Handling Assembly Instructions". Lift foot valve from solution and let pump run pumping air for a few minutes. Then remove pump head.

C. Set stroke length knob (lower knob) to zero, rotate it counter-clockwise ↺ with the pump running, then stop the pump by turning stroke frequency knob (upper knob) to "off".

D. Lift edge of Liquifram® and rotate it counter-clockwise ↺ to unscrew the Liquifram®.

E. Before installing new pumping Liquifram®, turn pump on and rotate stroke length control knob (lower knob) to the proper setting per the table following.

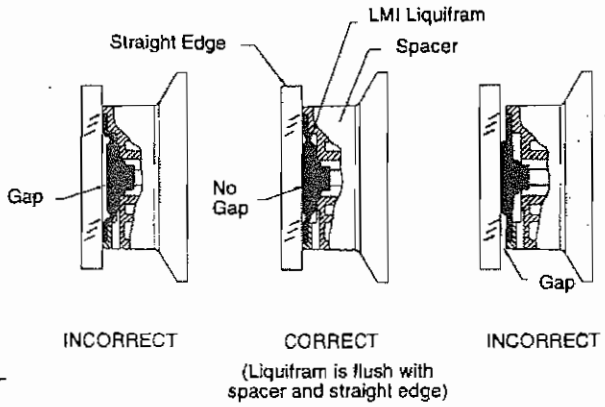
Model	Stroke Setting Length
E70, E71, E72	90%
E73, E74	70%

With pump stroking, screw on new Liquifram® until the center part begins to buckle inwards during the latter half of the stroke. Turn pump off and check Liquifram® position with a straight edge according to the illustration below.

If Liquifram® setting is not correct, restart pump then screw the Liquifram® in or out. Always stop pump electrically when checking Liquifram® setting. Repeat procedure if necessary.

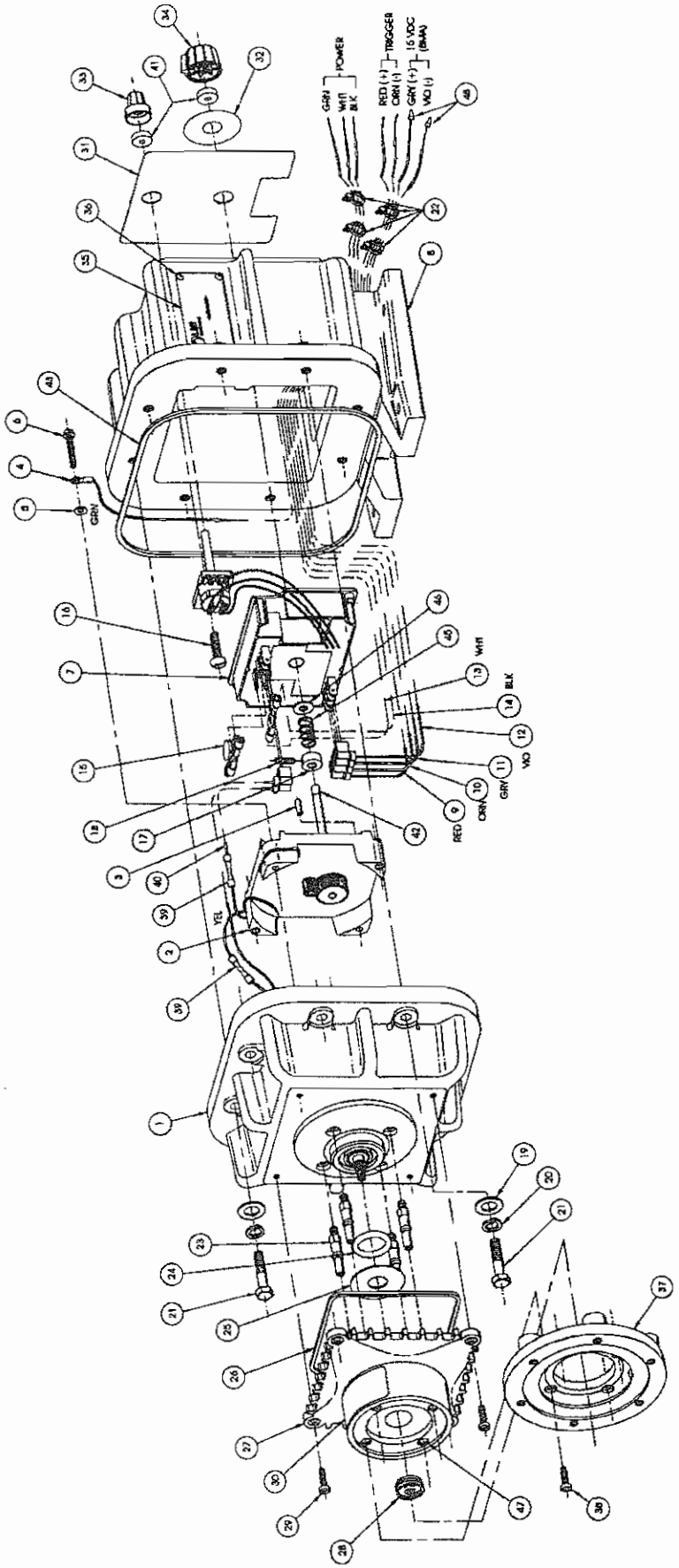
After Liquifram® is set properly, restart pump and turn stroke knob to 100%.

F. Reinstall pump head and tighten head mounting screws in criss-cross pattern.



KEY NO.	FOR MODEL NO.	PART NO.	DESCRIPTION	QUANTITY
1	E701, E711, E721, E731, E741	33055	EPU & Cover Asm., 120 V	1
	E702, E712, E722, E732, E742	33056	EPU & Cover Asm., 240 V	1
2	E7	32251	Stroke Bracket Asm.	1
3	E7	28817	Pin, .187" O.D.	1
4	E7	31726	Wire Asm., Green	4
5	E7	10415	Washer #10	4
6	E7	27551	Screw, 10-24 S.S.	1
7	E701, E711, E721, E731, E741	33057	Unipulser Asm., 120 V	1
	E702, E712, E722, E732, E742	33058	Unipulser Asm., 240 V	1
8	E7	31462	Housing	1
9	E7	33084	Wire Asm., Red	1
10	E7	33085	Wire Asm., Orange	1
11	E7	33086	Wire Asm., Grey	1
12	E7	33087	Wire Asm., Violet	1
13	E7	33082	Wire Asm., White	1
14	E7	33083	Wire Asm., Black	1
15	E701, E711, E721, E731, E741	10626	MOV Asm., 120 V	1
	E702, E712, E722, E732, E742	10627	MOV Asm., 200 - 240 V	1
16	E7	33092	Screw, 1/4-20	1
17	E7	25424	Collar	1
18	E7	25423	Set Screw, 10-32	1
19	E7	26150	Washer	8
20	E7	31713	Lock Washer	8
21	E7	31736	Screw, 5/16-18	8
22	E7	10916	Tie, Cable	4
23	E70, E71, E72	27641	Stud	4
	E73, E74	29605	Stud	1
24	E7	26983	O-Ring	1
25	E7	27586	Shim	1
26	E7	35269	Seal	1
27	E70	27515	Spacer, 0.9	1
	E71, E72	27516	Spacer, 1.8	1
	E73, E74	27517	Spacer, 3.0	1
28	E7	10973	Shaft Seal	1
29	E7	10598	Screw, 10-24 S.S.	4
30	E7	24452	Label	1
31	E7	31542	Nameplate	1
32	E70, E71	32465	Stroke Dial	1
	E72	32466	Stroke Dial	1
	E73	32467	Stroke Dial	1
	E74	32468	Stroke Dial	1
33	E7	25889	Knob Asm., Speed	1
34	E7	31891	Knob Asm., Stroke	1
35	E701, E711, E721, E731, E741	33225	Dataplate 120 V	1
	E702, E712, E722, E732, E742	33226	Dataplate 240 V	1
36	E7	30014	Screw, Drive	4
37	E74	25887	Adapter, 6.0SI	1
38	E74	10598	Screw, 10-24	4
39	E7	27694	Wire Connector	3
40	E7	33088	Wire Asm., Yellow	1
41	E7	30803	Gasket	2
43	E7	33223	Seal	1
45	E7	10139	Spring	1
46	E7	26169	Washer	1
48	E7	10240	Connector	2

Exploded View



LE-20S LE-26S
LIQUID HANDLING ASSEMBLY

CAUTION

When pumping solutions make certain that all tubing is securely attached to the fittings. It is recommended that tubing or pipe lines be shielded to prevent possible injury in case of rupture or accidental damage. Always wear protective clothing and face shield when working on or near your metering pump.

Note: See parts list for materials of construction

A. INSTALLING INJECTION CHECK VALVE

1. The purpose of the injection check valve is to prevent backflow from the treated line.
2. A 1/2" NPT female fitting with sufficient depth will accept the injection check valve.
3. To insure correct seating of the ball inside the injection check valve, the injection check valve should be installed upwards (vertically) into bottom of the pipe.

B. CONNECTING DISCHARGE TUBING

NOTE:
Cut tubing to length needed for discharge line.

1. Route tubing from the injection check valve to the metering pump, making sure it does not touch hot or sharp surfaces, or is bent so sharply that it kinks.
2. Slide the small end of the coupling nut onto tubing, then slide on the clamp ring.
3. Push tubing on the valve housing nozzle so that tubing flares out and butts up against valve housing and will not go any further.
4. Slide the clamp ring and coupling nut to the threads and engage. While pushing the tubing on to the valve housing nozzle, tighten the coupling nut by hand until tubing is held securely in place.

EXCESSIVE FORCE WILL CRACK OR DISTORT FITTINGS.
DO NOT USE PIPE WRENCH.

C. CONNECTING SUCTION TUBING

1. Cut suction tubing to a length so that the foot valve hangs just above the bottom of the solution container. Maximum recommended vertical suction lift is 5 ft. (1.5m).
2. Follow same procedure in connecting suction tubing to suction valve and foot valve (see B. Connecting Discharge Tubing).

D. PRIMING

1. Connect pressure relief tubing to pressure relief port on the four function valve.
2. Route tubing to solution reservoir and anchor with a plastic tie. Do not submerge tubing in solution.
3. Correct position of relief and anti-syphon knobs are: anti-syphon arrow must be vertical (word "anti-syphon" is upright). Relief arrow must be horizontal (word "relief" is upright).

NOTE:
At injection pressures below 25 psi (1.75 kg/cm²) a slight buzzing noise may be made by the anti-syphon valve during each stroke of the metering pump. This is normal.

4. Start pump. Set at 80% speed and 100% stroke.
5. When solution begins to flow through the return tubing, rotate relief arrow to the vertical position.
6. The pump is now primed.

NOTE:
(a) Pump is normally self-priming if suction lift is not more than 5 ft. (1.5m), valves in the pump are wet with water (pump is shipped from factory with water in pump head) and the above steps (D. Priming) are followed.
(b) If the pump does not self prime, remove discharge valve housing and ball and pour water or solution slowly into discharge port until head is filled. Follow step D. Priming thereafter.

E. DEPRESSURIZING DISCHARGE LINE

1. It is possible to depressurize the discharge line and pump head without removal of tubing or loosening of fittings.

Be sure injection check valve is properly installed and is operating. If a gate valve or globe has been installed downstream of injection check valve, it should be closed. Be certain relief tubing from the four function valve is connected and run to solution reservoir.

2. Rotate both anti-syphon and relief arrows so they are in a horizontal position.
3. The discharge line is now depressurized.
4. If injection check valve is of higher elevation than pump head, disconnecting tubing at injection check valve end will allow air to enter and cause solution to drain back to tank.

LMI
LIQUID METRONICS DIVISION
MILTON ROY
ISO9001 Certified • a unit of Sundstrand Corporation

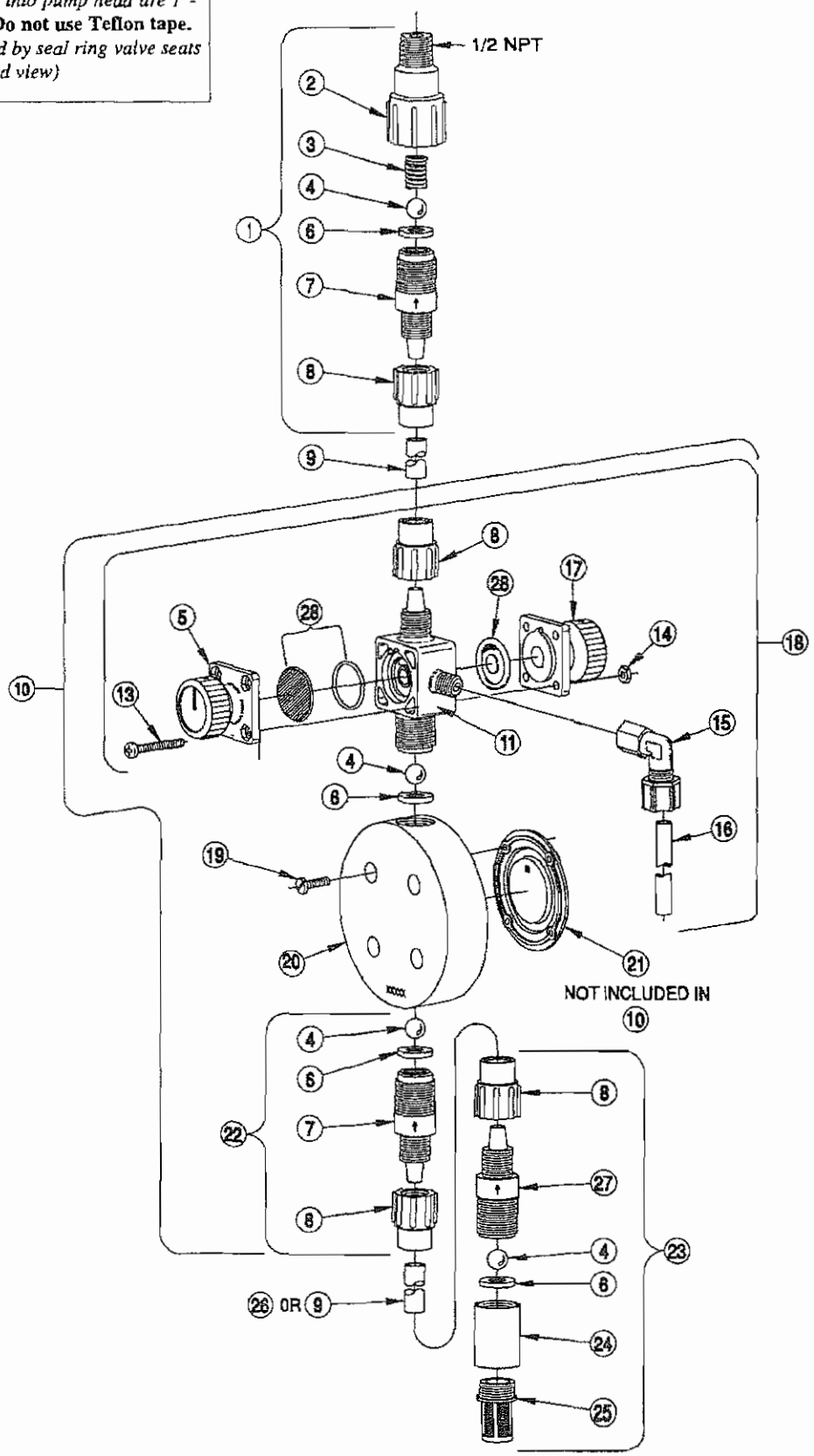
8 Post Office Square
Acton, MA 01720 U.S.A.
TEL (508) 263-9800
FAX (508) 264-9172

Catalog Sec 4.0 pg 1375
Replaces same of 12/94
1042. I 1/96

KEY NO.	PART NO.	DESCRIPTION	QUANTITY	
			LE-20S	LE-26S
1	26851	Injection Check Valve Assembly	1	
	26751	Injection Check Valve Assembly		1
2	25108	Injector Fitting, PVC	1	1
3	10339*+	Spring PVDF	1	1
4	10138*+	Ball, Ceramic .500	4	4
5	34615	Cap Assembly, Anti-Syphon	1	1
6	10128*	Seal Ring, Hypalon	4	
	10228+	Seal Ring, Viton		4
7	10206	Valve Seat, PVC	2	2
8	10411	Coupling Nut	4	4
9	10142-10	Tubing, Polyethylene, .5" O.D.	1	
	10142-16	Tubing, Polyethylene, .5" O.D.		1
10	10588	Head Assembly, LE-20S, Acrylic	1	
	10589	Head Assembly, LE-26S, PVC		1
11	34610	Valve Body, ASM, PVDF	1	1
13	34679	Screw, 10-24 x 1 5/8"	4	4
14	10143	Nut, 10-24	4	4
15	10587	Elbow Connector, Polypropylene	1	1
16	10342-10	Return Tubing, Polyethylene, .375" O.D.	1	1
17	32115	Cap Assembly Relief	1	1
18	34626	Anti-Syphon Valve Assembly	1	1
19	10340	Screw, 10-24 x 3/4", S.S.	4	4
20	10524	Head, 3.0 SI, Acrylic	1	
	10525	Head, 3.0 SI, PVC		1
21	31419*+	Liquifram, 3.0 SI, Fluorofilm	1	1
22	10562	Suction Valve Assembly	1	
	10564	Suction Valve Assembly		1
23	10153	Foot Valve Assembly	1	
	10253	Foot Valve Assembly		1
24	25600	Foot Valve Seat, Polypropylene	1	1
25	10123	Strainer, Polypropylene	1	1
26	10141-06	Tubing, Vinyl, .5" O.D.	1	
27	10273	Valve Housing, PVC	1	1
28	34613	Seal Repair Kit	1	1
	32700	Suction Tubing Straightener (Not Shown)	1	1

* Parts included in Spare Parts Kit 20S
+ Parts included in Spare Parts Kit SP-26S

NOTE:
Threaded connections into pump head are 1"-12 straight threads. **Do not use Teflon tape.** *These joints are sealed by seal ring valve seats (item 6 on the exploded view)*



QUACKENBUSH CO., INC.
MECHANICAL CONTRACTORS
505 Franklin Street, Buffalo, New York 14202
☐ Phone 716-886-4355 ☐ Fax 716-883-8277

SECTION 11

13020 - SAFETY SHOWER & EYEWASH

Supplier: Schaefer Plumbing Supply Co., Inc.
146 Clinton St.
Buffalo, NY 14203

Phone: (716) 853-2406

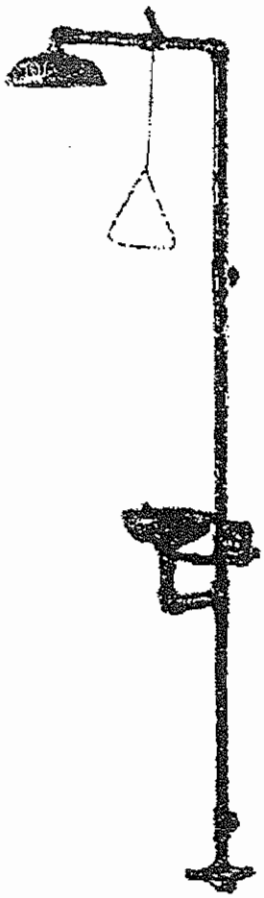
Fax: (716) 852-3732

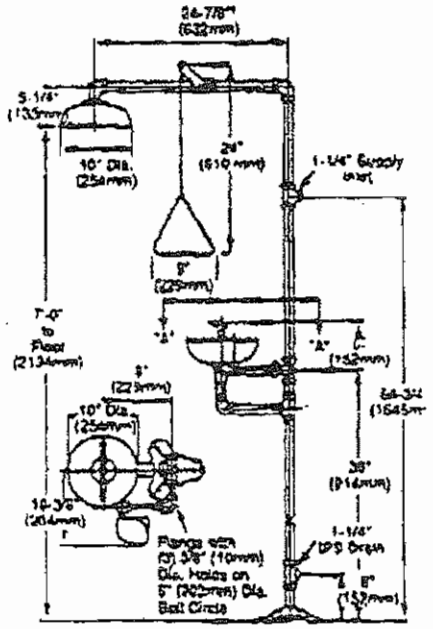
Contact: Mr. Dave Kilijanski

Service: Schaefer Plumbing Supply Co., Inc.

Combination Drench Shower/Eye Wash Unit
Model S19-310SB

- Complies with American National Standard Z358.1-1990
- Galvanized Steel Protected with BRADTECT™ Safety Yellow Coating
- Universal Identification Sign Included
- Full, One-Year Warranty





Specifications

Combination Drench Shower/Eye Wash Unit saves space and fits easily into any work environment. Shower valve operates quickly by a pull rod with a triangular handle. Eye wash operated by a large, highly visible push handle. Safe, steady water flow under varying water supply conditions is assured by integral flow control in the sprayhead assembly.

Construction

Impact-resistant plastic shower head is colored bright yellow for high visibility in emergency situations. Eye wash bowl and shower pull rod are stainless steel. Galvanized steel piping is additionally protected with BRADTECT™ safety yellow coating. Complies with American National Standard Z358.1-1990.

Standard Equipment

Shower Head
10" (254mm) diameter yellow impact-resistant plastic.

Shower Valve
Chrome-plated brass 1" IPS stay-open ball valve. Operated by stainless steel pull rod with triangular handle.

Eye Wash Bowl
10" (254mm) diameter stainless steel.

Standard Sprayhead Assembly
Chrome-plated brass sprayhead assembly with twin, soft flow, eye wash heads and protective sprayhead covers. The integral flow control assures safe, steady flow under varying water supply conditions.

Eye Wash Valve
Chrome-plated 1/2" IPS stay-open ball valve. Hand operated by a large, highly visible safety yellow PVC push handle.

Pipe and Fittings
1-1/4" galvanized steel protected with BRADTECT™ safety yellow coating.

Water Supply
1-1/4" IPS.

Sample Specification

Fixture shall be Bradley Model S19-310SB Combination Drench Shower/Eye Wash. To include the following standard equipment:

- Shower head constructed of yellow impact-resistant plastic
- Eye wash bowl constructed of corrosion-resistant stainless steel
- Chrome-plated brass 1" IPS stay-open shower ball valve
- Chrome-plated brass 1/2" IPS stay-open eye wash ball valve
- Chrome-plated brass sprayhead assembly with twin, soft flow, eye wash heads and protective sprayhead covers

Pipe and fittings to be constructed of 1-1/4" galvanized steel protected with BRADTECT™ safety yellow coating. Water supply to be 1-1/4" IPS.

