Attachment B5.A
Groundwater Sampling and Analysis Plan
Wayne Disposal Inc.

MID 048 090 633

Table of Contents

I. Introduction

40 CFR, Part 264.97 requires the owner or operator of a hazardous waste facility to develop and follow a consistent program of groundwater sampling and analysis procedures. The program must include procedures and techniques for:

1) sample collection;
2) sample preservation and shipment;
3) analytical procedures; and
4) chain of custody control.

Some of the wells are also subject to monitoring under the TSCA requirements of 40 CFR, Part 761.75. This document has been developed to direct the efforts of Wayne Disposal, Inc.'s (WDI) groundwater monitoring personnel and thereby meet the requirements of the rules referenced above.

II. General Description

The current groundwater monitoring system for WDI consists of 28 wells, numbered 18, 19R, 20 through 22, 23AR, 24, 25, 26A, 27A, 28 through 30, 31AR, 32, 36 through 40R and 47 though 53. Wells numbered 1A through 16, 26, 27, 31 and 41 through 46 also exist at the site but do not form a part of the groundwater monitoring sampling network for the hazardous waste management area of WDI. Wells OB-21, OB-23R, OB-24, OB-40R and OB-48 through OB-53 are also monitored under the Toxic Substances Control Act (TSCA) per conditions contained in 40CFR 761.75. Well locations are shown on Attachment A.

For Cell VI-F&G, a two-phase monitoring system will be implemented to supplement the current monitoring program. Construction of the MC VI-F&G began in with the Woodlot (MC VI-G Phase 1). During this initial monitoring phase, a line of wells were installed south of the MC VI-G, Phase I As shown on Attachment A, this set of wells is designated as OB-49 through OB-52. Well OB-51 required relocation approximately 215 feet west of the original well as part of WDI's 2019 transfer area relocation. The well was redesignated OB-51A in order to document it is a relocated well. Addtionally, observation wells W-1 and W-10S, which were installed as part of the hydrogeologic investigation, have been re-designated as wells OB-48 and OB-53, respectively and incorporated into the monitoring plan. Three of the new wells (OB-50, OB-51A and OB-52) were installed in the lower sand aquifer and one (OB-49) was installed in the bedrock.

When construction of cells south of the these wells begins, these initial phase wells will be abandoned, and additional wells will be installed (or re-designated) at the downgradient (i.e., south) side of MC 1, which will be incorporated into the Part 111 groundwater monitoring program for MC VI-F&G. This second set of wells will include existing wells OB-6, OB-8, OB-12R, and OB-13 (to be re-designated as dual Part 111/115 monitoring wells), and four new monitoring wells (OB-54, OB-55, OB-58 and OB-59).

As new wells are installed, they must be sampled four times to establish an intrawell minimum background concentration for all primary and secondary parameters prior to waste being placed in the cell (or phase of cell) that will be monitored by the new well. If possible, these four samples should be collected quarterly to provide suitable background variance. If the background samples are collected on an accelerated schedule, the background statistics should be recomputed once four samples collected quarterly are completed, assuming of course, that there is no evidence of impact by waste or waste constituents at the time.

Copies of the well logs for all of WDI's wells are included in Attachment B. As new wells are added or abandoned, Attachments A, B and E must updated and the updates submitted to the EGLE.

III. Laboratory

Analyses of samples from the wells are conducted by a contract laboratory.. Analytical arrangements and sample bottle preparation can be ordered in advance by calling the contract laboratory. Request all analyses when calling for bottles so the laboratory personnel can properly prepare the containers.

If WDI decides to contract analysis of groundwater samples to another laboratory, the change will be made only after at least two concurrent sampling/analysis events show adequate correlation of analysis results of the existing and proposed contract laboratories.