MODEL	
Model No.	Description
☐ S19-310SB	Combination Drench Shower/ Eye Wash Unit

This information is subject to change without formal notice.
Form No. W10-596

Bradley
P.O. Box 309, Menomonee Falls, WI 53052-0309
Phone 414-251-6000 FAX 414-251-5817
http://www.bradleycorp.com

QUACKENBUSH CO., INC.
MECHANICAL CONTRACTORS
505 Franklin Street, Buffalo, New York 14202
☐ Phone 716-886-4355 ☐ Fax 716-883-8277

SECTION 14

13290 - PRESSURE FILTRATION SYSTEM

Supplier: Ayer Sales Systems Division
6715 Joy Dr.
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BAG FILTER
INSTALLATION, OPERATION
AND MAINTENANCE

INSTALLATION:

INSPECTION

UPON RECEIPT OF THE BAG FILTER, INSPECT IT FOR DAMAGE THAT MIGHT HAVE OCCURRED DURING TRANSIT. REPORT ANY DAMAGE TO THE CARRIER IMMEDIATELY.

LOCATION AND SUPPORT

THE HAYWARD BAG FILTER SHOULD BE INSTALLED NOT LESS THAN 24" DOWN STREAM OF A HAYWARD STRAINER. THE BAG FILTER MUST BE BOLTED TO THE FLOOR TO INSURE PROPER PIPING INSTALLATION. A INTEGRAL FLANGE ON THE BASE OF THE BAG FILTER WILL ACCEPT 3/4" STUDS.

PIPING INSTALLATION

FROM THE HAYWARD STRAINER, A 2" LINE IS REQUIRED TO THE INLET OF THE BAG FILTER. CONNECT 2" LINE TO A VALVE AND THEN TO THE UPPER 2" NPTF (INLET) OF THE BAG FILTER.

A 2" LINE MUST BE PIPED FROM THE BAG FILTER 2" NPTF BOTTOM PORT (OUTLET) TO A DETERMINED SUCTION SOURCE (SYSTEM PUMP SUCTION). A VALVE IS REQUIRED ON THIS OUTLET LINE.

IT IS RECOMMENDED THAT A 2" DRAIN VALVE BE INSTALLED ON THE UNUSED BOTTOM 2" NPT PORT

THE VENT FITTING MUST BE INSTALLED ON THE TOP OF THE UNIT. *DO NOT FORGET THE O-RING.* A 3/8" ID tube should be attached over the barb and secured with a hose clamp on the vent fitting. This hose will be used to direct the flow from the vent fitting.

THE TOP OF THE VENT FITTING IS NORMALLY PLUGGED. THIS PLUG CAN BE REMOVED AND REPLACED WITH A PRESSURE GAUGE THAT MEASURES INLET PRESSURE TO THE BAG FILTER. IT IS RECOMMENDED THAT A GAUGE GUARD BE INSTALLED BETWEEN THE FILTER VENT AND THE GAUGE.

OPERATION:

OPERATING INFORMATION

THE HAYWARD POLYPROPYLENE BAG FILTER IS DESIGNED AS AN INTEGRAL PART OF THE HAYWARD FILTRATION-BAG FILTER SYSTEM. INSTALLED DOWN STREAM OF THE HAYWARD STRAINER, THE HAYWARD BAG FILTER CONCENTRATES THE SOLIDS, AND PROVIDES CONVENIENT, ECONOMICAL REMOVAL OF THE SOLIDS FROM THE PROCESS WITH VERY LOW LIQUID LOSS.

LARGE SOLIDS ARE SEPARATED FROM THE LIQUID WITH THE HAYWARD STRAINER WHILE SMALLER SOLIDS ARE ACCUMULATED BY THE BAG FILTER . THE BAG FILTER CONCENTRATES THE SOLIDS IN A DISPOSABLE BAG, WHILE CLEAN LIQUID IS PIPED BACK TO THE PROCESS.

SYSTEM STARTUP

FOLLOW THE PROCEDURE BELOW FOR CHANGING THE BAG FOR INITIAL BAG INSTALLATION.

THE PIPING SYSTEM SHOULD BE PURGED OF AIR BEFORE FULL PRESSURE IS APPLIED.

1. CLOSE THE VALVE ON THE OUTLET OF THE BAG FILTER .
2. OPEN THE VENT LOCATED ON THE TOP OF THE BAG FILTER.
3. SLOWLY AND PARTIALLY OPEN THE VALVE ON THE INLET OF THE BAG FILTER.
4. CAREFULLY VENT ALL THE AIR FROM THE BAG FILTER. CLOSE THE VENT WHEN LIQUID BEGINS TO DISCHARGE.
5. FULLY OPEN THE INLET VALVE.
6. FULLY OPEN THE OUTLET VALVE.

THE SYSTEM IS NOW IN OPERATION. SOLIDS WHICH ARE COLLECTED IN THE FILTER BAG NEED TO BE REMOVED PERIODICALLY. A PRESSURE DIFFERENTIAL GAUGE SHOULD BE USED SO THAT THE BAG IS CHANGED WHEN THE DIFFERENTIAL PRESSURE REACHES OR EXCEEDS 15 PSIG.

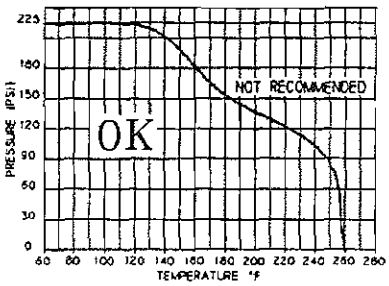
NEVER DISASSEMBLE THE BAG FILTER WHILE THERE IS FLUID IN IT. DRAIN ALL PROCESS FLUID BEFORE REMOVING THE COVER.

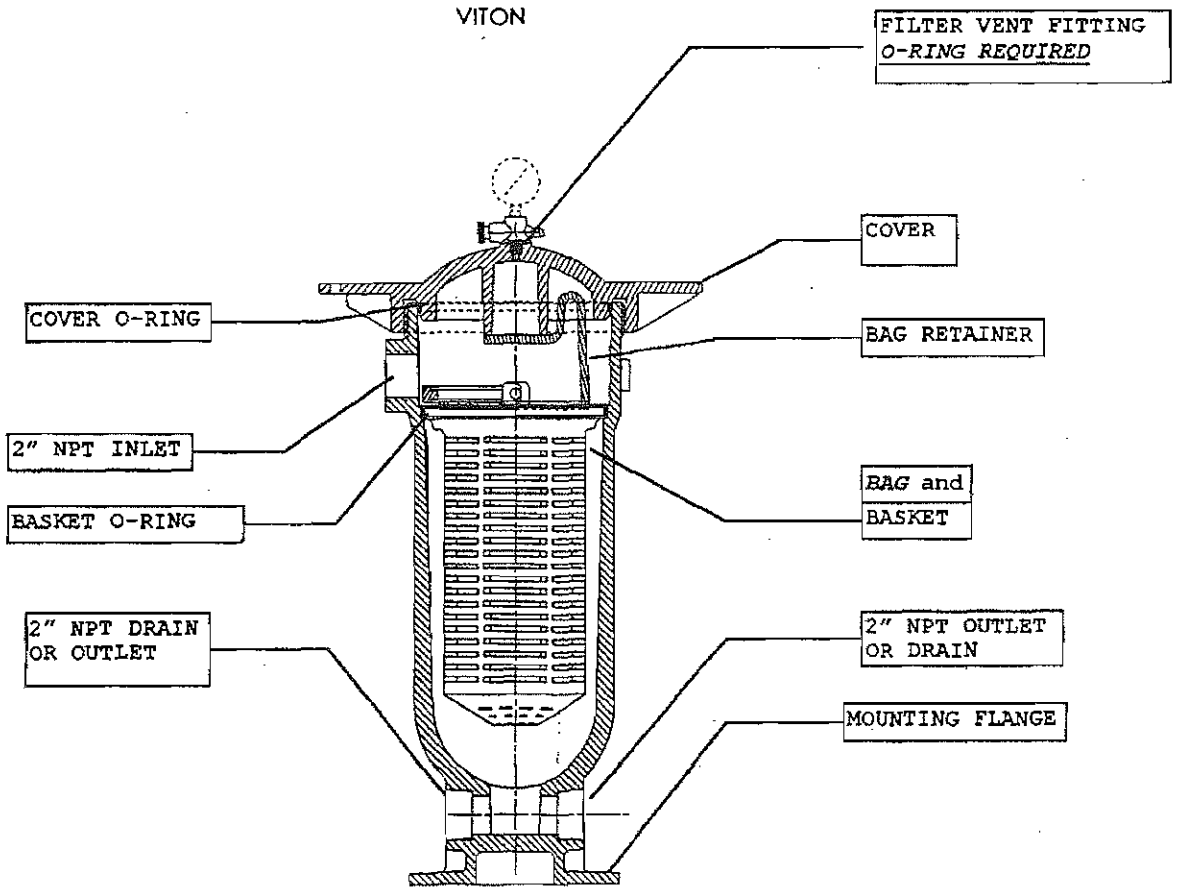
TO CHANGE THE BAG:

1. CLOSE THE INLET VALVE.
2. CLOSE THE OUTLET VALVE.
3. OPEN THE DRAIN ON THE BAG FILTER .
4. SLOWLY OPEN VENT TO FULLY DRAIN THE BAG FILTER.
5. REMOVE BAG FILTER COVER.
6. REMOVE THE POLYPROPYLENE BAG RETAINER AND THEN THE BAG.
7. INSTALL THE NEW BAG, THE POLYPROPYLENE BAG RETAINER AND THE COVER.
8. REPEAT STEPS 3-6 UNDER START-UP

SPECIFICATIONS

MAXIMUM WORKING PRESSURE		225 PSIG @ 70°F
MAXIMUM WORKING TEMPERATURE		240°F
MAXIMUM FLOW		100 GPM WITHOUT BAG
SHIPPING WEIGHT	FLT4201	48 POUNDS
SHIPPING WEIGHT	FLT4202	82 POUNDS
SOLIDS COLLECTION CAPACITY		25 POUNDS
INLET/OUTLET/DRAIN		2" NPT
VENT		3/8" Male tube fitting
50 Micron FILTER BAG	FLT4201	7" X 16" FB331050
50 Micron FILTER BAG	FLT4202	7" X 32" FB332050
SEALS		VITON





Chapter 3 Programming Guidelines

Introduction

This chapter discusses the sampling features of the 3700FR Sampler in detail and covers the procedures used to program the sampler.

We recommend that you have a sampler with you when you read this chapter. The most effective way to learn how to program the 3700FR Sampler is to read this chapter and experiment. The sampler cannot be harmed by improper programming, so there is nothing to be lost by experimenting. A few minutes spent in actually programming the sampler and observing its operation usually proves to be a worthwhile investment of time. Simply "playing" with the sampler is the best way to become familiar with programming, and may help avoid costly delays or problems when the sampler is used in the field.

If you are already familiar with the sampling capabilities of the 3700FR Sampler, you may prefer to begin with *Programming Introduction,* on page 20. This section introduces the specifics of programming the sampler.

Chapter Organization

A description of sampling operations, sample events and the sampling cycle is placed in *Description of Sampling Operations,* on page 16.

The types of samples available with the 3700FR Sampler are listed and discussed in *Types of Samples,* on page 17.

A programming introduction and a discussion of the sampler's program structure is placed in *Programming Introduction,* on page 20. The basic and extended programming modes are introduced.

The three operating states of the sampler are discussed in *Operating States,* on page 20.

The interactive operating state, used to program the sampler, is discussed in *Interactive State,* on page 21.

The programming procedure is outlined in *Introduction to the Programming Procedure,* on page 23.

Using the keypad to program the sampler is discussed in *Using the Keypad to Respond to Displays,* on page 24, *Keypad Description,* on page 24, and *Displays,* on page 26.

Programming examples for the basic programming mode are placed in *Basic Programming Mode Introduction.*

The configure sequence, used to tailor the sampler to your specific application, is discussed in *Configure Sequence,* on page 44.

The extended programming mode and several extended programming examples are discussed in *Extended Programming Mode,* on page 57.

Adjusting the sampler for foreign languages and metric units of measure is discussed in *Foreign Languages and Metric Units of Measure,* on page 73.

The standby state is discussed in *Standby State,* on page 88.

Run state is discussed in *Run State,* on page 94.

Description of Sampling Operations

This information serves to acquaint you with the 3700FR Sampler's operation during a typical sampling routine. It introduces you to the types of sampling performed by the sampler and the terminology used to describe those capabilities.

Sample Events and the Sampling Cycle

A sample event is the process of taking a sample or a series of samples. It includes the full sampling cycle. Although the sampling cycle varies somewhat according to the program settings which define the sampling routine, the cycle described here follows the typical sequence. This information is presented here to provide you with a frame of reference for the remainder of this chapter.

1. A sample event is initiated when the interval following the previous sample has expired. For time based intervals, the samples are taken when the internal clock reaches the time of the sampling event. For flow-paced intervals, the interval is set to the programmed number of pulses received from a flow meter or flow logger; the sample event begins when the pulses are counted down to zero.
2. When the time or pulse interval countdown reaches zero, the distributor moves to the bottle which is to receive the sample.
3. The pump rotates in the reverse direction for the pre-sample purge. The pre-sample purge is an air purge of the suction line and inlet which clears the line of any accumulated debris and residual liquid to avoid cross-contamination of samples.

4. The pump direction changes, pumping in the forward direction to fill the suction line up to the liquid detector.
5. After the suction line has been filled to the liquid detector and liquid has been detected, the sample volume measuring portion of the sampling cycle begins. The pump continues to rotate in the forward direction until the programmed volume of liquid has been delivered to the appropriate sample bottle. In this manual, the amount of liquid delivered to the bottle is referred to as the "sample volume."
6. The pump direction again changes, pumping in the reverse direction for the post-sample purge. Like the pre-sample purge, the post-sample purge is an air purge of the suction line. After the post-sample purge, the pump then shuts off.
7. The sample interval is reset and the cycle begins again at step 1.

Types of Samples

The 3700FR Sampler is principally designed to collect sequential (discrete) samples. However, it may be programmed to collect a number of other types of samples. As noted in Chapter 1, the 3700FR Sampler has two programming modes: basic and extended. The basic programming mode is used for conventional routines which include the types of sampling described and introduced in this section. A discussion of the types of sampling available through the extended programming mode is placed in *Types of Sampling Available Through the Extended Programming Mode,* on page 18 and *STORM Programming,* on page 20.

Sample types can be characterized by sample distribution and by sample pacing. Sample distribution is the order in which the samples are placed in the bottles. Sample pacing refers to the interval between samples.

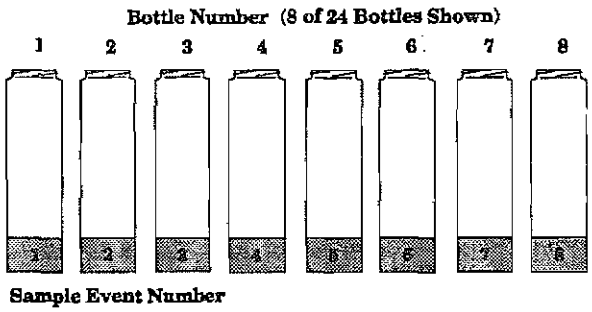
Types of Sample Pacing

There are two types of sample pacing: time-pacing and flow-pacing. In time-paced sampling, the interval between samples is a time interval. In flow-paced sampling, the interval between samples is a certain volume of liquid which has passed a measuring point in a flow stream. Flow-paced sampling requires a flow meter or flow logger. The 3700FR Sampler can also be interfaced with certain non-Isco flow meters. The flow instruments measure the flow quantity and sends a pulse for every predetermined flow quantity to the sampler. The sampler totalizes the number of pulses received from the flow instrument and collects a sample when the total reaches a programmed number.

Types of Sample Distribution

There are two primary types of sample distribution: sequential and composite sampling. In a sequential sample, each bottle receives one sample. A sequential sample represents a "snapshot" of the flow stream at a particular point in time. **Figure 14** shows a diagram of sequential sample distribution. In a composite sample, the individual samples are combined – "composited" – into a single container. A composite sample represents an average of the characteristics of the flow stream over the total elapsed time of sampling.

Figure 14 Sequential Sample Distribution



Note: The 3700FR Sampler is fully programmable for both sequential and composite sampling; however, in addition to programming the sampler for composite sampling, you must convert the sampler mechanically for single bottle compositing. This requires the composite conversion kit which contains the extra equipment needed to adapt the sampler for composite sampling. Conversion procedures are discussed in the instruction sheets provided with the conversion kit.

The types of sample pacing and sample distribution can be combined. Thus, you can take time- or flow-paced sequential samples and time- or flow-paced composite samples. Each combination is noted below.

Time-Paced Sequential: In a time-paced sequential sample, samples are collected at equal increments of time. Each bottle receives one sample.

Flow-Paced Sequential: In a flow-paced sequential sample, samples are collected at equal increments of flow volume, as measured by an associated flow meter. Each bottle receives one sample.

Time-Paced Composite: In a composite time sample, the individual samples are combined – "composited" – into a single container. Samples are collected at equal increments of time.

Flow-Paced Composite: In a composite flow sample, the individual samples are combined into a single container. Samples are collected at equal increments of flow volume, as measured by an associated flow meter.

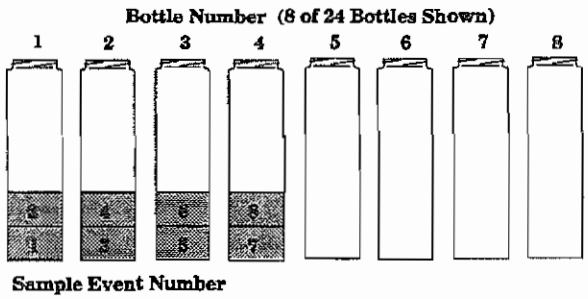
Multiplexing

Both time-paced and flow-paced sequential samples can be multiplexed. Multiplexing places more than one sample in a bottle at different sample events or places a sample in several bottles at the same sample event. Two types of multiplexing are commonly used: samples-per-bottle multiplexing and bottles-per-sample multiplexing.

Samples-per-Bottle Multiplexing

In samples-per-bottle multiplexing, a number of individual samples are deposited in the same bottle. Samples-per-bottle multiplexing is useful when you need to collect a series of small composite samples. In sample-per-bottle multiplexing, the normal sampling cycle (relocate distributor, pre-sample purge, sample delivery, post-sample purge) is modified by altering the number of times the distributor is relocated. Because a bottle will receive more than one sample from more than one sample event, the distributor does not relocate to a new bottle at each sample event. At the first sample event, the distributor relocates, if necessary, to the appropriate bottle. The normal sampling cycle is completed. At the next sample event, the distributor does not relocate, and a second sample is deposited into the same bottle.

Figure 15 Samples-Per-Bottle Multiplexing

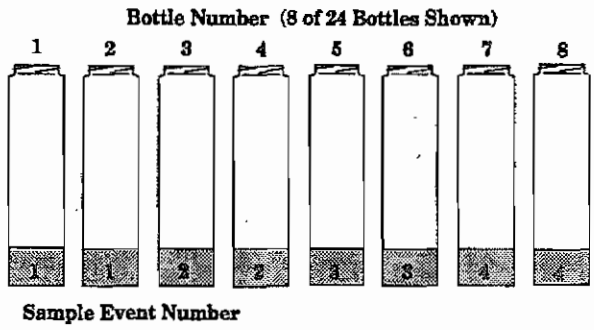


Compositing multiple samples continues up to the programmed number of samples. After the last sample is deposited in the bottle, the sampler pauses until another sample event occurs, the distributor then rotates to the new bottle position, and multiple samples are deposited into the new bottle. **Figure 15** illustrates sample-per-bottle multiplexing.

Bottles-per-Sample Multiplexing

In bottles-per-sample multiplexing, a programmed number of bottles is filled at each sample event. (The programmed number of bottles is called a bottle set; up to 24 bottles can be included in a set.) Bottles-per-sample multiplexing is useful when you need a sample larger than the 350 ml or 1000 ml bottles will contain. It is also useful when you need sets of identical samples; for example when you are using more than one preservative.

Figure 16 Bottles-Per-Sample Multiplexing



When you use bottles-per-sample multiplexing, the normal sampling cycle (relocate distributor, pre-sample purge, sample delivery, post-sample purge) is modified by delaying the complete post-sample purge until sample volumes have been delivered to each bottle of the set. Instead, the pump reverses until the pump tubing is purged just beyond the liquid detector. When the purged liquid passes the detector, the distributor moves to the next bottle, and the pump begins pumping forward to deliver the next sample. This is repeated until each bottle of the set is filled. A full post-sample purge is completed at the end of the sample event. The sampler then pauses until the next sample event occurs, at which time the cycle is repeated for the following bottle set. **Figure 16** illustrates bottles-per-sample multiplexing.

Types of Sampling Available Through the Extended Programming Mode

The extended programming mode expands the variations of sample pacing and distribution. The extended features listed below are used in more complex sampling routines.

Note, however, that the sampling capabilities described above, in *Types of Samples,* on page 17, are available in both the basic and the extended programming modes. STORM programming is available only in the extended programming mode.

Nonuniform Time Intervals

The 3700FR Sampler, through the extended programming mode, can take samples at nonuniform time intervals. With nonuniform time intervals, samples are taken at irregular time intervals, rather than at equal time intervals.

Nonuniform time intervals are typically used in run-off studies (often in conjunction with a Model 1640 Liquid Level Actuator). Nonuniform time intervals permit a number of samples to be collected at short intervals after a rainfall or other event occurs and remaining samples to be collected at widening intervals. For example, when the sampler is used with the Actuator in a runoff study, the Actuator turns the sampler on when the liquid level of the flow stream rises to contact the Actuator's probe. Nonuniform time intervals allow the sampler to collect samples frequently when the flow rate is highest, and to sample less frequently as the flow rate decreases. Nonuniform times can also be used to simulate flow-paced sampling; when the flow rate varies predictably, using nonuniform time intervals allows you to take samples at equal flow volumes. As the flow rate increases, you can take samples at equal flow volumes by decreasing the time interval. As the flow rate decreases, you can increase the time interval.

When you use nonuniform times, the time interval between each sample event is individually programmable. You can enter nonuniform times in two ways: in minutes or in clock times. The first method, minutes, allows you to enter the number of sample events spaced at intervals defined in minutes: 12 samples at 5-minute intervals, 6 samples at 10-minute intervals, 4 samples at 15-minute intervals, and so on. You can also enter a specific time and date for each sample event: sample event 1 at 6:00 on April 20, sample event 2 at 6:30 on April 20, sample event 3 at 7:15 on April 20, and so on. You can specify as many as 999 sample events spaced in nonuniform minutes, or up to 99 events specified as clock times. (If a routine requires a large number of nonuniform times, you can save the routine with the program storage feature so that you do not have to reenter the nonuniform times again.) Nonuniform time intervals can be used with sequential, multiplexed, and composite sampling.