IV. Required Documentation

Documentation required for this monitoring program include:

a) A field notebook must be utilized to record all pertinent field data and sampling information during every sampling event. This must include the name(s) of sampling personnel, sample date, sample time, sample location, depth to standing water in the well, calculations for determining the volume of water to be purged from the well prior to sampling, results of any field measurements on groundwater samples and observations of sample characteristics or the sampling environment. Any odors, colors, sheens or other unusual characteristics of the samples must be described in detail. Copies of these field data notes must be included in reports sent to EGLE.

b) During each sampling event, a Monitoring Well Inspection Log must be filled out and filed with the Site Environmental Manager. A copy of this form is included as Attachment C-2. This report must be filled out to note any conditions of the monitoring wells or surrounding area that needs maintenance or repairs.

c) An equipment inventory, repair and calibration log is maintained in the Engineering Field Office. This log is used to list the inventory (by serial number) of all sampling apparatus and field measurement devices. Any changes of equipment or repairs to equipment must be noted in this log, as well as daily instrument calibrations, etc.

d) Also required for the sampling process are standard chain of custody forms from the contract laboratory used. A sample copy of this record is included herein as Attachment C-1. This sheet must be filled out fully for each sample submitted for analysis as described in Section X.

V. Standing Water Level Measurements

To obtain the an accurate measurement of static water levels for the site, 1) the levels must be obtained for all wells listed on Attachment E before any water is removed for purging or sampling, and 2) the levels must be obtained for all wells in as short a time as possible on the same day, to limit changes due to barometric pressure effects. Generally static water levels for the wells are determined at least 30 days after the wells were last sampled ensuring water levels reach static elevations.

The depth to standing water within the well casing is measured from the top of casing (TOC). The top of the well casing is exposed by removing the white plastic Well Wizard™ well heads. The surveyed point on the casing is always at the edge on the north side of the casing. Additionally, there is a permanent mark on the north side of the casing which marks the edge from which water levels are to be taken. The TOC elevations shall be surveyed at least once every two years to verify accuracy. Removal of the well head is necessary for determination of the standing water level. The depth to water is measured using an electric water level indicator. Attachment D describes the operating procedures for the water level indicator, which is used for this purpose.

When using the water level indicator, make certain that the probe and submersed portion of the cable are cleaned with distilled water and a clean cloth, followed by a distilled water rinse. This prevents cross contamination between wells. Lower the probe into the casing slowly while watching for the light. Carefully determine the water level by raising and lowering the probe at the water surface, and monitoring the light and buzzer. Record the distance from the point on the cable at TOC to the nearest marking on the cable within the well casing. The markings on the cable are scaled in 0.01 foot intervals. Record the measurement to the nearest 0.01 foot. The depth to standing water is then the distance from the probe tip at the water level to the marking on the cable. Record this depth in the field notebook.

VI. Well Purging

Before purging a well, it is necessary to determine the quantity of water contained within the well casing. This is done by subtracting the depth to standing water from the depth to the well screen. The depth to standing water must be determined just prior to beginning sample collection. The depth to the well screen for each existing well is listed on Attachment E. The difference between depth to the bottom of the screen and depth to water level is the height of water standing within the well. Multiply this height of water by 0.17 gallons per foot (for 2 inch diameter well casing). Multiply that product by 3, the number of standing volumes to be purged, which is the minimum recommended by EGLE. The resultant product is the total quantity to be purged from the well, in gallons. Once again,

Amt. purged (in gallons) = (Ht. of standing water) x 0.17 x 3

Record these calculations in the field notebook.

The depth to the well screen should be confirmed by removing the dedicated pump assemblies and lowering the water level indicator probe to the very bottom of the well casing for a determination of the clear depth of the well (make sure that the indicator cable is cleaned between each well). Well depths should be checked if a change in well yield or sample appearance (i.e. turbidity) is noted. A change in well yield is identified by an increase in the time it takes to complete the purging process compared to the wells historical performance. If the purge time increases by 25% compared to normal the well should be sounded to make sure that it is not due to silting-in. If the water after purging is completed is cloudy or siltier than the normal appearance, then this also may be indicative of silting in and the well should be sounded. If there is evidence of silting in based on the sounding the well will need to be redeveloped or possibly replaced. When sounding a well it is very important to ensure that the pump and tubing are kept clean when removed from the well (i.e. do not place equipment on ground, rather, wrap in plastic sheeting).