Extended Multiplexing

Multiplexing is somewhat more flexible in the extended programming mode. In the extended mode, you can switch multiplexed bottles or bottle sets after a programmed number of samples have been deposited, or after a programmed period of time has elapsed. Under most conditions, we recommend you switch bottles or sets after a programmed number of samples have been deposited. This allows you to control the number of samples in each bottle precisely. When you switch bottles or sets on a time basis, the total volume of each bottle or bottle set may vary in samples-per-bottle or bottles-per-sample multiplexing.

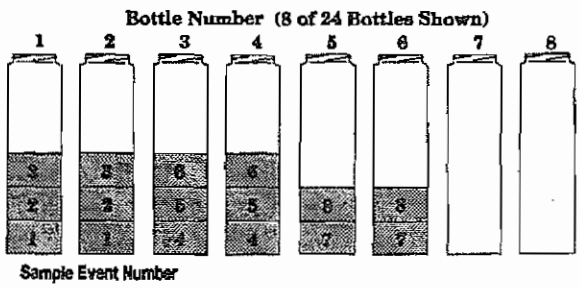
Multiple Bottle

The extended programming mode offers a third multiplexing possibility: multiple bottle compositing. Multiple bottle compositing combines samples per bottle and bottles per sample multiplexing by depositing multiple samples in a bottle set. At each sample event, the sampler places a sample into each bottle of a set. This is repeated until each bottle of the set contains a programmed number of samples. **Figure 17** illustrates multiple bottle compositing. The bottle sets can be switched after a programmed number of samples have been deposited or after a programmed period of time elapses. Multiple bottle compositing is useful when you want a series of identical sets of samples or a larger volume composite sample than can be collected in a single 350 or 1000 ml bottle. Multiple bottle compositing can be used with time-paced or flow-paced routines.

Stops and Resumes

The extended programming mode allows you to create an intermittent sampling schedule. You can program the sampler to stop the routine at a specific time. The routine can then be resumed at a later time. Up to 12 stop times and 12 resume times can be entered. Stops and Resumes can be used with time-paced and flow-paced routines and with routines programmed for nonuniform time intervals.

Figure 17 Multiple Bottle Compositing



STORM Programming

The 3700FR Sampler's STORM programming allows you meet storm water monitoring requirements easily. The sampler's STORM pacing program divides the bottles of the 4, 12, and 24 bottle configurations into two separate groups. The first group receives a first flush (time-paced) grab sample. The second bottle group receives either a flow-paced or time-paced "composite" sample.

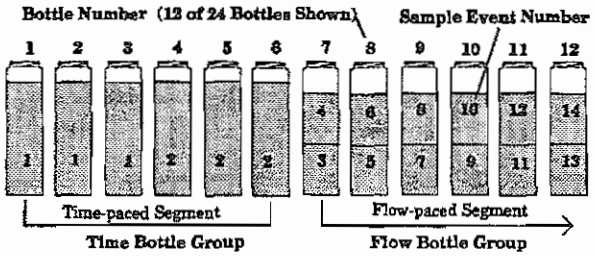
STORM Event Sample Distribution Schemes

A bottle group can consist of one or more bottles. Thus, the first flush sample can be a large sample delivered to a single bottle or distributed to several bottles with a multiplexing scheme. The remaining samples can be distributed to the second bottle group sequentially or according to any of the three available multiplexing distribution schemes — bottles-per-sample, samples-per-bottle, or multiple bottle compositing. By dividing the samples into multiple bottles, you can analyze the pollutant concentration from each phase of the storm event. To obtain an analysis of a composite sample, simply combine the contents of the bottles into a composite for the grab sample and a composite for the flow-weighted samples.

Figure 18 shows a STORM distribution scheme that combines time-paced bottles-per-sample multiplexing with flow-paced samples-per-bottle multiplexing. The program has allocated bottles 1, 2, and 3 for the timed grab samples, and bottles 4 through 24 for flow-weighted samples. At each time-paced sample event, the sampler places a single sample in the first bottle group: bottles 1, 2, and 3. Each bottle of the second group receives two samples per bottle.

If you need to obtain a greater number of samples or a larger volume of samples than a single sampler will permit, use the master/slave option. The master/slave option allows you to use the first sampler to acquire a set of samples based on STORM programming and the second (slave) sampler to continue the sampling.

Figure 18 Storm Distribution Scheme



Programming Introduction

The sampler's programming process is self-prompting. Prompts displayed on the LCD step you through the programming sequence in a logical order, indicating the needed value or option. For example, the sampler will prompt you to enter settings for the interval between samples (time-paced or flow-paced); sample volume in ml; determine whether you want sequential, composite, or multiplexed samples; and other operating controls. These settings can be changed at any time. If the unit is turned off or power is disconnected, the settings are retained in the sampler's memory by the lithium battery. The sampler will accept only appropriate values for the program settings and will reject any unacceptable values.

Operating States

Although there is a certain amount of overlap between the types of operations the sampler performs, there are essentially three operating states: the standby state where the sampler is waiting for your instructions, the run state where the sampler is running a sampling routine, and the interactive state used to program the sampler. Each state serves a different purpose and is discussed separately.

Standby State

In the standby state, the sampler is waiting for your instructions. From standby, you can start a sampling routine, placing the sampler in the run state. You can also access the interactive state to program it. The standby state is discussed in *Standby State,* on page 88.

Run State

In the run state, the sampler's sampling routine is being executed and the sampler is operating under program control. While the sampling routine is executed, the LCD displays a number of messages to communicate the progress of the sampler through the routine. The current bottle or bottle set, current time or flow pulse count, and remaining time or pulse count to the next sample are reported. These status messages vary according to the sampling routine; a representative set of messages are included with the programming examples placed in *Basic Programming Procedure,* on page 28 and *Start Times,* on page 58.

As the routine progresses, the sampler creates a log of sampling results that records pertinent information about each sample event. The results include the time and date of each sample, the number of pump counts occurring until liquid is detected for each sample event, and any problems encountered.

This information can be retrieved with the Display Status procedure, discussed in *Display Status,* on page 91. You can retrieve the results in the middle of a routine or when the routine is done. The results remain in the sampler's memory until you start the sampler again. More information on the run state is placed in *Run State.*

INTERACTIVE STATE

The interactive state allows you to program the sampler. The interactive state contains two branches: the program sequence and the configure sequence. **Figure 19,** on page 22 diagrams the structure of the interactive state. The program sequence is used to define the sampling routine; it allows you to enter the interval between samples, the number of samples in each bottle, the sample size, and the start time. The configure sequence provides a number of setup options. Some configure options provide equipment specifications. For example, the 3700FR Sampler can be used with two sizes of sequential bottles: 350 ml and 1000 ml. You must tell the sampler which bottle size you are using so that it can calculate the number of samples of a certain size each bottle can contain. This information is used to prevent overfilling. Other options allow you to set the sampler's real time clock, calibrate the sampler, or enable the password program protection.

Programming Modes

The configure sequence also allows you to select either of the programming modes: basic or extended. The basic programming mode is used for conventional sampling routines. Using the basic programming mode, you can take sequential or composite samples at uniform time intervals or flow pulse intervals. You can multiplex samples, if desired; both bottles-per-sample and samples-per-bottle multiplexing are available.

Extended Programming

The extended programming mode increases the number of available features. These features make more complex sampling routines possible. While all basic programming features are available in the extending programming mode, the less frequently used extended features have been separated to simplify the programming process for conventional routines. For example, you can use STORM programming, multiple bottle compositing, or create an intermittent sampling schedule with the Stops and Resumes feature.

Although the basic and extended program sequences vary in detail, both can be divided into four sections: Sample Pacing (interval between samples), Sample Distribution (number of samples in each bottle), Sample Volume (sample size in ml), and Key Times (start times or, in the extended mode, stop and resume times). These sections are noted in the Program Sequence section of the diagram shown in **Figure 19,** on page 22.

Configure Sequence

The program sequence and the configure sequence are interdependent. The selections you make in the configure sequence determine what settings will be available to you in the program sequence. For example, the basic or extended programming modes are selected in the configure sequence as a setup option. When you select the extended programming mode, the program sequence is modified to accommodate the extended features by adding one or more input displays. For example, because Nonuniform Times are an extended programming feature, the nonuniform times input displays are available in the Sample Pacing program section in the extended programming mode, but not in the basic programming mode.

The extended programming mode not only extends the number of features available in the program sequence, it extends the number of configure options. Refer to **Figure 19,** on page 22. The configure options marked with asterisks are available only when you select the extended programming mode. As in the programming sequence, less frequently used options have been separated to simplify the configuration process.

Most configure options are available to both programming modes. The configure sequence contains 18 options which are summarized in **Table 3,** on page 22; each option is marked as available in both modes or available only in the extended mode. A detailed discussion of each configuration option is found in *Set Clock,* on page 44 and through *Exit Configuration,* on page 54.

It is usually not necessary to change the configure option settings unless the sampling application changes significantly. The sampler is always programmed and configured: program and configure settings are maintained by the sampler's internal battery. The sampler is shipped with factory program and configure settings. It is configured for the basic program mode and for the bottles and suction line ordered with the sampler. **Table 7,** on page 55 lists the factory settings for the program sequence; **Table 6,** on page 54 lists the factory settings for the configure options.

Figure 19 Interactive State Structure

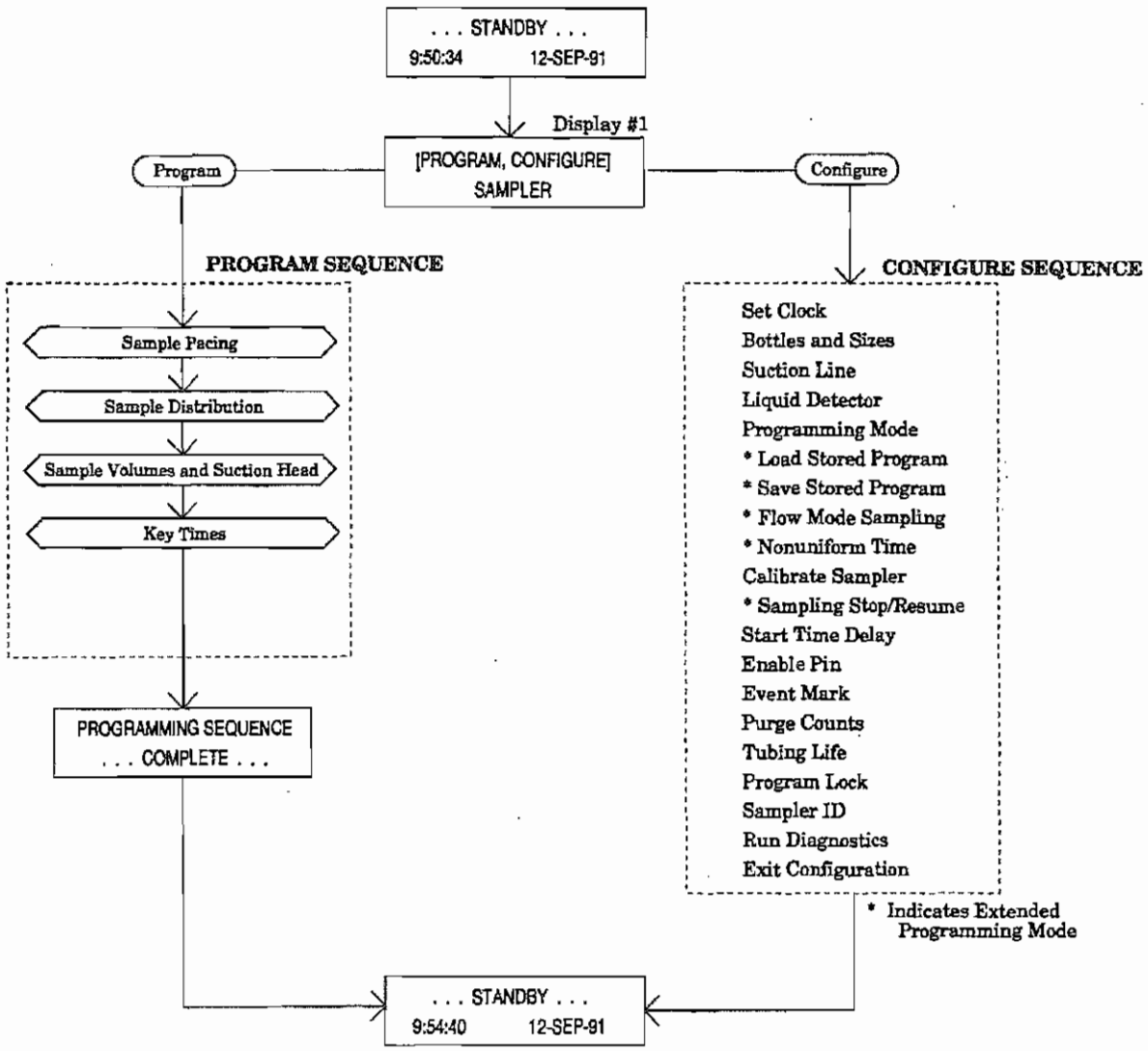


Table 3 Configure Option Functions

Configure Option	Programming Mode	Function
Set Clock	Basic & Extended	Sets the sampler's real time clock.
Bottles and Sizes	Basic & Extended	Sets the number and size of bottles used in the tub.
Suction Line	Basic & Extended	Sets the type of line (vinyl or Teflon), line diameter (¼ or⅜ inch), and line length (3 to 99 ft).
Liquid Detector	Basic & Extended	Enables/disables liquid detector, sets the number of rinse cycles (0 to 3), enables/disables the suction head entry, and sets the number of sampling retries (0 to 3).
Programming Mode	Basic & Extended	Sets the programming mode: basic or extended.
Load Stored Program	Extended	Loads one of up to three previously saved sampling programs.
Save Current Program	Extended	Saves current sampling program.
Flow Mode Sampling	Extended	Directs sampler to take a sample at the beginning of a flow-paced program. Directs sampler to take a sample at time-switches.

Configure Option	Programming Mode	Function
Nonuniform Time	Extended	Directs sampler to accept nonuniform intervals as specific clock times or in minutes.
Calibrate Sampler	Basic & Extended	Enables/disables the calibration sequence.
Sampling Stop/Resume	Extended	Enables/disables Sampling Stops and Resumes feature.
Start Time Delay	Basic & Extended	Sets the start time delay (from 0 to 9999 minutes). If no start time is entered in the program sequence, the program will delay the routine according to the amount of time entered in the Start Time Delay option. The delay begins after the start sampling key is pressed.
Enable Pin	Basic & Extended	Enables/disables the master/slave sampling mode. Directs the sampler to take a sample when disabled and/or enabled by a Liquid Level Actuator or like device. Allows you to restart the sampling interval when the sampler is enabled.
Event Mark	Basic & Extended	Allows you to select one of four types of event marks.
Purge Counts	Basic & Extended	Adjusts the number of pre-sample and post-sample purge counts.
Tubing Life	Basic & Extended	Displays the pump tubing life information. Resets the tubing life count.
Program Lock	Basic & Extended	Enables/disables the password protection for input displays.
Sampler ID	Basic & Extended	Allows you to enter a 10 character ID number for the sampler.
Run Diagnostics	Basic & Extended	Tests the RAM, ROM, pump, and distributor. Allows for re-initialization of certain program and configure settings.

Introduction to the Programming Procedure

The procedure used to program the sampler, in the basic programming mode, essentially follows the steps listed below.

Note: because the configuration settings determine portions of the program sequence and affect the accuracy of the sample, check the configuration settings before programming. Steps 2 and 3, configuring and programming the sampler, are covered in greater detail in *Basic Programming Mode Introduction,* on page 27 and in programming **Example 1,** on page 31 through **Example 7,** on page 43.

1. Determine the equipment you will be using with the sampler. You will need to know the size of the bottles you will be using and the inside diameter, type, and length of the suction line. You will need this information when you verify and revise the configuration settings in step 2.

   If you will be using the sampler for composite sampling, you may need to convert the sampler. **Example 6,** on page 40 demonstrates the configuration changes you must make.
2. Configure the sampler. From standby, access the interactive state. Select the configure sequence. Check the configuration settings, revising any settings as needed; select basic or extended programming mode. Return to the standby state.

   Example 1, on page 31 shows you how to check and revise the configuration settings in the configure sequence. We recommend you review *Keypad Description,* on page 24 and *Displays,* on page 26 before you work through the programming examples. These sections discuss the functions of the individual keys and how to use the keys when programming the sampler.
3. Program the sampler. Again, from standby, access the interactive state. Select the program sequence. Enter the program settings for your routine. The sampler will prompt you through the programming process. When the process is completed, the sampler will automatically return to standby. (A more detailed discussion of this procedure is placed in *Basic Programming Mode Introduction,* on page 27). **Example 2,** on page 34 through **Example 7,** on page 43 demonstrate several types of sampling programs in the basic mode. **Example 10,** on page 74 through **Example 17,** on page 86 demonstrate several sampling programs in the extended mode.
4. Install the sampler, if you have not already done so. (The sampler can be programmed on site or in the office before installation.) If desired, connect the sampler to a flow meter or other interfacing equipment. Chapter 2 discusses the installation of the sampler and interfacing equipment. Start the sampler to place the sampler into the run state and execute the routine.

5. As the routine runs, the displays will report the sampler's progress. The programming examples in this manual conclude with the run state displays you should see for each sampling routine. When the routine is done, the sampler will return to standby.
6. Retrieve the filled sample bottles. If desired, use the display status procedure, discussed in *Display Status,* on page 91, to examine the sampler's log of sampling results.
7. If you need to reprogram the sampler, follow this procedure from the beginning. If the sampler's current program is correct, start the sampling routine again.

Using the Keypad to Respond to Displays

Configuring and programming the sampler is as simple as responding to displays with the keypad. The sampler will prompt you through many of the entries by presenting a question or a choice on the display. You must respond with the keypad. The LCD and the keypad are located on the 3700FR Sampler control panel, shown in **Figure 20,** on page 25.

A summary of each key's function is placed in *Keypad Description,* on page 24. For a discussion of the displays presented on the LCD and the way you can use the keypad to interact with the sampler, refer to *Displays,* on page 26.

Keypad Description

Keys are grouped together to assist you in identifying related functions. Control keys manually control the sampler, numeric keys enter program values, programming keys monitor the sampler's status and direct programming activities. In this manual, individual keys are indicated in small capital letters.

The individual key switches that make up the keypad provide both tactile and audio feedback to assure you that the key switch has been successfully actuated. You can feel the deflection of the spring member in the switch; an audio indicator inside the sampler will beep once. The sampler has a 10-keystroke buffer which, in some cases, allows you to "type ahead" of the display.

Control Keys

Control keys allow you to turn the sampler on or off, start or resume the currently entered program, and control the sampler manually. The functions of the control keys are listed below.

ON/OFF - Pressing the ON/OFF key when the sampler is off will turn the sampler on, reactivate the display and place the sampler in the standby state. Pressing the ON/OFF key (when the sampler is on) will halt all sampling activity and clear the display.

PUMP FORWARD - While in the standby state, pressing the PUMP FORWARD key will cause the pump to run continuously in the forward direction. The pump will run until the STOP key is pressed.

PUMP REVERSE - While in the standby state, pressing the PUMP REVERSE key will run the pump continuously in reverse. The pump will continue to operate until the STOP key is pressed.

STOP - The STOP key will stop the pump any time it is running. When the STOP key is pressed in the run state, the sampling routine will be halted, the sampler will be transferred to the standby state, and the "PROGRAM HALTED" message will be displayed. Pressing the STOP key while in the interactive state will access the display's reference number.

START SAMPLING - When in the standby state, pressing the START SAMPLING key will begin the sampling program. When entering a sampler ID, the key will type a space.

RESUME SAMPLING - When "PROGRAM HALTED" is displayed, pressing the RESUME SAMPLING key will cause the sampler to continue with the current sample program at the point at which it was halted. When entering a sampler ID, the key will type a period

MANUAL SAMPLE - Pressing the MANUAL SAMPLE key will allow you to take a manual sample. The MANUAL SAMPLE key is valid in the standby state, the run state, and when calibrating the sampler. When entering a sampler ID, the key will type a dash (-).

NEXT BOTTLE - Pressing the NEXT BOTTLE key will cause the distributor to move to the next bottle. If the distributor is positioned over the last bottle, it will move to bottle position 1.

Program Keys

The four program keys are used to enter program settings. Each key's function is listed below.

DISPLAY STATUS - While the sampler is in the standby or run state, pressing the DISPLAY STATUS key will allow you to view the program settings or the sampling results.

EXIT PROGRAM - Pressing the EXIT PROGRAM key while in the program sequence will return the sampler to standby. Pressing the EXIT PROGRAM key while in the run state will halt the program; the message "PROGRAM HALTED" will be displayed.

CLEAR ENTRY - When entering a number, the CLEAR ENTRY key can be used to return to the original entry.

ENTER/PROGRAM - Pressing the ENTER/PROGRAM key, while in the standby state, will cause the sampler to enter the interactive state. While at an input display, pressing the ENTER/PROGRAM key will accept an entered value or a blinking option, and direct the sampler to proceed to the next step. Input displays are discussed in *Displays,* on page 26

Figure 20 3700FR Sampler Control Panel

Numeric Keys

The numeric keys consist of 10 digit keys, a LEFT ARROW key, and a RIGHT ARROW key. The digit keys are used to enter quantities. The ARROW keys are used to move through lists or program options.

LEFT ARROW - The LEFT ARROW key is used to select one of two or more program options displayed when the sampler is in the interactive state. When more than one numeric entry is displayed – for example, the hours and minutes of a time setting – the LEFT ARROW can be used to step back to a previously entered value. When entering a number, the LEFT ARROW can be used to erase the most recently entered digit.

RIGHT ARROW - The RIGHT ARROW key is used to select one of two or more program options displayed in an input display. It is also steps through status information.

DISPLAYS

There are two types of displays: displays which communicate information about the sampler's status and displays which request input. In many cases, you must respond with the keypad.

Informational Displays

Informational displays communicate information about the sampler's status. For example, when the sampler completes a sampling program, a display similar to the illustration below appears. It communicates the sampler's status, "DONE," the number of samples taken (which will vary according to the program), and the current time and date.

```
DONE. . . 24 SAMPLES
10:32:34  14-JUN-91
```

Input Displays

Input displays can be identified easily because they contain a blinking word or number. The blinking word or number serves as a prompt for input and is said to be "selected." When the input displays shown below first appear, the word "PROGRAM" (display a) and the sample volume entry "250" (display b) will be blinking. Blinking words or numbers are represented in illustrations with OUTLINED characters.

```
[PROGRAM, CONFIGURE]
SAMPLER
```
a

```
SAMPLES VOLUMES OF
250 ml (10-1000)
```
b

Display Numbers

Nearly all input displays have a number assigned to them. The number is used to cross reference the input displays with a explanatory listing found in Appendix A - Display Index or in the 3700R/3700FR Sampler Pocket Guide. If you have a question about a given input display, you can easily locate the description of the display with the display number.

The display number can be accessed by pressing the STOP key when viewing the input display in the interactive and standby states. (In the run state, the STOP key is used to halt the sampling program.) To see the display number, press the stop key, read the number from the display, then look up the corresponding number in *Appendix B Display Index,* on page 145 for information on that display. The display number for display is "1."

Displays With Choices

There are two types of input displays: displays which prompt you to make a choice (between time-paced and flow-paced sampling, for example) and displays which prompt for numeric input (sample volume, for example). In displays which prompt you to make a choice, you must select one of up to four alternatives placed in brackets.

For example, display a above prompts you to select the program or the configure sequence. The choices, "PROGRAM" and "CONFIGURE," are placed in brackets.

When an input display prompting for a choice first appears, the blinking word indicates the currently selected choice. If the blinking word is acceptable, press the ENTER/PROGRAM key. If the blinking word is not acceptable, select the preferred choice by pressing the LEFT ARROW or RIGHT ARROW key until the preferred choice is blinking; then press the ENTER/PROGRAM key. The sampler will store the selected choice and advance to the next step.

When the display illustrated in a appears, the word "PROGRAM" will be blinking. If "PROGRAM" is acceptable, press the ENTER/PROGRAM key. If "PROGRAM" is not acceptable, press the LEFT ARROW or RIGHT ARROW key until "CONFIGURE" is blinking. Then, press the ENTER/PROGRAM key. The ENTER/PROGRAM key directs the sampler to advance to the next step.

Numeric Input Displays

A numeric input display will prompt for input by blinking the currently stored number. In the display illustrated in b, the number "250" will blink to prompt you to enter a value.

If the blinking number is acceptable, it is not necessary to type the number again: pressing the ENTER/PROGRAM key will store the number and advance the program to the next step. To enter a new number, press the appropriate numeric keys, then press the ENTER/PROGRAM key.

The sampler will not accept a number that exceeds the allowable range of values placed in parentheses on the display. In illustration b, no less than 10 ml and no more than 990 ml can be entered as a sample volume. If an entered number exceeds the range, the sampler will emit a series of beeps and the original number will reappear. An acceptable value must be entered to advance to the next step.

Editing Numbers

The LEFT ARROW key and CLEAR ENTRY key can be used to edit numeric entries if they are used after you press a numeric key and before you press the enter/program key. The CLEAR ENTRY key will clear any typed number and the original number will reappear. The LEFT ARROW will erase the most recently typed number.

Some numeric input displays prompt for more than one value. In the illustration below, the prompt asks for five number entries: hours, minutes, month, day, and year. The LEFT ARROW key and RIGHT ARROW key can be used to move back and forth between each of the five entries. Individual entries can be changed, as discussed above. Pressing the RIGHT ARROW or ENTER/PROGRAM key on the last entry will store the values and advance to the next display.

HH:MM	DD-MM-YY
12:33	21/06/91

Military Times

Times must be entered in military format. For example, to set the sampler's clock to 3:30 PM, enter a time of 15:30. When the display above first appears, the first two digits, "12," will blink. To enter a new time, type in the new hour, "15." Store the hour entry and advance to minutes by pressing the ENTER/PROGRAM key. Although months are displayed with a three-letter abbreviation, you must enter the month as a number. If the month or year entry does not need to be changed, accept the entry by pressing the RIGHT ARROW or ENTER/PROGRAM key. The LEFT ARROW key can be used to return to a previous position. Pressing the RIGHT ARROW or ENTER/PROGRAM key on the last entry, "91," will store the value and advance to the next display.

European Date Format

The sampler uses the European date format where the day precedes the month's three-letter abbreviation. To enter a date, enter the day before the month's number, and the year. The sampler will convert the numeric entry to the three-letter abbreviation for you.

Exit Program Key

The user can exit an input display by pressing the EXIT PROGRAM key. If you use the EXIT PROGRAM key, the currently stored setting will not change.

Basic Programming Mode Introduction

The following examples demonstrate the steps used to check the configure option settings and program the sampler for several different sampling routines. They are designed to provide you with step-by-step procedures and are provided as models for you to use later when programming the sampler for your "real" applications. Each programming example concludes with the run state displays that appear while that routine is being executed. These displays can be used to monitor the sampler's progress through a routine.

Two Sets Of Examples

There are two sets of examples. Examples for the basic programming sequence are provided in **Example 2,** on page 34 through **Example 7,** on page 43. Because many of the features of the extended programming mode are affected by selections made in the configure sequence, examples for the extended programming sequence follow *Basic Programming Mode Introduction,* on page 27, which discusses each configure option separately. We recommend you become familiar with the basic programming mode procedure and basic programming examples before using the extended programming mode. Most of the procedures used in the extended programming mode duplicate those of the basic programming mode and are not repeated in the section on extended programming procedures.

Examples for both programming modes are accompanied by flow charts. These charts diagram the program sequence structure for each mode. **Figure 21,** on page 29 charts the Basic Programming Mode structure.

Figure 23A, on page 59 charts the structure of the Extended Programming Mode. The charts are provided to act as a "map" to the programming process. Both charts are divided into sections - Sample Pacing, Sample Distribution, Sample Volume, and Key Times - which correspond to the steps listed in *Basic Programming Procedure,* on page 28.

Each chart contains the input displays used in the sequence. The input displays, in turn, are labeled with their display number so they can be cross-referenced with the listing found in *Appendix B Display Index,* on page 145. When programming the sampler, the display number can be accessed by pressing the STOP key.

As noted earlier, the sampler is shipped with a test program and factory configuration settings. The examples in this manual assume that all factory settings are being used, that the sampler will use the 24 bottle base, and that a 10 foot length of ⅜ inch vinyl suction line is being used.

Most program and configure settings can be re-initialized to factory settings, if desired. **Table 6,** on page 54 and **Table 7,** on page 55 list factory settings. A discussion of the re-initialize option, located in the Run Diagnostics configure option is found in *Run Diagnostics,* on page 54. Instructions for re-initializing the sampler are also included as part of **Example 1,** on page 31 and **Example 2,** on page 34 provide detailed instructions to help you work through the procedures detailed in *Basic Programming Procedure,* on page 28.

BASIC PROGRAMMING PROCEDURE

The steps needed to program the sampler in the basic mode follow the procedure outlined below.

1. Turn the sampler on with the ON/OFF key. The sampler always "wakes up" in the standby state. The "STANDBY" message will appear; or, if the sampler were turned off while running a routine, the "PROGRAM HALTED" message will be displayed. Both messages indicate the sampler is in standby.
2. Press the ENTER/PROGRAM key to access the interactive state. Select the program sequence. Refer to **Figure 21,** on page 29 for displays noted in steps 3 - 6. During the programming procedure, if you want to return to a previous display; press the EXIT PROGRAM key. The sampler will return to standby and you can repeat steps 1 and 2. Then press the ENTER/PROGRAM key to scroll through the settings until you locate the display in question.
3. Enter the Sample Pacing settings. The sampler will prompt you to select either time- or flow-pacing. Depending on your selection, you will then be prompted to enter the time interval between samplers, or the flow pulse interval.

   Note: If you will be using very short sample intervals, be sure the interval is longer than the duration of the sampling cycle. The duration of the cycle can be determined by programming the sampler with the desired settings, pressing the MANUAL SAMPLE key, and simply timing the cycle. For truly representative sampling, the interval – in either time- or flow-paced sampling – should be longer than the duration of the sampling cycle. If the intervals are too short, no sample events will be missed, although some events will occur at improper times.

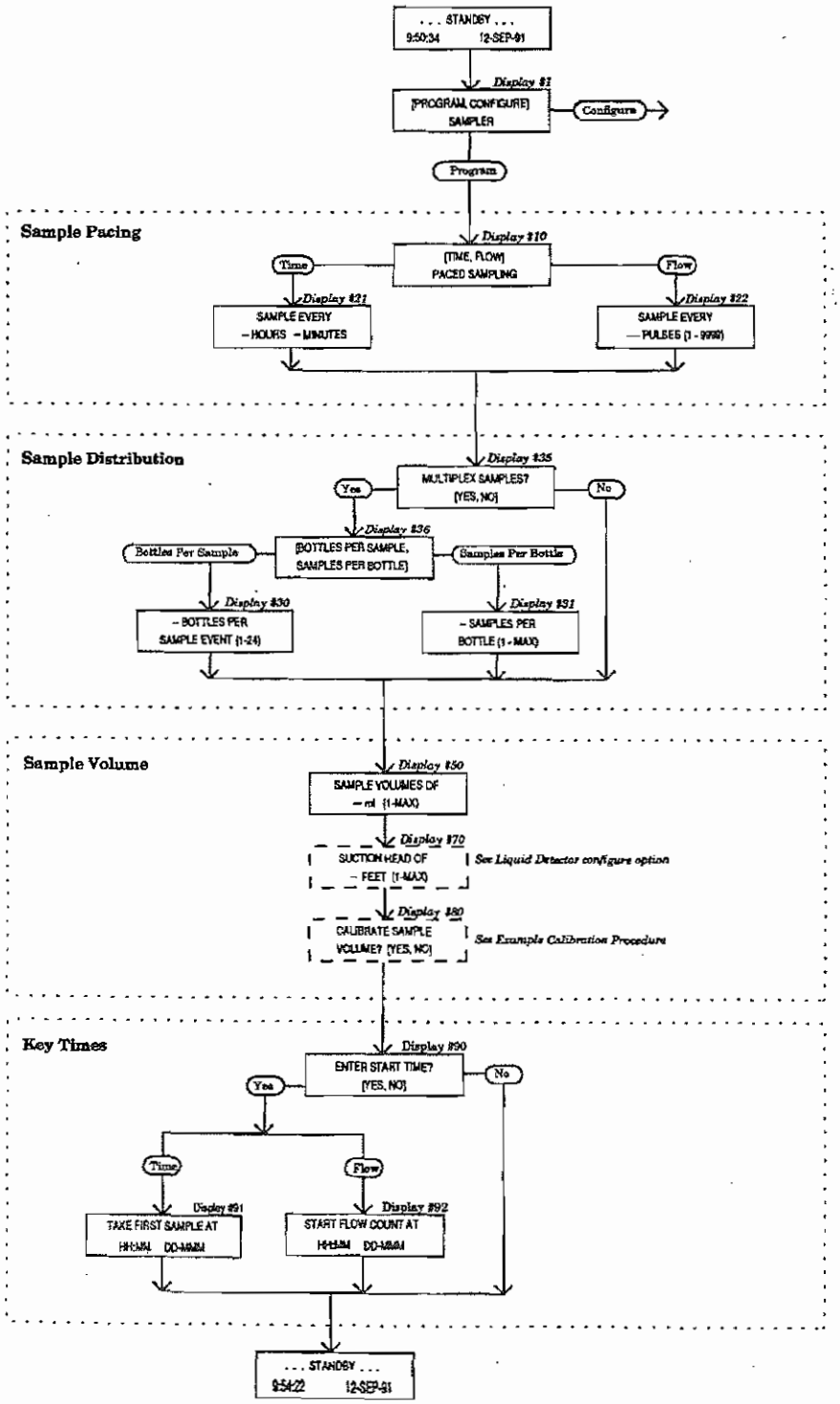
   When programming the sampler for flow pacing, you must enter the number of pulses that make up the flow interval. If the flow meter has been set to send a pulse once every 1000 gallons, you can program the sampler to collect a sample once every 1000 gallons by entering a flow pulse interval of "1." To collect a sample once every 50,000 gallons, you would enter a sample interval of 50 pulses. *Appendix C Calculating Flow Increment Between Samples,* on page 154 provides a discussion of some of the calculations needed when determining flow pulse intervals.
4. Enter the Sample Distribution settings. The settings in the Sample Distribution section allow you to perform sequential or multiplexed sampling. The first display of the Sample Distribution program section asks you if you want to multiplex samples or not. If you want simple sequential sampling – one sample per bottle – select "NO." The sampler will then prompt you for the Sample Volume settings.

   If you want to use bottles-per-sample or samples-per-bottle multiplexing, select "YES." The next display will prompt you to select, "BOTTLES PER SAMPLE" or "SAMPLES PER BOTTLE."

   Bottles-per-sample multiplexing is useful where a sample volume greater than the capacity of a single bottle is required, or where various types of preservatives must be added to the samples. Samples-per-bottle multiplexing is useful when it is desirable to collect a series of small composite samples. For example, four samples at 15 minute intervals can be collected in each bottle, resulting in a series of hourly composite samples.*Types of Samples,* on page 17 discusses the various types of multiplexing.
5. Enter the Sample Volume settings. The Sample Volume program section will always contain prompts for the sample volume. Depending on the selections made in the configure sequence, it may contain prompts for the suction head and for calibrating the sampler.

When entering the sample volume, the ± 10 ml sample volume repeatability should be kept in mind (refer to **Table 1,** on page 7). Because the sample volume programmed is a "nominal" value, it is prudent to enter a total sample volume which is somewhat less than the volumetric capacity of the bottle, as a safety factor. This will minimize the effects of cumulative error. Refer to *Bottles and Sizes,* on page 44 for notes on cumulative error and bottle size.

Figure 21 Basic Programming Mode: Program Sequence Structure



If bottles-per-sample multiplexing is being used to add preservatives to a number of consecutive samples, be sure to take the volume of the preservative into account.

The sampler can be configured, through the Liquid Detector configure option, to add the suction head setting to the program sequence. The suction head display will appear after you enter the sample volume. However, when the head is unknown or variable, the suction head setting should be omitted by disabling the suction head setting in the Liquid Detector configure option. By disabling the setting, you allow the liquid detector to determine the operating suction head each time a sample is taken. If the Liquid Detector is disabled, the suction head is automatically added to the program sequence and you are required to enter the suction head.

If you want to calibrate the sample volume, the calibration option must be enabled. To enable this option, select "ENABLE" in the Calibrate Sampler configure option. (Refer to *Calibrate Sampler,* on page 50). Enabling the option will add the calibration displays to the Sample Volume program section. These displays are included in **Example 7,** on page 43 which demonstrates the calibration procedure.

6. Enter the Key Times settings. In the basic programming mode, you will be asked if you want to enter a start time for the routine. If you select "YES," you will be prompted to enter a specific start time and date. If you select "NO," the sampler will use the start time delay. The start time delay can be set from 0 to 9999 minutes in the Start Time Delay configure option (see section 3.2.4.12). When you select "NO," the routine will start according to the delay setting in the Start Time Delay configure option. *Start Times,* on page 58 contains an extensive explanation of the sampler's start times.

   When the sampler is operating under factory configuration settings, the first sample will be taken at the start time for time-paced sampling. This is true whether you enter a specific start time and date, or if you use the start time delay. For flow-paced sampling, however, the flow pulse countdown will begin at the start time and the first sample will be taken when the countdown reached zero. Refer to the discussion on the Enable Pin option in *Enable Pin,* on page 51 for additional information.
7. The sampler will automatically return to standby.
8. From standby, start the routine by pressing the START SAMPLING key. This places the sampler into the run state. You will be prompted to enter the starting bottle number. If you want to begin with bottle 1, press the ENTER/PROGRAM key. If you make no response within 60 seconds, sampler will automatically begin with bottle 1. If you happen to start the routine after the programmed start time, the sampler will allow you to reprogram the start time. For more information, see *Standby State,* on page 88.
9. Use the run state displays to monitor the sampler's progress.

Example 1 Checking the Configure Option Settings

Before programming the sampler – especially if you are unfamiliar with the settings used in the previous routine, or if you think the settings have been changed – you should verify the configure option settings. You must change the settings if they do not match the number or size of the bottles, or the suction line used with the unit. The entries suggested in this example configure the sampler for 24 1000-ml bottles, a 10-foot length of ⅜-inch vinyl suction line, enable the liquid detector, and select the basic programming mode among other settings. Procedures for reinitializing the program settings and configure options to factory settings are placed in steps 22 through 26.

Not all configure options are discussed in this example; however, the options noted in this example include all the configure options which are not reinitialized to factory settings when the reinitialization process is run.

Step No.	Display	Procedure
1	...STANDBY... 10:34:50 19-JUN-91	If the sampler is not already on, press the ON/OFF key to turn it on. The standby display shown here will appear. Press the ENTER/PROGRAM key to access the interactive state. The next display you'll see is shown in step 2.
2	[PROGRAM, CONFIGURE] SAMPLER	Access the configure sequence by selecting "CONFIGURE." Select "CONFIGURE" by pressing the RIGHT ARROW key once. When "CONFIGURE" blinks, accept the selection by pressing the ENTER/PROGRAM key.
3	SELECT OPTION: (← →) SET CLOCK	Press the LEFT ARROW or RIGHT ARROW key to scroll through the configure options. The first option displayed is the Set Clock configure option. If the time displayed on the LCD in the standby message is not correct, reset the time with the Set Clock configure option. Access the Set Clock input display by pressing the ENTER/PROGRAM key.
4	HH:MM MM/DD/YY 10:35:20 19-JUN-91	Use this display to reset the time. This display requires five entries. The LEFT ARROW and RIGHT ARROW key can be used to move back and forth between each of the five entries. Use the ARROW keys until the entry you want to change blinks. Type in the new entry. Press the ENTER/PROGRAM key to accept the new entry. Pressing the RIGHT ARROW or ENTER/PROGRAM key on the last entry will store the values and advance to the next display.
5	SELECT OPTION: (← →) BOTTLES AND SIZES	To verify the Bottles and Sizes settings, press the ENTER/PROGRAM key. The display shown in step 6 will appear.
6	[PORTABLE, REFRIG.] SAMPLER	The 3700 Series portable and refrigerated samplers use the same controller. Because the 3700FR Sampler is a refrigerated sampler, select "REFRIG." Accept the selection by pressing the ENTER/PROGRAM key.
7	[1, 2, 4, 8, 12, 24] BOTTLES	For the purposes of this example, select "24" when you are using the 24 bottle base. Use the ARROW keys until "24" blinks, then press the ENTER/PROGRAM key. Select "1" when you are using a single bottle for composite sampling. NOTE: The 12 bottle configuration is available for Isco's fiberglass refrigerated samplers only.

Step No.	Display	Procedure
8	BOTTLE VOLUME IS 1000 ml	Enter the bottle size here. Enter "350" for the 350 ml glass bottles, "1000" for plastic bottles. Press the ENTER/PROGRAM key. If you enter a number that exceeds the standard bottle size, the message, "WARNING: STANDARD BTL VOLUME EXCEEDED!", will be displayed for a short time. The sampler will then prompt you to confirm the volume entered. This prompt is displayed in step 9.
9	1001 ml! . . . ARE YOU SURE? [YES, NO]	Select "YES" if you want to use the non-standard bottle volume. Select "NO" if you want to revise the entry. The display shown in step 8 will reappear; use it to enter the revised bottle volume. Press the ENTER/PROGRAM key to accept the entry and advance to step 10.
10	SELECT OPTION: (← →) SUCTION LINE	Press the ENTER/PROGRAM key at this display to access the Suction Line input displays shown in steps 11 - 13.
11	SUCTION LINE ID IS [1/4, 3/8] INCH	Select "¼" if you are using ¼ inch suction line, "⅜" if you are using ⅜ inch suction line. Press the ENTER/PROGRAM key to accept the entry and advance to the next step. If you select "¼," you will not see the display shown in step 12; instead you will be prompted for the suction line length, as shown in step 13. (¼ inch suction line is only available in vinyl, so you do not need to specify the line type.)
12	SUCTION LINE IS [VINYL, TEFLON]	This display appears when you have selected "⅜" in step 11. Select "VINYL" if you are using vinyl suction line, "TEFLON" if you are using Teflon suction line. Press the ENTER/PROGRAM key to accept the selection.
13	SUCTION LINE LENGTH IS 10 FEET (3 - 99)	Enter the length of the suction line. The length should not include the tube coupling or the strainer. Press the ENTER/PROGRAM key to accept the entry and move to the step 14. If you change the suction line settings, the ". . . CALCULATING . . . PUMP TABLE VALUES" message will appear for a short time.
14	SELECT OPTION: (← →) LIQUID DETECTOR	Press the ENTER/PROGRAM key at this display to access the Liquid Detector input displays shown in steps 15 - 18.
15	[ENABLE, DISABLE] LIQUID DETECTOR	Select "ENABLE" to turn the Liquid Detector on, "DISABLE" to turn the Liquid Detector off. For the purposes of the following examples, select "ENABLE." Press the ENTER/PROGRAM key to accept the selection. The detector should normally be left enabled unless you suspect it is malfunctioning. If you disable the detector, you will be required to enter the suction head in the program sequence.
16	0 RINSE CYCLES (0 - 3)	This display appears when you have selected "ENABLE" in step 15. Enter the number of rinse cycles. For the purposes of this example, enter "0." Press the ENTER/PROGRAM key to accept the entry. Rinse cycles condition the suction line to reduce cross contamination.
17	ENTER HEAD MANUALLY [YES, NO]	This display appears when you have selected "ENABLE" in step 15. Select "YES" to add the suction head setting to the program sequence. For the purposes of the following examples, select "NO" to omit the setting. Press the ENTER/PROGRAM key to accept the selection.