Once three standing well volumes have been removed, measure and record the pH and specific conductance of the water coming from the well. Continue to record these values at a rate of once every 10 minutes. After three values of pH and specific conductance have been obtained in this manner, compare the highest and lowest values. If the difference between the highest and lowest pH value is 0.07 su or less, then the well is considered stabilized with respect to pH. If the difference between the highest and lowest specific conductance values is 18 µmhos/cm or less, then well stabilization with respect to this parameter is considered complete. If the difference between the highest and lowest values for either parameter exceeds this criteria, pump the well another 10 minutes and recheck both parameters. Perform the comparison again, using only the last three monitored values of pH and specific conductance. Once the criteria are satisfied for any three consecutive monitored values of both pH and specific conductance, then consider the well fully stabilized and proceed with sampling. Measure and record well water temperature at this time as well. Record in the field notebook all the data obtained to establish well stabilization. In the cases where an individual well cannot be purged to stabilization in a manner described above because the well becomes fully dewatered, then sample the well after completely dewatering (evacuating) the well four times. For each sampling event, the second, third and fourth well evacuations should be performed within three days of the previous well evacuation. Sampling should be accomplished as soon after the fourth well evacuation as possible, depending upon the rate at which the water level in the well recovers. Measure and record pH, specific conductance and temperature in the field at the time the sample is obtained from such a well. Fully record in the field notebook all instances of well evacuation.

At this time all wells are outfitted with the "Well Wizard"^{TM} system of dedicated pumps. This means that each well has a submersible pump within it, with the pump intake generally located within the screened interval. The control unit and cylinders of compressed nitrogen (or another source of compressed gas needed to operate the pumps) are the other components that complete this system. Because sampling immediately follows the purging step in nearly all cases, the

sampling box (if used) must be prepared during well purging. The sample box is discussed in greater detail in the Sample Collection portion of this document.

Prior to a sampling round for the wells, replace the sampling box discharge tube. To set up the Well Wizard™ system for operation, connect the nitrogen cylinder hose or other source of compressed gas to the supply port on the controller unit. Connect one end of the coiled tubing within the controller unit to the Drive Air Out port on the unit, and the other end to the smaller of the two ports on the well head assembly. If using the sampling box, connect the water sample line from the larger of the two well head ports to the back of the sampling box. Make certain that the valve on the rear of the box directs flow out of the box and through the discharge tube, until well purging is completed.

To initiate purging, begin the flow of nitrogen or other compressed gas into the controller. Measure the quantity of water purged from the well using a bucket with known volume and marked with gradations kept with this equipment. Note that all purged water should be discharged on the ground away from the well. Do not allow the purged water to re-enter the well or the well protective casing nor should you allow ponding of the water around the well. Further background on Well Wizard™ operation can be gained by referring to Attachment F. Report any problems with equipment function to the Site Environmental Manager.

VII. Sample Collection

Upon completion of the well purging step, or upon return to a well which has been evacuated four times for purging, you are ready to take samples. Make sure each sample bottle for a given monitoring well has a label (affixed by the analytical laboratory personnel) which contains our facility name, the monitoring well number, the date and the sampler's initials. If a preservative has been included by the laboratory, such a note should appear on the label.

In the past sampling programs, it has been shown that airborne artifacts from disposal operations and engine exhaust can affect the number of detected constituents and their concentrations within groundwater samples. For this reason, a controlled-atmosphere sampling box was constructed and used for use in the collection of groundwater samples. Nitrogen, under positive pressure, is used as the sampling atmosphere within the box, thereby minimizing the probability of impacts to sample quality by airborne artifacts. As site operations have progressed, most of the samples can now be collected at a safe distance from active landfill operations and the use of the sampling box is optional for those locations.