Step No.	Display	Procedure
18	RETRY UP TO 0 TIMES WHEN SAMPLING (0 - 3)	This display appears when you have selected "ENABLE" in step 15. Enter the number of retries. For the purposes of this example, set the number of retries to "0." Press the ENTER/PROGRAM key to accept the entry. This setting determines the number of times the sampler will try to detect the presence of liquid for each sample event.
19	SELECT OPTION: (← →) PROGRAMMING MODE	To verify the programming mode setting, press the ENTER/PROGRAM key.
20	[BASIC, EXTENDED] PROGRAMMING MODE	Select "BASIC." Press the ENTER/PROGRAM key to accept the selection.
21	↓ ↓	Scroll through the remaining options with the arrow keys. Use the techniques demonstrated above to change or verify the settings. If you want to re-initialize the configure and program settings to factory settings, follow the procedures given in steps 22-27.
22	SELECT OPTION: (← →) RUN DIAGNOSTICS	To access the displays used in this option, press the ENTER/PROGRAM key.
23	SOFTWARE REVISION #4.6	The sampler will display the software revision number for a short period of time.
24	RAM' PASSED TEST TESTING 'ROM'	The software revision display is replaced by the RAM and ROM test messages. A successful test is indicated by the messages "RAM PASSED TEST" or "ROM PASSED TEST." If either the RAM or ROM fail the test, the sampler will display one of the following messages: "RAM FAILED TEST" or "ROM FAILED TEST" and beep every three seconds until you turn the sampler off. If either the RAM or ROM fail their test, the sampler should be serviced. Contact Isco Customer Service for instructions on returning the sampler.
25	ABCDEFGHIJKLMNOPQRST UVWXYZ[¥]^_`abcdefgh	After successful RAM and ROM tests, the sampler will then test the LCD by first filling the display with solid rectangles and then printing the alphabet and other characters. Each character position in the display should contain a character.
26	PUMP COUNT TEST OFF/ON = 105	The next step tests the pump. During the test, the pump will run briefly and the display will indicate an "OFF/ON" number. The number should fall within the range of 50 to 200. If the count falls below 50 or exceeds 200, the pump should be serviced. A count near 100 is typical.
27	TEST DISTRIBUTOR? [YES, NO]	For the purposes of this example, select "NO" to skip the test. Press ENTER/PROGRAM to accept the selection.
28	RE-INITIALIZE? [YES, NO]	If you want to re-initialize the settings, select "YES." The entire RAM, with the exception of the current pump count total, bottle size settings, and suction line settings, will be re-initialized to factory settings. When you select "YES," the sampler will automatically turn itself off as part of the re-initialization process. Select "NO" leave the controller unchanged. Press the ENTER/PROGRAM key to accept the selection.

Example 2 Time-Paced Sequential Sampling

The steps in this example program the sampler to take samples every 30 minutes. Each bottle is to receive one 250 ml sample volume. The sampling routine is to begin according to the start time delay - one minute after the start sampling key is pressed.

Step No.	Display	Procedure
1	...STANDBY... 5:34:50 19-JUN-91	If the sampler is not already on, press the ON/OFF key to turn it on. The standby display shown here will appear. Press ENTER/PROGRAM to access the interactive state.
2	[PROGRAM, CONFIGURE] SAMPLER	Access the program sequence by selecting "PROGRAM." Because the choice "PROGRAM" will already be selected (blinking), press the ENTER/PROGRAM key to accept it and move to the next step.
3	[TIME, FLOW] PACED SAMPLING	To enter the interval between samples in time increments, select "TIME." If "TIME" is already blinking, press the ENTER/PROGRAM key to accept the selection. If "FLOW" is blinking, press the LEFT ARROW key once so that "TIME" blinks. Then, press the ENTER/PROGRAM key to accept "TIME."
4	SAMPLE EVERY 0 HOURS, 1 MINUTES	This display requires two entries: one for the hours, one for the minutes. Enter "0" to set the hours at zero. Press ENTER/PROGRAM to accept the number "0" and move to the minutes entry shown in step 5.
5	SAMPLE EVERY 0 HOURS, 30 MINUTES	Enter "30" to set the minutes entry to 30. Press ENTER/PROGRAM to accept the entry.
6	MULTIPLEX SAMPLES? [YES, NO]	For the purposes of this example, select "NO." Press the ENTER/PROGRAM key to accept the entry. If you select "YES" in response to this question, you would be able to select bottles-per-sample or samples-per-bottle multiplexing for your routine.
7	SAMPLE VOLUMES OF 250 ml (10 - 1000)	Enter "250" to set the sample volume at 250 ml. Press the ENTER/PROGRAM key to accept the entry.
8	ENTER START TIME? [YES, NO]	Because this sampling routine does not require a specific start time, use the arrow keys to select "NO." Press the ENTER/PROGRAM key to accept the entry. If you select "YES," you would be able to enter a specific start time and date for the routine.
9	PROGRAMMING SEQUENCE COMPLETE...	After this message is displayed briefly, the sampler will automatically return to the standby state.
10	...STANDBY... 5:42:23 19-JUN-91	After the sampler is properly installed, press the START SAMPLING key to run the program.
11	START SAMPLING BOTTLE 1 (1-24)	To start the sampling routine with the first bottle, accept the blinking "1" by pressing the ENTER/PROGRAM key. If you want to start the routine with another bottle, enter the starting bottle number here.
12	BOTTLE 1 AT 5:44 5:42:33	This display appears as the sampler counts down the time remaining to the start time. The first line reports the bottle which will receive the next sample volume. The second line reports the start time at the left and the current time on the right.

Step No.	Display	Procedure
13	BOTTLE 1	When the start time arrives, the sampler will take the first sample. The sample event cycle begins with a pre-sample purge. During the purge, the display indicates the bottle number which will receive the sample volume.
	BOTTLE 1 PUMPING 250 ml	As soon as the pump runs forward to deliver the sample volume, the message on the second line appears. This message remains through the post-sample purge.
14	BOTTLE 2 AT 6:14 5:45:11	This display appears when the post-sample purge from the previous sample event is completed. It indicates the bottle number which is to receive the sample at the upcoming sample event. The second line displays the scheduled time for the next event on the left. The current time is displayed on the right.
15	↓ ↓	The cycle of displays, illustrated in steps 12 through 13, is repeated for each bottle until the sampling routine is done.
16	DONE . . . 24 SAMPLES 6:10:35 21-JUN-91	When the routine is completed, this message appears. It reports the status of the routine ("DONE"), the total number of sample events, and the current time and date.

Example 3 Flow-paced Sequential Sampling

This example programs the sampler to take flow-paced samples at intervals of 5 pulses. One 500 ml sample is to be placed in each bottle. The sampling program will default to the start time delay entered in the Start Time Delay configure option.

Step No.	Display	Procedure
1	. . . STANDBY . . . 10:34:50 19-JUN-91	Press ENTER/PROGRAM to access the interactive state.
2	[PROGRAM, CONFIGURE] SAMPLER	Access the program sequence by selecting "PROGRAM."
3	[TIME, FLOW] PACED SAMPLING	Select "FLOW."
4	SAMPLE EVERY 5 PULSES (1-9999)	Enter "5" as the flow pulse interval. The sampler will take a sample every fifth flow pulse received.
5	MULTIPLEX SAMPLES? [YES, NO]	
6	SAMPLE VOLUMES OF 500 ml (10 - 1000)	Enter "500" to set the sample volume at 500 ml.
7	ENTER START TIME? [YES, NO]	ENTER START TIME? [YES, NO] Select "NO."

Step No.	Display	Procedure
8	PROGRAMMING SEQUENCE COMPLETE . .	After this message is displayed briefly, the sampler will automatically return to the standby state.
9	. . . STANDBY . . . 10:37:23 19-JUN-91	After the sampler is properly installed, press the START SAMPLING key to run the program.
10	START SAMPLING AT BOTTLE 1 (1-24)	To start the sampling routine with the first bottle, press the ENTER/PROGRAM key. To start the routine with another bottle, enter the starting bottle number here.
11	START AT 10:38 19-JUN 10:37:26 19-JUN	The first line of this display indicates the start time. The second line reports the current time and date.
12	BOTTLE 1 AFTER 5 PULSES	This display indicates the bottle which will receive a sample at the next sample event. The second line indicates the number of pulses remaining to the sample.
13	BOTTLE 1 AFTER 4 PULSES	This display shows that one flow pulse has been received. The pulse countdown will continue until the sample event.
14	↓ ↓	
15	BOTTLE 1	The second line of the display will disappear as the sampler begins the presample purge.
	BOTTLE 1 PUMPING 500 ml	This display appears when the pump begins to run in the forward direction to deliver the sample volume. It remains through the end of the post-sample purge.
16	BOTTLE 2 AFTER 5 PULSES	When the first sample volume has been delivered, the display will indicate the next sample bottle and the number of pulses remaining until the next sample event. This series of displays will repeat until the last sample is taken at bottle 24 and the sampling routine is done.
17	↓ ↓	
18	DONE . . . 24 SAMPLES 22:48:32 20-JUN-91	This display informs you that the sampling routine is completed. The number of sample events is displayed in the upper right corner. The second line indicates the current time and date.

Example 4 Time-paced Multiplexed (Samples-Per-Bottle) Sampling

This programming example demonstrates samples-per-bottle multiplexed sampling. Samples are to be taken every 15 minutes. Each bottle is to receive four sample volumes of 200 ml each, so that bottles are switched every hour. The sampling routine is to start at 6:00 AM on the following day.

Step No.	Display	Procedure
1	. . . STANDBY . . . 10:34:50 19-JUN-91	Press ENTER/PROGRAM to access the interactive state.

Step No.	Display	Procedure
2	[PROGRAM, CONFIGURE] SAMPLER	Access the program sequence by selecting "PROGRAM."
3	[TIME, FLOW] PACED SAMPLING	Select "TIME."
4	SAMPLE EVERY 0 HOURS,1 MINUTES	Enter "0" to set the hours at zero. Press ENTER/PROGRAM to store the number "0" and move to the minutes entry.
5	SAMPLE EVERY 0 HOURS,15 MINUTES	Enter "15" to set the minutes entry to 15.
6	MULTIPLEX SAMPLES? [YES, NO]	Select "YES" to set up the samples-per-bottle multiplexing.
7	[BOTTLES PER SAMPLE, SAMPLES PER BOTTLE]	Select "SAMPLES PER BOTTLE."
8	4 SAMPLES PER BOTTLE (1 - 50)	Enter "4" to set the number of samples per bottle to 4.
9	SAMPLE VOLUMES OF 200 ml (10 - 250)	Enter the sample volume of "200" ml.
10	ENTER START TIME? [YES, NO]	Select "YES" so you can enter the specific start time.
11	TAKE FIRST SAMPLE AT 6:00 20-JUN-91	When this display first appears, it will show you the sampler's "guess" at the start time. Type in the desired start time. For this example, the start time is 6:00 on June 20.
12	PROGRAMMING SEQUENCE COMPLETE . . .	After this message is displayed briefly, the sampler will automatically return to the standby state.
13	. . STANDBY . . . 10:37:23 19-JUN-91	To run the program, press the START SAMPLING key after the sampler is installed.
14	START SAMPLING AT BOTTLE 1 (1-24)	To start the sampling routine with the first bottle, accept the blinking "1" by pressing the ENTER/PROGRAM key. If you want to start the routine with another bottle, enter the starting bottle number here.
15	1 OF 4, BOTTLE 1 AT 6:00 5:55:33	This display is used with samples-per-bottle multiplexing. The first line shows the number of the next sample, the number of samples each bottle is to receive, and the current bottle number. Here, the next sample is the first of four samples for bottle 1. The second line shows the time of the next sample and displays the current time.
16	1 OF 4, BOTTLE 1	When the scheduled sample event time arrives, the second line will disappear while the sampler completes the pre-sample purge.
	1 OF 4, BOTTLE 1 PUMPING 200 ml	This message appears when the pump begins to deliver the sample. The message remains through the post-sample purge.

Step No.	Display	Procedure
17	2 OF 4, BOTTLE 1 AT 6:15 6:00:26	When the sampling cycle is completed, the display will again indicate the upcoming sample.
18	2 OF 4, BOTTLE 1	The next displays illustrated here, in steps 18 through 20, show the displays as the sample volumes are deposited in bottle 1.
	2 OF 4, BOTTLE 1 PUMPING 200 ml	
19	3 OF 4, BOTTLE 1 AT 6:30 6:15:27	
20	3 OF 4, BOTTLE 1	
	3 OF 4, BOTTLE 1 PUMPING 200 ml	
21	↓ ↓	
22	1 OF 4, BOTTLE 2AT 7:00 6:45:25	When the final sample has been deposited in the first bottle, the display changes to indicate the new sample bottle. This display indicates that the next sample event will place the first of four sample volumes in bottle 2 at 7:00.
23	1 OF 4, BOTTLE 2	This display appears as the pump begins the pre-sample purge for the first sample delivered to bottle 2.
	1 0F 4, BOTTLE 2 PUMPING 200 ml	
24	↓ ↓	The cycle of displays is repeated for each bottle until the sampling routine is done.
25	DONE . . . 96 SAMPLES 6:10:35 21-JUN-91	When the routine is completed, this message appears. It reports the status of the routine ("DONE"), the total number of sample events, and the current time and date.

Example 5 Flow-paced Multiplexed (Bottles-per-Sample) Sampling

This example demonstrates the steps needed to program the sampler for a flow-paced routine that is to place a sample in two bottles at each sample event. Sample volumes of 500 ml are to be placed in the bottle sets at intervals of 10 flow-pulses. The routine is to start at 5:00 AM, the following morning.

Step No.	Display	Procedure
1	. . . STANDBY . . . 10:34:50 19-JUN-91	Press ENTER/PROGRAM to access the interactive state.
2	[PROGRAM, CONFIGURE] SAMPLER	Access the program sequence by selecting "PROGRAM."

Step No.	Display	Procedure
3	[TIME, FLOW] PACED SAMPLING	Select "FLOW."
4	SAMPLE EVERY 10 PULSES (1-9999)	Enter "10" as the flow pulse interval. The sampler will take a sample every tenth flow pulse received.
5	MULTIPLEX SAMPLES? [YES, NO]	Select "YES" to multiplex samples.
6	[BOTTLES PER SAMPLE, SAMPLES PER BOTTLE]	Select "BOTTLES PER SAMPLE."
7	2 BOTTLES PER SAMPLE EVENT (1-24)	Enter the number of bottles per sample event: "2."
8	SAMPLE VOLUMES OF 500 ml (10 - 1000)	Enter "500" to set the sample volume at 500 ml.
9	ENTER START TIME? [YES, NO]	Select "YES."
10	START FLOW COUNT AT 5:00 20-JUN-91	Enter the start time for the sampling routine. Note that the sampler may receive flow pulses before the sampling routine begins. Any pulses received before the start time will be disregarded.
11	PROGRAMMING SEQUENCE COMPLETE . . .	After this message is displayed briefly, the sampler will automatically return to the standby state.
12	. . . STANDBY . . . 10:37:23 19-JUN-91	Press the START SAMPLING key to run the program.
13	START SAMPLING AT BOTTLE 1 (1-23)	START SAMPLING?AT BOTTLE 1 (1-23) To start the sampling routine with the first bottle, accept the blinking "1" by pressing the ENTER/PROGRAM key. If you want to start the routine with another bottle, enter the starting bottle number here.
14	START AT 5:00 4/20 10:37:23 19-JUN	This display appears after you press the start SAMPLING KEY to start the routine. It reports the scheduled start time on the first line. The second line reports the current time and date.
15	BOTTLES 1- 2 AFTER 10 PULSES	When the scheduled start time arrives, the sampler will begin to count flow pulses. This display indicates the bottles which will receive sample volumes at the sample event. (If the bottle set consisted of four bottles, the first line of the display would read, "BOTTLES 1 - 4.") The number of flow pulses remaining to the sample event is displayed on the second line.
16	BOTTLES 1- 2 AFTER 9 PULSES	The second line of the display changes as each flow pulse is received.
17	↓ ↓	

Step No.	Display	Procedure
18	BOTTLES 1-2 AFTER 1 PULSES	This display shows one pulse remaining until the sample event.
19	BOTTLE 1	When the tenth pulse is received, the first line will report the current bottle number.
20	BOTTLE 1 PUMPING 500 ml	When the pump begins to run forward to deliver the sample volume, the second line appears. After the pump completes the sample delivery, it reverses to purge the liquid from the pump tube past the liquid detector. The suction line is not completely purged; instead, the liquid is pumped just past the liquid detector. At the end of the pump tube purge, the distributor moves to the next bottle of the set. The display remains unchanged until the distributor relocates to the next bottle of the set.
21	BOTTLE 2 PUMPING 500 ml	When the distributor is relocated above the next bottle, the bottle number reported in the display changes to indicate the bottle number. The message, "PUMPING 500 ml," will remain on the display. When the distributor reaches the correct position over the second bottle, the pump delivers the sample volume. When the delivery is completed, the pump reverses to complete the post-sample purge.
22	BOTTLE 3-4 AFTER 10 PULSES	At the end of the post-sample purge, the display changes to indicate the bottle numbers of the next bottle set. The display will change as it receives each flow pulse.
23	↓ ↓	The cycle is repeated until the sampling routine is completed.
24	DONE . . . 12 SAMPLES 6:10:35 21-JUN-91	When the routine is complete, the display will indicate the status of the routine ("DONE"), the number of sample events, and the current time and date.

Example 6 Time-Paced Composite Sampling

This example demonstrates the programming procedures for a composite sampling routine. When using the 3700FR Sampler for composite sampling, the unit must be mechanically converted for single bottle sampling.

After converting the sampler, check the configure settings to verify the sampler is configured for composite sampling. This example begins with a demonstration of the steps needed to check the Bottles and Sizes configure option settings. The Bottles and Sizes configure settings should indicate that only one bottle is being used. Be sure to enter the correct bottle volume. The settings used in this example are for the 4-gallon (15000 ml) composite bottle. Please refer to *Bottles and Sizes,* on page 44. for a discussion of the Bottles and Sizes configure option.

This time-paced routine takes samples at 15-minute intervals for a 12-hour period. Sample volumes are to be 250 ml each. When entering the program settings, you must enter the number of samples required before entering the sample volumes. At four samples per hour, the 12 hour period would yield 48 samples. The total volume at the end of the routine would be 12000 ml (48 samples x 250 ml/sample), well within the capacity of the 4-gallon bottle.

Step No.	Display	Procedure
1	. . . STANDBY . . . 10:34:50 19-JUN-91	If the sampler is not already on, press the ON/OFF key to turn it on. Press ENTER/PROGRAM to access the interactive state.

Step No.	Display	Procedure
2	[PROGRAM, CONFIGURE] SAMPLER	Access the configure sequence by selecting "CONFIGURE."
3	SELECT OPTION: (← →) SET CLOCK	Press the LEFT ARROW or RIGHT ARROW key to scroll through the configure options until the Bottles and Sizes configure option appears.
4	SELECT OPTION: (← →) BOTTLES AND SIZES	To access the Bottles and Sizes settings, press the ENTER/PROGRAM key.
5	[PORTABLE, REFRIG.] SAMPLER	Select "REFRIG."
6	[1, 2, 4, 8, 12, 24] BOTTLES	Select "1" for single bottle composite sampling.
7	BOTTLE VOLUME IS 15000 ml	Enter the bottle size here, "15000." (**Table 4,** on page 45 lists the standard Isco bottle sizes.)
8	SELECT OPTION: (← →) SUCTION LINE	Press the ENTER/PROGRAM key at this display to access the Suction Line input displays.
9	SUCTION LINE ID IS [1/4, 3/8] INCH	Select "¼" if you are using ¼ inch suction line, "⅜" if you are using ⅜ inch suction line.
10	SUCTION LINE IS [VINYL, TEFLON]	This display appears when you have selected "⅜" in step 9. Select "VINYL" if you are using vinyl suction line, "TEFLON" if you are using Teflon suction line.
11	SUCTION LINE LENGTH IS 10 FEET (3 - 99)	Enter the length of the suction line. The length should not include the tube coupling or the strainer.
12	SELECT OPTION: (← →) LIQUID DETECTOR	To verify the Liquid Detector configure options, press the ENTER/PROGRAM key.
13	↓ ↓	Continue to scroll through the configure options with the RIGHT ARROW key. When you have checked the settings for the desired options, press the EXIT PROGRAM key to return to standby.
14	. . . STANDBY . . . 10:38:50 19-JUN-91	Press the ENTER/PROGRAM key to reenter the interactive state.
15	[PROGRAM, CONFIGURE] SAMPLER	Access the program sequence by selecting "PROGRAM."
16	[TIME, FLOW] PACED SAMPLING	Select "TIME."
17	SAMPLE EVERY 0 HOURS, 1 MINUTES	Enter "0" to set the hours at zero. Press ENTER/PROGRAM to store the number "0" and move to the minutes entry.
18	SAMPLE EVERY 0 HOURS, 15 MINUTES	Enter "15" to set the minutes entry to 15.

Step No.	Display	Procedure
19	48 COMPOSITE SAMPLES (0-200)	Enter the number of samples to be collected: "48."
20	SAMPLE VOLUMES OF 250 ml H (10 - 310)	Enter the sample volume: "250." Note that the upper limit of the range of acceptable volumes has been adjusted. When 48 samples are to be collected, the maximum sample volume is 310 ml. If you need to use a larger sample volume, you would need to adjust the sample number downward.
21	ENTER START TIME? [YES, NO]	Select "YES" to enter the start time for the routine.
22	TAKE FIRST SAMPLE AT 6:00 20-JUN	Enter the start time and date: "6:00" on "4-20."
23	PROGRAMMING SEQUENCE COMPLETE . . .	After this message is displayed briefly, the sampler will automatically return to the standby state.
24	. . . STANDBY . . . 10:40:23 19-JUN-91	After the sampler is properly installed, press the START SAMPLING key to run the program.
25	SAMPLE 1 OF 48 AT 6:00 5:50:43	The first line of this display indicates the number of the upcoming sample event and the total number of programmed samples. The second line indicates the scheduled time of the upcoming event followed by the current time.
26	SAMPLE 1 OF 48	When the time to the next sample event has elapsed and the sampler has initiated the sample event, the sampling cycle begins.
	SAMPLE 1 OF 48 PUMPING 250 ml	When the pump reverses for the pre-sample purge, the second line disappears. At the end of the pre-sample purge, the pump runs forward to deliver the sample, and the second line appears on the display. This display remains through the end of the post-sample purge.
27	SAMPLE 2 OF 48 AT 6:15 6:00:33	At the end of the sample event, the display changes to indicate the number and time of the next event. The current time is in the lower right corner.
28	SAMPLE 2 OF 48	The cycle is repeated for the remainder of the sampling routine.
	SAMPLE 2 OF 48 PUMPING 250 ml	
29	↓ ↓	
30	DONE . . . 48 SAMPLES 6:10:35 21-JUN-91	This display appears when the routine is completed. It reports the status of the routine ("DONE"), the total number of sample events, and the current time and date.

Example 7 Calibration Procedure

This example demonstrates the method used to calibrate the sampler for a 200 ml sample volume. The Calibrate Sampler configure option must be enabled in the configure sequence before the calibration displays shown below appear.

Even without calibrating, the 3700FR Sampler will deliver accurate sample volumes. If your sample volumes vary significantly with the entered values, check the suction line first. Be sure the line slopes continuously downhill and is draining completely after each pumping cycle. Then, please check the suction line entries in the configure sequence to see that they are accurate. The calibration procedure is intended for "fine tuning" only. After you enter the sample volume actually delivered, as shown in step 8, the next sample volume delivered will be adjusted to correct for the difference between the expected sample volume and the actual volume entered. All subsequent volumes delivered will be adjusted. The adjustment can be cleared by changing a suction line entry in the Suction Line configure option or by re-initializing the sampler.

We suggest using a spare sample bottle as the collection container. Because the sample volume can be calibrated to ± 10 ml, a graduated cylinder should be used to facilitate measurement. A graduated cylinder and spare bottles are available as accessories from the factory. Refer to the Accessories List at the back of this manual for details.

The calibration pump cycle will include rinse cycles and retries, if the sampler is configured to perform them (*Liquid Detector*, on page 45). This insures that the calibration procedure includes the pump cycle used while running the sampling program.

Step No.	Display	Procedure
1	...STANDBY... 9:34:50 19-JUN-91	Press ENTER/PROGRAM to access the interactive state.
2	[PROGRAM, CONFIGURE] SAMPLER	Access the program sequence by selecting "PROGRAM."
3	[TIME, FLOW] PACED SAMPLING	Step through the program until the "CALIBRATE SAMPLER?" (step 5) input display appears.
4	↓ ↓	Other program sequence displays.
5	CALIBRATE SAMPLER? [YES, NO]	Select "YES."
6	PRESS MANUAL SAMPLE KEY WHEN READY...	Before pressing the MANUAL SAMPLE key, make sure a collection container is underneath the distributor.
7	...MANUAL SAMPLE... PUMPING 200 ml	The sampler will deliver the programmed sample volume.
8	200 ml VOLUME DELIVERED	Measure the actual volume delivered and enter that value here.
9	CALIBRATE SAMPLER? [YES, NO]	Repeat the procedure if desired, then select "NO." Under normal conditions, you should not need to repeat the procedure more than once.
10	↓ ↓	Other program sequence displays.
11	...STANDBY... 9:39:50 19-JUN-91	The sampler will return to standby. Press the START SAMPLING key to run the program.

CONFIGURE SEQUENCE

The configure sequence provides a number of setup options. Some options enable sampling features, some provide reference data, and others affect run state operations.

Example 1, on page 31 shows the procedure used to access the configure sequence. (When you see a "SELECT OPTION: (← →)" display, you are in the configure sequence.) Each option uses at least two displays. The first display lists the option name. The following displays are input displays. To access an input display, press the ENTER/PROGRAM key while the desired option name is displayed. Once you've accessed the input display, use the keypad to enter numbers and make choices as described in *Keypad Description,* on page 24 through *Displays,* on page 26.

Note: pressing the EXIT PROGRAM key in the configure option list will return the sampler to standby. Pressing the EXIT PROGRAM key in a configure option input display will return you to the list of configure options without changing the setting.

By pressing the LEFT ARROW or RIGHT ARROW key at the "SELECT OPTION:" display in the configure sequence, you can scroll through the list of configure options without viewing each input display. If you are interested in only one or two options, you can locate the option of interest quickly.

Each option is discussed below in the order in which it appears when configuring the sampler. Individual input displays and their settings, are discussed separately within the discussion of each option. For these, the name of the setting is placed in the left margin so you can identify each topic. Illustrations of displays are not included in each discussion; however, each discussion includes the display number, should you need to refer to display listing in *Appendix B Display Index,* on page 145.

SET CLOCK

The Set Clock option is used to synchronize the sampler's clock with real time. Times must be entered in military time: 9:30 AM would be entered as 9:30, 9:30 PM would be entered as 21:30. When the year entry is accepted, the seconds will be reset to zero. (Display #210).

BOTTLES AND SIZES

The Bottles and Sizes option is used to enter the number of bottles and the bottle volume. The option uses four input displays:

- The first display specifies a portable or refrigerated sampler.
- The second display sets the number of bottles (1, 4, 12, or 24) for portable configurations. The second display appears only when you specify a portable sampler in the first display.
- The third display sets the number of bottles (1, 2, 4, 8, 12, 24) for refrigerated configurations. The third display appears only when you specify a refrigerated sampler in the first display.
- The fourth display sets the bottle volume.

Portable or Refrigerated Sampler

Because the 3700 Series portable and refrigerated samplers use the same control box, you must specify the type of unit. The 3700FR Sampler will be shipped with this setting as "REFRIGERATED." This setting is not changed when you reinitialize the settings. You should not specify "PORTABLE" unless you move the control box to portable sampler. (Display #220).

CAUTION

The sampler uses the bottle configuration setting to position the distributor. If you enter a bottle configuration that does not correspond to the actual configuration used in the sampler, the sampler may position the distributor over locations without a bottle and fill the refrigerator instead of a sample bottle.

1, 4, 12, 24

If you specify "PORTABLE" in the previous display, you will be able to specify a 1-, 4-, 12, or 24-bottle configuration. The sampler comes configured for the number of bottles ordered with the sampler. Each bottle configuration requires a different base section. The 1-bottle configuration requires the composite base section; the 4-bottle configuration requires the 4 bottle base section, and so on. Change the configuration setting only when you have moved the controller to a portable sampler. If you change the bottle configuration without changing the base section, the sampler will not position the distributor arm over the bottles and will miss the bottle mouth, filling the base section instead of the bottles. (Display #222).

1, 2, 4, 8, 12, 24

If you specify "REFRIGERATED," you will be able to specify a 1-, 2-, 4-, 8-, 12-, or 24-bottle configuration. The 2- and 8-bottle configurations are used only with Isco's 3700 Series Refrigerated Samplers. (Display #221).

Table 4 Bottle Volume Settings for Sequential and Composite Bottle Configurations

Bottle Configuration	Bottle Size	Bottle Volume Setting
24 (polypropylene)	1000 ml	1000
24 (glass)	350 ml	350
12 (polyethylene)	2500 ml	2500
8 (polyethylene)	2000 ml	2000
8 (glass)	1800 ml	1800
4 (glass and polyethylene)	1 gal	3800
2 (glass and polyethylene)	2.5 gal	9400
1 (glass and polyethylene)	2.5 gal	2.5 gal
1 (polyethylene)	4 gal	15000

Continuous Sampling

You can program the 3700FR refrigerated sampler for continuous sampling. A 3700FR programmed for continuous sampling will deposits samples into successive sets of bottles, until it reaches the last set of bottles. It then returns to the first set of bottles and continues sampling indefinitely into successive sets. Continuous sampling is available for all multiple-bottle configurations.

Before programming a sampler for continuous sampling, configure the sampler as follows. Select "refrigerated" and "2," "4," "8," "12," or "24" bottles in the Bottles and Sizes configure option. Next, configure the sampler for extended programming in the Programming Mode configure option. Under these settings, the display illustrated below will appear in the sample distribution section.

SAMPLE CONTINUOUSLY? [YES, NO]	Display #48

Note: The sampler will deposit samples indefinitely, even though the bottles have been filled to capacity. To avoid overfilling the bottles, replace them at regular time intervals or as soon as they are filled.

Cumulative Error

The sample accuracy is the greater of 10% of the sample volume or 20 ml and is repeatable to ± 10 ml. If you wish to fill a 1000-ml bottle with five 200-ml samples, adjust the actual sample volume according to the sample accuracy. Since samples of 200 ml can vary by 10% or ± 20 ml, the cumulative error for five samples would be ± 100 ml. If the sampler consistently places an actual sample volume of 220 ml for each of five samples, the total volume held by the bottle would be 1100 ml. Again, to avoid possible overfilling, enter a bottle volume that is less than the actual bottle capacity.

Suction Line

The Suction Line configure option is used to configure the sampler for the type (vinyl or Teflon), diameter, and length of the suction line used. Because the volumetric delivery varies with line diameter, type, and length; it is important that these settings be entered accurately. An incorrect setting will impair the accuracy of the sample volume. If you change the current suction line settings, the ". . . CALCULATING . . . PUMP TABLE VALUES" message will appear for a short time. Because the volumetric delivery of the sample varies with the diameter, type, and length of the suction line, the sampler must revise the internal pump tables. The tables are used as reference for the electronic pump count for sample delivery.

There are three types of suction lines available for use with the 3700FR sampler: ¼ inch vinyl, ⅜ inch vinyl, and ⅜ inch Teflon. If you specify ¼ inch line, the sampler will prompt you for the line length immediately. If you specify ⅜ inch line, the sampler will prompt you to specify vinyl or Teflon before prompting for the line length. (Display #'s 230 and 231).

The sampler will accept suction line lengths of 3 to 99 feet. When measuring the line, do not include the tube coupling or the strainer in the measurement. The line should be cut to even foot lengths. It is important to enter these settings accurately. These settings affect the accuracy of the sample volume and are used to determine the number of post-sample purge counts. It is important to have sufficient counts to completely clear the line. (Refer to *Purge Counts*, on page 52.) (Display #232).

Liquid Detector

The Liquid Detector configure option is used to turn the liquid detector on or off, set the number of rinse cycles, add a suction head setting to the program sequence, and set the number of sampling retries should the suction line become clogged. The option uses four input displays. Each display is discussed below.

Enable/Disable Detector

The recommended setting for the Enable/Disable Detector option is "ENABLE." The 3700FR Sampler determines the delivered sample volume suction head by counting revolutions of the peristaltic pump rotor.

The volume of liquid delivered by one revolution of the pump rotor is a function of the suction head of the pump; as the suction head increases, the volume delivered by one revolution of the pump rotor decreases and vice versa. By enabling the detector, the sampler can accurately determine the operating suction head. It does not have to rely on a programmed suction head value, but can instead begin its volume delivery count when liquid is detected. This minimizes inaccuracies which can occur in changing head conditions, or when measurement of the suction head is difficult to determine accurately.

The disable option is provided should the detector or its associated circuitry become suspect. If the detector is disabled, the manual suction head setting (Display #70) is automatically added to the sample volume program section in the program sequence. If the detector is disabled, the sampler will use a calculated number of pump counts based on the suction head entry to deliver the correct sample volume. The programmed suction head entry is then used to determine the operating suction head. The sampler will operate at diminished accuracy with the detector disabled. (Display #240).

Rinse Cycles

The Rinse Cycle setting is available only when the detector is enabled. It is used to set the number of suction line rinses, from 0 to 3. Rinses are used to condition the suction line to reduce cross contamination. During a rinse cycle, the pump draws liquid up through the line until it is detected by the liquid detector. At that point, the pump reverses to purge the line. This cycle is repeated according to the number of rinse cycles entered. (See *Sample Events and the Sampling Cycle,* on page 16 for a discussion of the sample event cycle.) (Display #241).

Rinse cycles contribute to the wear on pump tubing; therefore, if you use rinse cycles, it may be necessary to replace the tubing more frequently. The Tubing Life configure option, *Tubing Life,* on page 53, allows you to monitor pump tubing wear.

Enter Head Manually

Entering the head manually is available as an option when the detector is enabled and allows you to add the suction head entry (Display #70) to the program sequence. When the detector is disabled, the Suction Head entry is automatically added to the program sequence. By disabling the suction head setting, you allow the liquid detector to determine the operating suction head each time a sample is taken. Using the Suction Head entry in conjunction with the liquid detector, when the head is stable and known accurately, further increases accuracy of the delivered volume. When the head is variable or unknown, you should select "NO." An incorrect head setting diminishes the delivered volume accuracy. (Display #242).

Sampling Retries

The Sampling Retries option is used to set the number of times, from 0 to 3, the sampler will try to detect liquid in the line before skipping the sample. The option can be used when sampling liquid with a high concentration of solids which tend to clog the suction line or the strainer. The sampler will also retry the rinse cycle when you are using the Sampling Retry option. (Display #243).

Programming Mode

The Programming Mode option allows you to specify either the basic or extended programming mode. The basic programming mode is used for conventional routines; the extended programming mode can be used for either conventional or more complex routines. Storm programming is available through the extended programming mode.

Table 5 summarizes the sampling features according to programming mode in the program sequence. **Table 3,** on page 22, placed in *Interactive State,* on page 21, summarizes the features available in the configure sequence. Extended features are normally used in exceptional applications and are not available in the basic mode to simplify the programming process for conventional routines.

Table 5 Sampling Capabilities Available Through the Program Sequence

Pacing:	Mode	Feature
Time-pacing: Uniform Time Intervals	Basic & Extended	Samples taken at regular time intervals from 1 minute to 99 hours, 59 minutes.
Time-pacing: Nonuniform Intervals in Minutes	Extended	Samples taken at irregular time intervals by specifying the amount of time in minutes between each sample. Intervals can be entered from 1 to 999 minutes.

Pacing:	Mode	Feature
Flow-pacing	Basic & Extended	Samples taken at regular flow intervals. The sampler will totalize flow intervals of 1 to 9999 pulses.

Distribution:	Mode	Feature
Sequential	Basic & Extended	One sample volume placed in each bottle.
Samples per Bottle Multiplexing	Basic & Extended	More than one sample volume placed in each bottle. Bottles can be switched after a specified number of samples have been deposited or after a specified period of time.
Bottles per Sample Multiplexing	Basic & Extended	Sample volumes placed in more than one bottle at each sample event.
Multiple Bottle Compositing	Extended	More than one sample volume placed in a set of bottles. Bottle sets can be switched after a specified number of samples have been deposited or after a specified period of time

Volumes and Accuracy:	Mode	Feature
Sample Volume	Basic & Extended	Volumes from 10 to 9990 ml can be entered.
Suction Head	Basic & Extended	Suction heads from 1 to 20 feet can be entered.
Calibration	Basic & Extended	Sample volumes can be calibrated, if desired.

Key Times:	Mode	Feature
Start Times	Basic & Extended	Specific start times can be entered for both time-paced and flow-paced routines. If no start time is entered, the Start Time Delay will be used.
First Switch Time	Extended	Bottles can be switched after specified time intervals. After the routine is started, the first switch time allows the first bottle or bottle set to receive samples for a partial interval. After the first switch, the remaining sets will receive samples for full time intervals. This allows you to place the sampler "on schedule."
Stop/Resume Times	Extended	Intermittent sampling can be performed by defining sampling stop and resume times. Up to 12 stop times and 12 resume times can be entered.

STORM Programming (Available in the Extended Mode Only.)

STORM Pacing:	Mode	Feature
Time-pacing	Extended	Samples taken at regular time intervals from 1 minute to 99 hours, 59 minutes.
Flow-pacing	Extended	Samples taken at regular flow intervals. The sampler will totalize flow intervals of 1 to 9999 pulses.

STORM Distribution:	Mode	Feature
Sequential	Extended	One sample volume placed in each bottle.
Samples per Bottle Multiplexing	Extended	More than one sample volume placed in each bottle. Bottles can be switched after a specified number of samples have been deposited.
Bottles per Sample Multiplexing	Extended	Sample volumes placed in more than one bottle at each sample event.
Multiple Bottle Compositing	Extended	More than one sample volume placed in a set of bottles. Bottle sets can be switched after a specified number of samples have been deposited.

STORM Volumes and Accuracy:	Mode	Feature
Sample Volume	Extended	Volumes from 10 to 990 ml can be entered for the time-paced and flow-paced segments separately.
Suction Head	Extended	Suction heads from 1 to 20 feet can be entered.
Calibration	Extended	Sample volumes can be calibrated, if desired. Sets calibration using the timed sample volume, only.

STORM Key Times:	Mode	Feature
Delay to First Timed Sample	Extended	A delay of up to 99 minutes can be entered to delay the first timed sample event after the programmed start time, and, in applications where a flow meter is programmed to enable the sampler, after the sampler is enabled.
Start Times	Extended	A specific start time can be entered for the routine. Bottle groups can be filled concurrently. If no start time is entered, the Start Time Delay will be used.
Maximum Flow Interval	Extended	Maximum period of time can be entered between flow-paced sample events. If this period of time is exceeded, the sampler will terminate the routine.

LOAD STORED PROGRAM

The Load Stored Program option allows you to load one of up to three sampling programs which have been previously saved with the Save Current Program configure option, discussed in section 3.2.4.7. The loaded program will replace the current program. After loading a program, the sampler will adjust the loaded program's time settings to current times and dates. Check the settings before starting the program to be sure they are appropriate for your application.

When the sampler loads a program, it compares the current Bottle Configuration setting (Display #220) to the Bottle Configuration setting required by the loaded program. If the settings do not match, an error message will be displayed: "LOAD ERROR - BOTTLE COUNT MISMATCH." The load process will be aborted. (Display #250).

The sampler is shipped from the factory with four programs: the current program and three stored programs, numbered from 1 to 3. All four programs contain the factory default program settings. Unless you have previously saved a program under one of the program numbers, loading a program will replace the current program with the factory default settings. When you reinitialize the sampler, all four programs return to the default program settings.

Example 8 Loading a Stored Program.

Step No.	Display	Procedure
1	...STANDBY... 10:34:50 19-JUN-91	Press ENTER/PROGRAM to access the interactive state.
2	[PROGRAM, CONFIGURE] SAMPLER	Access the configure sequence by selecting "CONFIGURE."
3	SELECT OPTION: (← →) SET CLOCK	Press the LEFT ARROW or RIGHT ARROW key to scroll through the configure options. The first option displayed is the Set Clock configure option.
4	↓ ↓	
5	SELECT OPTION: (← →) PROGRAMMING MODE	You can load a stored programmed only when the sampler is configured for the extended programming mode. To verify the programming mode setting, press the ENTER/PROGRAM key.

Step No.	Display	Procedure
6	[BASIC, EXTENDED] PROGRAMMING MODE	Select "EXTENDED." Press the ENTER/PROGRAM key to accept the selection.
7	SELECT OPTION: (← →) LOAD STORED PROGRAM	Press ENTER to access the Load Stored Program configure option.
8	LOAD PROGRAM [#1, #2, #3, NONE]	Select the number of the program you want to load. Select "NONE" when you do not want to load a program.
9	SELECT OPTION: (← →) SAVE CURRENT PROGRAM	When the sampler has loaded the program, it will display the next configure option. When you are done configuring the sampler, press EXIT PROGRAM to return to Standby.
10	. . . STANDBY . . . 10:37:23 19-JUN-91	After the sampler is properly installed, press the START SAMPLING key to run the program.

SAVE CURRENT PROGRAM

The Save Current Program option allows you to assign up to three sampling routines a number and store them. This option eliminates the need to reprogram the sampler for recurrent routines. Only the program settings are saved; if different routines require different configurations, the sampler must be reconfigured for each routine. For example, if the sampler is used at two sites, each requiring a specific sampling routine and different suction line lengths, the sampling routines can be stored for each site, but the suction line length settings must be reentered each time the line changes. (Display #260).

The sampler is shipped from the factory with four programs: the current program and three stored programs, numbered from 1 to 3. All four programs contain the factory default program settings. Saving a program will replace the default program with the current settings. Reinitializing the sampler will restore the default program settings. The default program settings are listed in **Table 7,** on page 55.

Note: saving a program will overwrite a program saved earlier under the same number. Settings for the current program can be viewed with the Display Status procedure. Refer to *Display Status,* on page 91.

Example 9 Saving a Current Program

Step No.	Display	Procedure
1	. . . STANDBY . . . 10:34:50 19-JUN-91	Press ENTER/PROGRAM to access the interactive state.
2	[PROGRAM, CONFIGURE] SAMPLER	Access the configure sequence by selecting "CONFIGURE."
3	SELECT OPTION: (← →) SET CLOCK	Press the LEFT ARROW or RIGHT ARROW key to scroll through the configure options. The first option displayed is the Set Clock configure option.
4	↓ ↓	
5	SELECT OPTION: (← →) PROGRAMMING MODE	You can save the current program only when the sampler is configured for the extended programming mode. To verify the programming mode setting, press the ENTER/PROGRAM key.

Step No.	Display	Procedure
6	[BASIC, EXTENDED] PROGRAMMING MODE	Select "EXTENDED." Press the ENTER/PROGRAM key to accept the selection.
7	SELECT OPTION: (↑ Æ) LOAD STORED PROGRAM	Press the RIGHT ARROW key to skip the Load Stored Program configure option.
8	SELECT OPTION: (← →) SAVE CURRENT PROGRAM	Press the ENTER/PROGRAM key to access the Save Current Program configure option.
9	SAVE PROGRAM AS [#1, #2, #3, NONE]	Select the number you want to use as the program "name." Select "NONE" when you do not want to save a program. When the sampler has saved the program, it will display the next configure option. When you are done configuring , press EXIT to return to Standby.
10	...STANDBY... 10:37:23 19-JUN-91	When the sampler is properly installed, press the START SAMPLING key to run the program.

Flow Mode Sampling

The Flow Mode Sampling option is used to direct the sampler to take a sample at key times in a flow-paced sampling program. The Flow Mode Sampling option has two settings. The first setting directs the sampler to take a sample at the start time. The second directs the sampler to take a sample at the switch times (when the bottle set changes are based on time). Both settings of the option are disregarded in STORM sampling routines. (Display #40).

Sample at Start Time

If you select "YES," the first sample will be taken at the start time. If you select "NO," the first sample is delayed until the number of flow pulses, set in the program sequence, have been counted. (Display #270).

Sample at Time Switch

If you select "YES," the sampler will switch to a new bottle or set, take a sample, and reset the flow pulse count. The next sample will occur after a full pulse countdown. If you select "NO," the sampler will take no samples at the switch time and will not reset the pulse countdown. The switch will occur in the middle of a pulse countdown and the first sample will be deposited in the new bottle or set when the countdown is completed. (Display #271).

Nonuniform Time

The Nonuniform Time option specifies the method in which nonuniform intervals are to be entered in the program sequence (Display #'s 26 or 27). If you select "clock-time," you will be able to enter a specific time and date for each sample event. If you select "MINUTES," you will be able to enter nonuniform intervals in minutes. Nonuniform times are not available in a STORM sampling routine. (Display #280).

Calibrate Sampler

The Calibrate Sampler option is used to add the calibration sequence to the program sequence. If you select "ENABLE," the calibration sequence will be added to the program sequence and you will be able to precisely calibrate the sample volumes. (Display #290)

Sampling Stop/Resume

The Sampling Stop/Resume configure option allows you to add stop and resume settings (Display #'s 100, 101, and 102) to the Key Time section of the program sequence. You can enter up to 24 times: 12 stop times and 12 resume times. For example, the Stop/Resume option allows you to define a sampling routine which will take samples at intervals of 15 minutes between 6:00 AM to 8:00 AM and between 4:00 PM to 6:00 PM. Sampling Stops and Resumes are not available in a STORM routine.

When you are using a time-switched sampling routine which includes stops and resumes, the sampler will reset the time-switch interval at each resume time. For example, if a routine with time-switches every hour is programmed for stop and resume times, the first time-switch would occur one hour after the resume time; switches would repeat every hour until a stop time occurred or the routine was completed. See **Example 10,** on page 74.