If the sampling box is used, prepare for sampling by connecting the nitrogen cylinder to the sampling box and purge the box atmosphere with nitrogen for 20 to 30 minutes. Make certain that all sample bottles to be used at a given location are placed within the box prior to purging the box atmosphere. Remove the caps from the bottles during the purging process to expose the interior of the bottles to the nitrogen environment. A new laboratory grade tygon tube connecting the wellhead to the sampling box or the area where the bottles are filled must be used for the collection of samples from each location. When using the sample box, turn the valve on the rear of the sampling box, diverting the flow of water from the discharge tube to the sampling tube within the box.

If the sampling box is not used, set the sample bottles on a clean surface and leave the caps on until the bottle is opened for filling. An air compressor is used instead of nitrogen. Ensure that the compressor is stationed downwind and as far as practicable from the well. It is important to note atmospheric conditions such as wind-blown dust and odors in the field notebook when sampling outside the box. If the sampling vehicle is nearby the engine should be off or downwind of the sampling area during sampling. A new laboratory grade Tygon^{TM} tube connecting the wellhead to the area where the bottles are filled must be used for the collection of samples from each location.

Samples for volatile organic compounds will be filled first. No headspace is permitted in the small glass vials. Make certain not to touch the inside of bottle necks or caps with your hands. Next, fill the bottles for total organic carbon, total phenolics, metals and then other miscellaneous parameters, in this order. Fill each sample bottle to the very top and allow minimal headspace (air bubbles when capped and tipped) and take care not to spill any of the preservatives. Record the number and type of samples taken and the time of sampling on the chain of custody record.

Trip blanks (VOC vials filled with laboratory "clean" water) shall accompany the sample containers every day that samples are collected. A trip blank is provided by the laboratory for each batch of sample bottles (usually one for each cooler). These remain unopened throughout the sampling day and are submitted with the sample bottles. A field blank shall also be collected at each well sampled. A field blank is an empty (except for preservative) VOC vial that is opened in the nitrogen sampling box (if used) or the atmosphere and filled with laboratory provided "clean" water while that well is being sampled. The purpose is to replicate the sampling environment in all ways except for the source of water in the container. Both kinds of blanks should be preserved, handled and shipped exactly as the well samples are. All of the trip blanks and a minimum of one field blank for each ten samples will be analyzed on a random basis for the primary parameters. However, if a positive result for any primary parameter is noted in a given well, the matching field blanks must be analyzed for the offending parameter(s). A complete replicate sample shall be obtained from one well, chosen randomly and labeled with an X, during each sampling round and will be analyzed for the same parameters as the sample it replicates.

VIII. Sample Preservation and Shipments

Attachment G is a tabulation of sample preservation procedures. The samples must be preserved in accordance with the procedures outlined in this attachment. For all samples the laboratory provides clean, pre-preserved bottles (where necessary). Samples to be analyzed for dissolved metals must be field filtered with a 0.45 μm in-line filter cartridge and preserved with a couple of drops of reagent grade HNO_3 to a pH of less than 2.

When the sample collection step is completed, open the sampling box, transfer all sample bottles to a cooler and pack the cooler with ice. Make sure that after each well sampling is completed that the tubing for the sampling box, is replaced with new tubing and the chain of custody record is completed.

All collected samples and blanks must be stored in a secure location until delivery to the contract laboratory personnel. This means within sight of sampling personnel or locked in a secure location. Chain of custody records must accompany the samples at all times. The handling of these forms is covered in the Chain of Custody Control portion of this document.

IX. Analytical Procedures

The parameters to be tested for as part of the monitoring program for the uppermost aquifer wells are shown in Attachment H.