There are two other settings which direct the sampler to take samples at stop or resume times.

Enable/Disable

Select "ENABLE" to add the stops and resume settings to the program sequence. (Display #300).

Sample at Stop

The Sample at Stop setting directs the sampler to take a sample at stop times. (Display #301).

Sample at Resume

The Sample at Resume setting directs the sampler to take a sample at resume times. (Display #302).

START TIME DELAY

The Start Time Delay option is used to set the amount of time in minutes, between the time you press the start sampling key and the time the sampling routine is initiated. The sampler's response varies according to specific entries: "0," "1," and entries greater than 1.

--- MINUTE DELAY TO START (0 - 9999)

Display #310

An entry of "0" eliminates the delay to start time; the start time occurs the moment you press START SAMPLING. For example, if you press START SAMPLING at 10:32:15, the sampler will initiate a time-paced sample event at 10:32:15.

However, the sampler will start clocking time intervals at the beginning of the minute (HH:MM:00) of the first sample event. If a sampling routine requires 10 minute intervals and you pressed start sampling at 10:32:15, the sampler would begin the time interval at 10:32:00. It would initiate the second sample event at 10:42:00. The sampler would begin the flow interval at 10:32:15 for flow-paced routines.

If you enter a start time delay of "1," the sampler will begin the routine at the beginning of the next minute. Thus, if you pressed start sampling at 10:32:15, the sampler would initiate the sample event at 10:33:00. The sampler would begin time and flow intervals at 10:33:00. If you enter a start time delay of "2," the sampler would begin time or flow intervals at 10:34:00. (Display #310).

Note: If you enter a start time, the sampler will disregard the start time delay. The sampler will use the start time delay setting when you do not enter the start time in the program sequence. Care must be taken when using a start time delay of greater than zero when the sampler is being inhibited by another sampler or by a Liquid Level Actuator. Refer to *Enable Pin*, on page 51.

ENABLE PIN

The Enable Pin option allows you to program the sampler's response to a device controlling pin F of the sampler's flow meter connector: for example, the Model 1640 Liquid Level Actuator. Samplers configured for refrigerated sampling have four Enable Pin setup options: Sample Upon Disable, Sample Upon Enable, Reset Sample Interval, and Inhibit Countdown. The sampler disregards the Enable Pin configure option setting when running a STORM routine. Each of these options is discussed below.

Sample Upon Disable

When you are using a flow meter, a Liquid Level Actuator, or like device, "SAMPLE UPON DISABLE?" allows you to direct the sampler to take a sample as soon as the sampler is disabled through pin F. A response of "YES" will cause the sampler to take a sample when the pin is disabled; a response of "NO" will prevent the sampler from taking a sample at that time. (Display #321).

Sample Upon Enable

When you are using a Liquid Level Actuator or like device, "SAMPLE UPON ENABLE?" allows you to direct the sampler to take a sample as soon as the sampler is enabled through pin F. A response of "YES" will cause the sampler to take a sample when the pin is enabled; a response of "NO" will prevent the sampler from taking a sample at that time. (Display #322).

Reset Sample Interval

"Reset Sample Interval" is used to control the time or flow pulse countdown. If you select "YES," a full sample interval will begin when pin F is enabled. If you select "NO," the interval will not be reset when the sampler is enabled; the interval is then governed by settings entered in the "INHIBIT COUNTDOWN?" option. If you are sampling on a time-paced basis and wish to synchronize all sampling with real time, do not reset the sample interval. (Display #323).

Inhibit Countdown

"INHIBIT COUNTDOWN?" is only applicable when you respond "NO" to "RESET SAMPLE INTERVAL?" The Inhibit Countdown option is used to control the countdown while the sampler is inhibited. Select "YES" to freeze the countdown to the next sample. The count will resume when the sampler is enabled. Select "NO" to allow the countdown to continue while the sampler is disabled. (Display #324).

The sampler determines an enable or disable condition by monitoring the voltage on pin F. High voltage is interpreted as an enable signal. Low voltage or ground is interpreted as a disable signal.

A sampler which has been inhibited while running a routine will move to the next bottle set when enabled if at least one sample volume has been deposited in the current bottle set. This is true for both time-switched and count-switched routines, and for bottles sets composed of one or more bottles.

A sampler which has been inhibited while running a time-switched routine will advance to the next bottle or bottle set, regardless of the number of time-switches that elapse while the sampler is inhibited. In other words, if the bottle sets were to be switched every two hours and the sampler has been inhibited for six hours, the recommenced routine will begin with the next bottle set. The routine may not continue with the bottle set that would have been used had the sampler not been inhibited.

Event Mark

The Event Mark option configures the sampler to send an event mark to an interfaced flow meter or other equipment. The sampler will supply a variable duration pulse of up to 700 mA at 12 V on pin E of the flow meter connector. Four types of signals can be sent: a pulse at the beginning of the pre-sample purge, a pulse at the beginning of forward pumping only, continuous during the entire pump cycle, and continuous during forward pumping only.

The event mark includes a signal sent on pin D which is interpreted and recorded by an Isco flow meter as the bottle number(s) for the sample event. The bottle number signal consists of a number of 100 millisecond, 12 V pulses which equal the bottle number; i.e., four pulses represent bottle 4, twenty pulses for bottle 20.

The type of signal selected from the Event Mark configure option affects both the event mark signal on pin E and the bottle number signal on pin D.**Figure 22,** on page 53 diagrams the signals during a sample event cycle according to the selection made in the option. The figure shows three sample volumes being delivered (to bottles 1, 2, and 3) at the sample event. In **Figure 22 (A)**, a pulse signal is sent at the beginning of the pre-sample purge and only the first bottle number of the bottle set is sent to the flow meter. In **Figure 22 (B)**, a pulse signal is sent during the sample volume delivery portion of the sample event. Since three sample volumes are delivered, three pulses are sent to the flow meter and three bottle number signals are sent. In **Figure 22 (C)**, a continuous signal is sent during the entire pump cycle; the bottle numbers are sent as shown. In **Figure 22 (D)**, three continuous pulses are sent for the duration of each sample volume delivery and three bottle number signals are sent.

Continuous/Pulse Signal

The Continuous/Pulse setting is used to select either continuous or pulse signals. Pulse signals are three seconds in duration; continuous signals are three seconds or longer and depend on the setting and the pump cycle. (Display #330).

Pump/Cycle Forward Pumping

The Pump Cycle/Fwd Pumping settings will appear when you have selected "CONTINUOUS." Select "PUMP CYCLE" when you want a continuous signal transmitted during the entire pump cycle, from the beginning of the pre-sample purge to the end of the post-sample purge. Select "FWD PUMPING" when you want a continuous signal transmitted while the pump is delivering a sample volume. A signal is transmitted for each bottle when the sampler is programmed for more than one bottle per sample. (Display #331).

Pulse Signal Timing

The Pulse Signal setting will appear when you have selected "PULSE." Two options are available. The first option, "PURGE," is used to send a pulse at the beginning of the pre-sample purge. The second option, "FWD PUMPING," is used to send a pulse at the beginning of the sample delivery when the pump is running forward. (Display #332).

Purge Counts

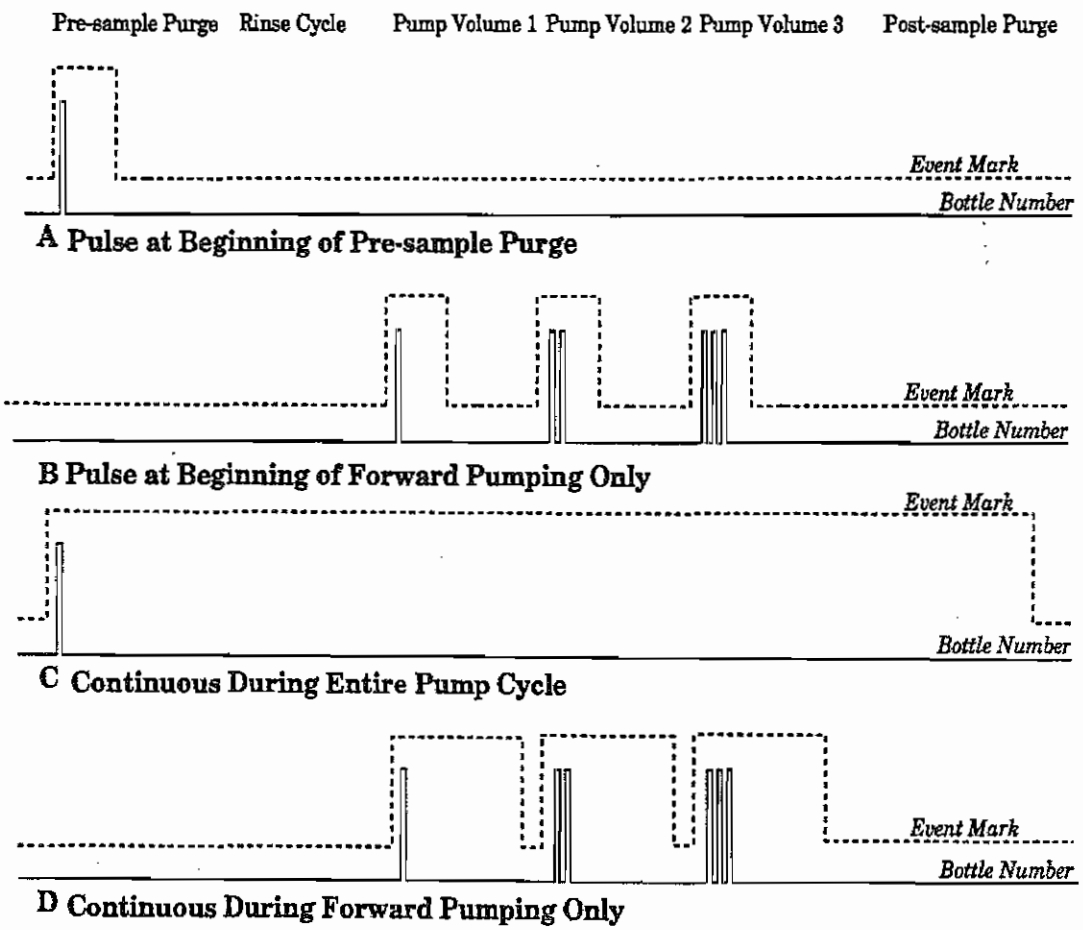
The Purge Counts option is used to override the number of pump counts needed to clear the suction line in both pre-sample purge and post-sample purge cycles. The pre-sample purge count is normally set to 150 counts and will be reset to this value if the sampler is re-initialized. The post-sample purge count is derived from the suction line diameter and length settings.

If your observations indicate that a greater or lesser number of pump counts in either purge is needed, you can change the count settings. Acceptable entries are between 0 and 9999 for both purges. A purge count can be obtained using the PUMP FORWARD or PUMP REVERSE keys; refer to section 3.3. (Display #'s 340 and 341).

TUBING LIFE

The Tubing Life option is used to set the number of pump counts needed to trigger the "Replace Pump Tubing" warning. You must reset the pump counter after replacing the pump tubing. The warning will be activated when the pump count reaches the entered value. If you consistently experience a tubing failure at a pump count that differs significantly from the current setting, enter that value here. The factory set value of 500,000 pump counts will deliver approximately 500 samples of 200 ml each, using a ⅜ inch x 10 ft vinyl suction line and a 5 ft suction head. (Display #350, 351, and 352).

Figure 22 Event Mark and Bottle Number Signal Output



PROGRAM LOCK

The Program Lock option allows you to protect program and configure settings with a pass-number. Select "ENABLE" to turn the protection on. When the Program Lock is enabled, each protected display can be viewed, but no values can be changed without first entering the pass-number: 3700. Once the pass-number has been entered, you can change any value or setting in either the program or configure sequence. (Display #360).

SAMPLER ID

The Sampler ID option allows you to enter a 10 character ID for the sampler. The ID number is used to identify sampling reports produced by the Isco Field Printer and in files created by SAMPLINK. The sampler is shipped from the factory with 10 dashes (-) entered for the ID. (Display #365).

Acceptable Characters

The ID field will accept digits, dashes, spaces, and periods. You can enter spaces, dashes, and periods with three of the control keys. Enter a space with the START SAMPLING key, a dash (-) with the manual SAMPLE KEY, and a period with the RESUME SAMPLING key.

Run Diagnostics

Run Diagnostics is used to perform a number of diagnostic functions. This option contains the software revision number; tests the sampler's RAM, ROM, display, distributor, and pump; and allows for re-initializing RAM. The display information is discussed below in the order of appearance.

Software Revision Number

The sampler will display the software revision number for a short period of time.

Test RAM and ROM

The software revision display is replaced by the RAM and ROM test messages. A successful test is indicated by the messages "RAM PASSED TEST" or "ROM PASSED TEST." If either the RAM or ROM fail the test, the sampler will display one of the following messages: "RAM FAILED TEST" or "ROM FAILED TEST" and beep every three seconds until you turn the sampler off. If either the RAM or ROM fail their test, the sampler should be serviced. Contact Isco Customer Service for instructions on returning the sampler. Contact Isco Customer Service for assistance: (800) 228-4373.

LCD Test

After successful RAM and ROM tests, the sampler will then test the LCD by first filling the display with solid rectangles and then printing the alphabet and other characters. Each character position in the display should contain a character.

Pump Test

The next step tests the pump. During the test, the pump will run briefly and the display will indicate an "OFF/ON" number. The number should fall within the range of 50 to 200. If the count falls below 50 or exceeds 200, the pump should be serviced. A count near 100 is typical.

Distributor Test

Following the pump test, you can test the distributor. If you elect to test the distributor, the sampler will move the distributor to position 24, then return it to position 1. The positions are indicated on the display. If the message, "DISTRIBUTOR JAMMED" is displayed; check the routing of the pump tubing and the bottles in the tub. If the tubing and bottles are correctly positioned, the distributor drive mechanism may need servicing. (Display #370).

Re-initialize Controller

The final step allows you to re-initialize the sampler. If you select "NO," the sampler will return to the configure option list. If you select "YES," the sampler will reset a number of configuration and program settings, then turn the sampler off. (Display #371).

Table 6, on page 54 and **Table 7,** on page 55 list the re-initialized settings. Note: not all settings are reset. Set Clock, Bottles and Sizes, and Suction Line configure option settings remain unchanged to minimize the settings you would need to change if the sampler were accidentally re-initialized. The Pump Count total is not reset to maintain an accurate count for the Tubing Life Warning.

Exit Configuration

This option allows you to leave the configure sequence and return to the standby state. There are no input displays. Press the ENTER/PROGRAM key to exit the configure sequence. The configuration sequence can also be exited at any time using the EXIT PROGRAM key.

Table 6 Factory Configure Option Settings

CONFIGURE OPTION	DISPLAY NO.	FACTORY SETTING
SET CLOCK	210	Not Reset
BOTTLES AND SIZES	220,221,222,223	Not Reset
SUCTION LINE	230, 231, 232	Not Reset
LIQUID DETECTOR		
LIQUID DETECTOR	240	ENABLE
RINSES	241	0
ENTER HEAD MANUALLY	242	NO
# OF RETRIES	243	0
PROGRAMMING MODE	250	BASIC
LOAD STORED PROGRAM	255	
SAVE CURRENT PROGRAM	260	
FLOW MODE SAMPLING		
SAMPLE AT START TIME	270	NO

CONFIGURE OPTION	DISPLAY NO.	FACTORY SETTING
SAMPLE AT SWITCH TIMES	271	NO
NONUNIFORM TIME	280	Minutes
CALIBRATE SAMPLER	290	DISABLE
SAMPLING STOP/RESUME	300	DISABLE
SAMPLE AT STOP TIMES	301	NO
SAMPLE AT RESUME TIMES	302	NO
START TIME DELAY	310	2
ENABLE PIN		
SAMPLE UPON DISABLE	321	NO
SAMPLE UPON ENABLE	322	NO
RESET SAMPLE INTERVAL	323	NO
INHIBIT COUNTDOWN	324	NO
EVENT MARK		
CONTINUOUS/PULSE	330	CONTINOUS SIGNAL
PUMP CYCLE/FORWARD ONLY	331	FWD PUMPING ONLY
PURGE COUNTS		
PRE-SAMPLE COUNTS	340	150
POST-SAMPLE COUNTS	341	BASED ON LINE LENGTH
TUBING LIFE		
RESET PUMP COUNTER	351	NO
# PUMP COUNTS	352	Not Reset
PROGRAM LOCK	360	DISABLE
SAMPLER ID	365	Not Reset
RUN DIAGNOSTICS		

Table 7 Factory Program Sequence Settings

PROGRAM SETTING	DISPLAY NO.	FACTORY SETTING
[TIME, FLOW, PACED] SAMPLING	10	TIME
UNIFORM/NONUNIFORM TIME INTERVALS	11	UNIFORM
[TIME, FLOW, STORM] PACED SAMPLING	12	TIME
-- MINUTE DELAY TO FIRST TIMED SAMPLE	15	0 MINUTES
[DURING, AFTER] TIME MODE	16	DURING
SAMPLE EVERY -- HOURS, -- MINUTES	21	1 HOUR 0 MINUTES
SAMPLE EVERY ---- PULSES (1 - 9999)	22	10
TAKE -- TIMED SAMPLE EVENTS (1-MAX)	23	1

PROGRAM SETTING	DISPLAY NO.	FACTORY SETTING
SAMPLE INTERVALS OF --MINUTES (1-99)	24	60
TAKE --- SAMPLES (1 - MAX)	25	10
QUANTITY AT INTERVAL 1. -- AT --- MINUTES	27	1 AT 60 MINUTES
-- BOTTLES PER SAMPLE EVENT (1 - 24)	30	1
-- SAMPLES PER BOTTLE (1-MAX)	31	1
MULTIPLEX SAMPLES? [YES, NO]	35	NO
[BOTTLES PER SAMPLE, SAMPLES PER BOTTLE]	36	SAMPLES PER BOTTLE
CHANGE BOTTLES BASED ON [TIME, SAMPLE]	40	COUNT
CHANGE SETS BASED ON [TIME, SAMPLE]	41	COUNT
CHANGE BOTTLES EVERY -- HOURS, -- MINUTES	42	2 HOURS 0 MINUTES
CHANGE SETS AFTER -- HOURS, -- MINUTES	43	2 HOURS 0 MINUTES
CHANGE BOTTLES AFTER -- SAMPLES	44	1
CHANGE SETS AFTER SAMPLES	45	1
SAMPLE CONTINUOUSLY? [YES, NO]	48	NO
SAMPLE VOLUMES OF --- ml EACH (10 - MAX)	50	200
--- COMPOSITE SAMPLES (0 - MAX)	60	10
SUCTION HEAD OF -- FEET (1 - MAX)	70	10
ENTER START TIME? [YES, NO]	90	NO
STORM ENABLED AFTER HH:MM MM/DD	93	
ENTER FIRST SWITCH TIME? [YES, NO]	95	NO
-- STOP or RESUME TIMES (0 - 24)	100	0
MAX FLOW INTERVAL OF -- HOURS, --MINUTES	110	2 HOURS 0 MINUTES

Extended Programming Mode

All sampling capabilities available in the basic programming mode are available in the extended programming mode; a listing of the capabilities is placed in **Table 5,** on page 46. The extended programming mode provides several additional capabilities: Nonuniform Time pacing, an additional multiplexing scheme (multiple bottle compositing), Sampling Stops and Resumes, program storage, etc.

The procedure used to program the sampler in the extended mode is the same as the procedure used to program the sampler in the basic programming mode. This procedure is outlined in *Basic Programming Mode Introduction,* on page 27. (To avoid duplication, the programming procedure is not repeated here.) There are some exceptions, however. The extended mode modifies the sections of the program sequence to allow you to take advantage of the additional features. The Sample Pacing section is extended to include settings for nonuniform times. The Sample Distribution section is modified to allow you to program the sampler for multiple bottle compositing. The procedure and displays used to program the sampler for bottles-per-sample and samples-per-bottle multiplexing, and sequential sampling are somewhat different. The section is also extended to allow you to switch multiplexed bottles or bottle sets after programmed periods of time. (With the extended mode, you can still switch bottles after a programmed number of samples have been deposited.) The Key Times section is extended to allow you to enter the time of the first bottle or bottle set change. If you have enabled the Sampling Stops and Resumes configure option, it will also include displays for sampling stops and resumes.

Each of these extended features is discussed briefly below. You may find it helpful to refer to **Figure 23A,** on page 59 which charts the program sequence in the extended mode.

Extended Mode Sample Pacing

In the extended programming mode, the Sample Pacing section allows you to select one of two types of time-pacing: uniform or nonuniform time intervals. Uniform time intervals are identical to the time intervals entered in the basic programming mode. Nonuniform times allow you to pace the sampler at irregular intervals. You can enter nonuniform intervals in two ways. The first method allows you to define the interval between each sample event in minutes. For example, you can program the sampler to take sample #2 after an interval of 10 minutes, sample #3 after an interval of 30 minutes, sample #4 after an interval of 60 minutes, and so on. Sample #1 would be taken at the start time. The second method allows you to enter a specific time and date for each sample event. For example, with nonuniform time pacing, samples can be collected at specific times and dates at irregular intervals: 6:00 AM on April 15, noon on April 15, 7:00 AM on April 16, and 1:00 PM (or 13:00 in military time) on April 16. If you have several sequences of nonuniform times, you can use the program storage feature to save the programs using each sequence.

Extended Mode Sample Distribution

The extended Sample Distribution section expands the multiplexing capabilities of the sampler. Both the bottles-per-sample and samples-per-bottle multiplexing are available; however, the procedure used to program them differs slightly from the procedure used in the basic programming mode. **Example 12,** on page 78 illustrates the bottles-per-sample multiplexing procedure; **Example 11,** on page 76 demonstrates the procedure used for samples-per-bottle multiplexing. The extended mode also offers multiple bottle compositing; refer to **Example 13,** on page 80.

In the extended programming mode, you can switch bottles or bottle sets after a programmed time period elapses or after a programmed number of samples have been deposited.

The displays used to specify the type of switches are shown in the Sample Distribution section of **Figure 23A,** on page 59. Display #40 allows you to select either "TIME" or "SAMPLES." If you select "TIME," the bottles can be changed after a programmed period of time.

If you select "SAMPLES," the bottles can be switched after a programmed number of samples. In Display #41, which allows you to switch bottle sets, you can select either "TIME" or "SAMPLES/BTL." If you select "TIME," the bottle sets can be changed after a programmed period of time. If you select "SAMPLES/BTL," the bottle sets can be changed after a programmed number of samples. You can use select either "TIME," "SAMPLES," or "SAMPLE/BTL" settings with both time- and flow-paced sampling.

Extended Mode Sample Volumes

The extended mode Sample Volumes section is identical to the Basic Mode Sample Volume section.

Extended Mode Key Times

The extended mode Key Times section has two additional sets of displays which allow you to specify the time of the first bottle or bottle set change and to set up the sampling stop and resume times.

First Switch Time

The first switch time displays will appear only when you have specified bottle or bottle set changes based on time in the Sample Distribution section. If you select "TIME" rather than "SAMPLES/BTL" in the "CHANGE SETS BASED ON [TIME, SAMPLES/BTL]" display, you first will be asked if you want to enter a setting for the first switch time. If you respond "YES," you will be asked for the time of the first bottle or set change.

The first switch time setting allows you to control the times of each bottle switch without delaying the routine and thereby missing samples. For example, if you have programmed the sampler for time switches every hour and you want the switches to occur on the hour, you can set the time of the first switch at the next even hour, start the sampling routine early, and deposit samples in the first bottle set until the first switch time. At the first switch time, the distributor moves to the next bottle set. The first bottle set may not be completely filled; however, by starting the routine early, you can sample until the bottle switches are placed "on schedule" to avoid missing any samples. The first time switch displays are indicated by display #'s 95, 46, and 47 in **Figure 18,** on page 20.

If you do not enter a first switch time, the sampler will begin timing the switch interval from the start time for the routine and the first bottle or bottle set will receive samples for the full time period. Switch times are not available in STORM routines.

Stops and Resumes

The Stops and Resumes settings are available only when you have enabled the Sampling Stop/Resume configure option (see *Sampling Stop/Resume,* on page 50). You must first enter the number of stops and resumes, from 0 to 24. (Enter "0" if you want to omit the stop and resume settings without returning to the configure sequence and disabling the Stops and Resumes option.) Then enter the stop and resume clock times beginning with the first stop time. Refer to the Key Times section of **Figure 23A,** on page 59, display #'s 100, 101, and 102.

Start Times

This section discusses the sampler's start times. It begins by outlining the sequence of events preceding the start time for most sampling routines.

Sequence of Events Preceding Sampling Routine

After you program a sampler, you must start the sampling routine by pressing the start sampling key. However, depending on the program and configure option settings, the sampling routine may not start at soon as you press the key. The "Delay to Start Time" is the period between the time you press start sampling and the start time for the routine. **Figure 24,** on page 62 diagrams the sequence of events preceding the start time.

The start time for a routine is either the programmed start time or the time at which the delay to start time expires. The programmed start time is determined by entries made in Displays #90, #91, #92 and #93. The delay to start time is determined by the entry in Display #310 of the Start Time Delay configure option. These input displays are illustrated below. They are also illustrated in the program structure charts in **Figure 16,** on page 18 and **Figure 18,** on page 20.

Note: Unless the sampling routine contains a programmed start time (Displays #91, #92, or #93), the sampler will delay the start time according to the amount of time specified in the Start Time Delay configure option. A programmed start time entry always overrides any settings made in the Start Time Delay configure option.

Programmed Start Time displays (Program Sequence)

ENTER START TIME? [YES, NO]	Display #90.
TAKE FIRST SAMPLE AT HH:MM DD-MMM	Display #91 (time-paced sampling).
START FLOW COUNT AT HH:MM DD-MMM	Display #92 (flow-paced sampling).
STORM ENABLED AFTER HH:MM DD-MMM	Display #93 (storm-paced sampling).

Start Time Delay display (Configure Sequence)

___ MINUTE DELAY? TO START (0 - 9999)	Display #310 (Start Time Delay configure option).

Figure 23A Extended Programming Mode: Sample Pacing and Sample Distribution

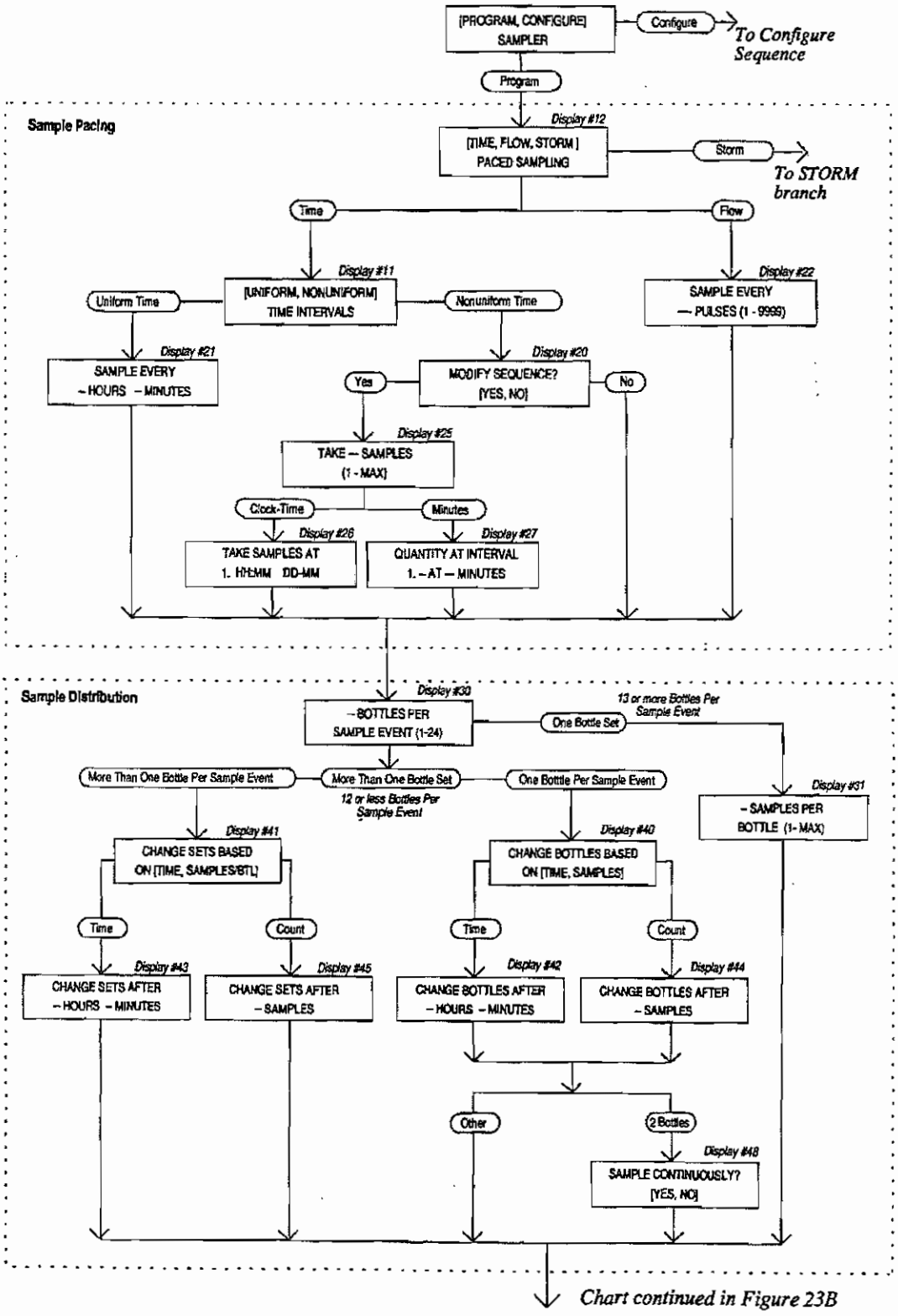


Figure 23B Extended Programming Mode: STORM Programming

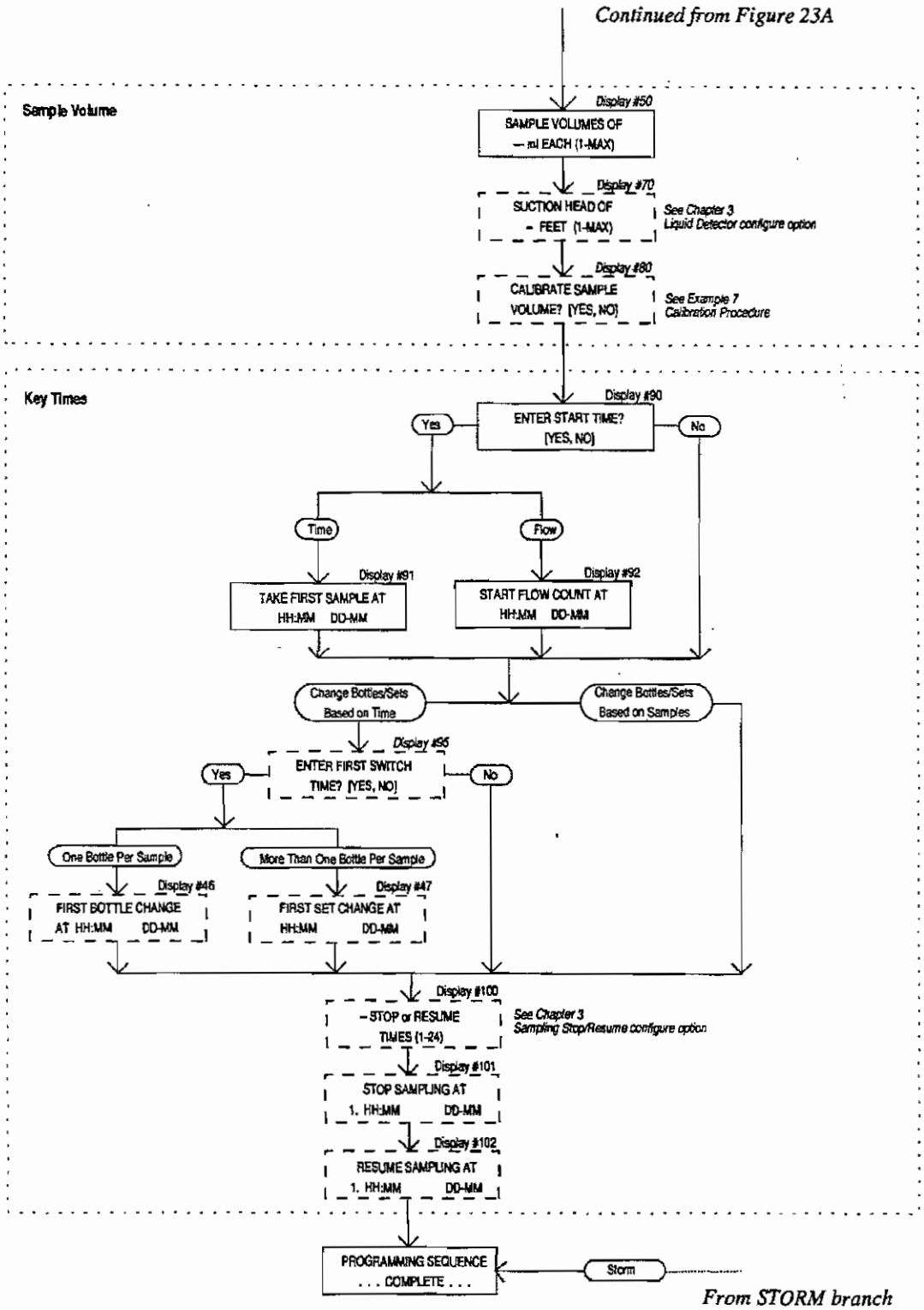


Figure 23C Extended Programming Mode: STORM Programming

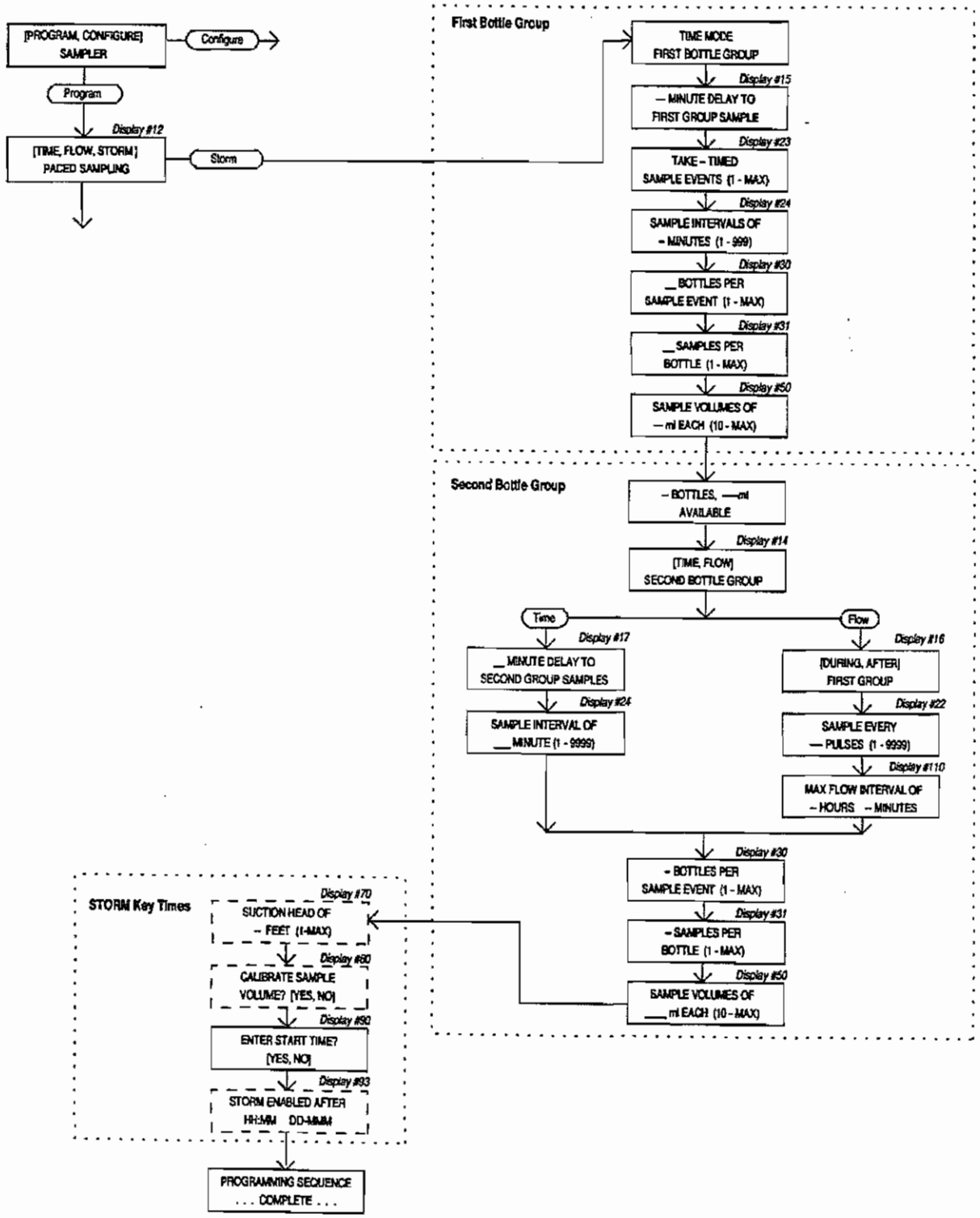
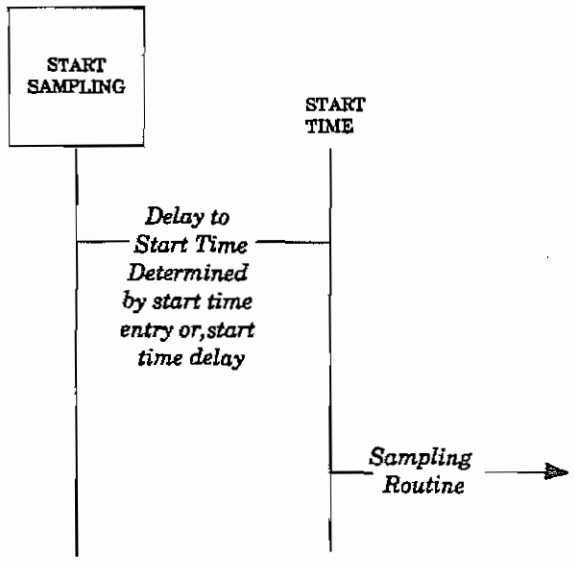


Figure 24 Simplified Start Time Diagram



Isco 3200 and 4200 Series Flow Meters and 4100 Series Flow Loggers provide two essential functions for certain sampling applications. They send flow-pacing signals — flow pulses — to the sampler for flow-paced sampling. The second function provides disable (inhibit) or enable signals to the sampler. A sampler receiving a disable signal will suspend the sampling routine until it receives an enable signal.

The sampler will disregard a disable signal received from a flow meter during the delay to start time. If the sampler is disabled when the start time occurs, it will suspend the routine until it is enabled. Once enabled, the sampler will begin the time or flow intervals. The sampler will initiate a sample event when enabled for all time-paced routines. For flow-paced routines, it will initiate a sample event when the sampler is configured to take a sample upon enable in the Enable Pin configure option (see *Enable Pin,* on page 51).

If the sampler is enabled when the start time occurs, it will begin the routine. The sampler will initiate a sample event at the start time for all time-paced routines. It will initiate a sample event at the start time for flow-paced routines when configured for sample at start time in the Flow Mode configure option (see *Flow Mode Sampling,* on page 50). Refer to **Figure 25,** on page 63. The diagram shows the sampler's response when enabled or disabled at the start time for most basic and extended mode routines.

Nonuniform Clock Times and Disable Signals

Figure 26, on page 64 diagrams the sequence of events preceding a routine programmed for nonuniform clock times. Nonuniform clock time programming allows you to enter a specific time and date for each sample event. Samplers programmed with nonuniform clock times may skip a number of samples if disabled for long periods. If the sampler is disabled and subsequently enabled, it will initiate only one event to compensate for the skipped sample events even if several sample event times have been passed.

Note: Nonuniform clock time programming is designed to replace flow-pacing when a flow meter is not available at the site. Before using a sampler programmed for nonuniform clock times with a flow meter, be sure flow-pacing is not a more appropriate application.

Manual Sample Key and Programmed Start Times

The sampler will disregard the manual sample key during the delay to start time and during the disable period. The periods where the sampler disregards disable signals (Delay to Start) and the manual sample key (when disabled) appear in **Figure 25,** on page 63 and **Figure 26,** on page 64.

Start Time Delay

Entries made in the Start Time Delay configure option affect the start times. The sampler's response varies according to specific entries: "0," "1," and entries greater than 1. *Start Time Delay,* on page 51 discusses the Start Time Delay configure option.

USFILTER WESTATES CARBON ASC-SERIES LOW PRESSURE LIQUID PHASE ADSORBERS

Benefits and Design Features

- *Rugged carbon steel construction; internally/externally welded seams*
- *SSPC-SP5 surface preparation, fusion bonded epoxy internal lining; rust preventative/urethane exterior coat. (ASC-1000/2000)*
- *Approved for the transport of hazardous spent carbon*
- *ASC-1000/2000 can be easily moved with a forklift*
- *Adapters are available to reduce the inlet/outlet to 1" FNPT (ASC-2000) and 2" FNPT (ASC-1000/2000)*
- *Cartridge and bag prefilters available*
- *ASC-1000/2000's available for rental or purchase*

Piping Manifold (Optional)

- *2"/3" sch 80 PVC piping and valves (optional carbon steel and stainless steel piping)*
- *Series or parallel operation.*
- *Clean utility water connection for manual backflush.*
- *Sampling ports and pressure gauges*
- *Flexible hoses with Kamlock fittings allow easy installation and removal during service exchange operations.*

ASC-Series Adsorbers are designed to provide uniform water flow for consistent treatment and to ensure efficient carbon usage. The ASC-Series Adsorbers can be cost effectively used in applications including:

- Groundwater remediation
- Wastewater filtration
- Pilot testing
- Leachate treatment
- Dechlorination
- Spill cleanup

Installation, Start Up and Operation

The ASC-Series Adsorbers are shipped filled with dry activared carbon that must be properly wetted and deaerated prior to use.

Your USFilter sales representative can assist with details on installation, preferred operating conditions and carbon usage calculations using our extensive isotherm database.

At the time of purchase or rental of the ASC-Series Adsorbers, arrangements should be made for the reactivarion of the spenr carbon. USFilrer Westates will provide instructions and assistance to obtain acceptance of RCRA or non-RCRA spent carbon for reactivation.

ASC-Seties Adsorbers must be drained and the inlet/outlet plugged prior to shipment. Spent carbon cannor be received until the acceptance process has been completed.

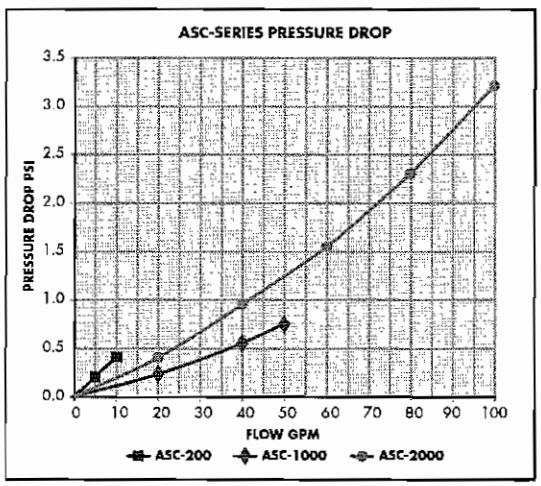
USFilter

DATA SHEET

ASC-SERIES LOW PRESSURE LIQUID PHASE ADSORBERS

SPECIFICATIONS			
	ASC-200	**ASC-1000**	**ASC-2000**
Dimensions, diameter x overall height	22" x 34"	48" x 56"	48" x 96"
Vessel Construction	Carbon Steel	Carbon Steel	Carbon Steel
Inlet/Outlet Connection	2" FNPT/2"MNPT	4" FNPT	4" FNPT
Manway	Top	18"	16"
Internal Piping	PVC	PVC	PVC
Interior Coating	Epoxy	Fusion Bonded Epoxy	Fusion Bonded Epoxy
Exterior Coating	Enamel	Epoxy/Urethane	Epoxy/Urethane
Carbon Bed Volume (cu.ft.)	6.8	34	68
Cross Section (sq.ft.)	2.6	12.3	12.3
Vessel Weight (lbs.):			
Shipping (carbon)	250	1890	3190
Operating (approx)	500	4280	7250
Flow, gpm (max)	10	50	100
Pressure, psig (max)	3	25	25
Temperature °F. (max)	140°	140°	140°
Pounds of Carbon	200	1000	2000
Contact time @ max flow/min:	5.1	5.1	5.2
Backflush rates (GPM)	15	75	75

For detailed specifications or dimensional information or drawings, contact your local USFilter Westates sales representative.



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