Specific analytical procedures and target detection limits, consistent with the current Policy and Procedure Document OWMRP-111/115-8 and used by the contract laboratory for this monitoring program are tabulated in Attachment I. However, when changes to analytical methods or to the detection limits contained within OWMRP-111/115-8 are published and made available, the contents of Attachment I must be updated accordingly, or EGLE approval must be attained for any alternate target detection limits. Further, this attachment should be reviewed periodically to determine if the laboratory has made changes that should be reflected in the attachment. QA/QC frequencies, and precision and accuracy calculations are included in the QA/QC manual. Changes made to detection limits, analytical methods or QA/QC in response to regulatory requirements must be included in an updated sampling and analysis plan.

Field measurements of specific conductance, pH and temperature will be performed using the equipment and procedures described in Attachment J or equipment of similar capabilities. The instruments must be calibrated prior to each day of use and the appropriate notation made in the Equipment Inventory, Repair and Calibration Log described in Section IV.

US Ecology's Quality Assurance Manual is provided in Attachment K. This manual describes the internal policies, guidelines and procedures that laboratories used by WDI must meet in order to be utilized for analytical work. This plan may be periodically updated and is used to audit contract laboratories to ensure that generally acceptable practices are employed.

X. Chain of Custody Control

Chain of Custody refers to the record of individuals and external conditions of sample handling through the time of laboratory analysis. The sample chain of custody record included as Attachment C is the principal document of this record. These sheets are fully filled in with sampling information as well as the persons involved and shipment conditions during transport to the analytical laboratory. These sheets accompanies the samples to the laboratory.

When the samples are surrendered at the laboratory, each chain of custody record must be signed by the person transporting the samples as well as a representative of the receiving laboratory. The lab will make a copy of each sheet for us and keep the originals. The copy must be maintained in the files. Upon completion of a full round of sampling, transmit depth to standing water information, field monitoring data and all chain of custody records to the Site Environmental Manager.

XI. Equipment and Well Maintenance

Equipment used for the collection and analysis of groundwater samples must be maintained in working order and replaced or repaired promptly when necessary. Electrodes for pH and specific conductance should be replaced if they become difficult to calibrate or appear to malfunction. The dedicated Well Wizard™ pumps and associated equipment require no routine maintenance but should be promptly replaced or repaired in the event of a malfunction. Any pump removed from a well should be thoroughly cleaned before replacement. Tubing removed from the well should be packaged and stored to prevent contamination or replaced. As outlined in Section IV, records of instrument calibration and any equipment replacement or repair must be kept in the Equipment Log maintained at the Engineering field office.

The well casings, protective covers, and Well Wizard™ pump heads should be inspected for damage at the time of each well sampling. Any damage should be noted in the field notebook and a Monitoring Well Inspection/Damage Report must be filled out and sent to the Site Environmental Manager. A copy of this form is included as Attachment C-2. It is important to note any surface erosion, standing water at the well or evidence of a damaged grout seal around the well.

In the event any damage requiring well repair becomes necessary, a Damage Incident Report will be prepared by the Site Environmental Manager. A copy of this report will be placed in the site the Groundwater Monitoring Operating Log. A proposed method of well repair will be prepared and submitted to the EGLE for approval. Repair efforts will be undertaken after approval by the EGLE is received. The EGLE shall then be notified at least 24 hours prior to initiating the repair efforts. Following completion of the well repairs, as-built documentation of the repair efforts will be prepared. A copy of this shall be placed in the Groundwater Monitoring Operating Log and a copy sent to the EGLE.

XII. Statistical Evaluation and Reporting Requirements

All ground water analyses for the uppermost aquifer wells must be analyzed for evidence of statistically significant increases in concentrations of all primary and secondary monitoring parameters as described in Attachment L

The analytical reports, the records of the field procedures and a report of the statistical analyses (narrative and tubular) must be submitted to the EGLE within 60 days of completing each sampling event. This report will also include a summary of the review of QA/QC data, a narrative of the sampling event including dates and sampling personnel, and a description of any unusual events or conditions encountered. Copies of the analysis and report must be maintained in designated files at the administration office at the site. In addition, an annual report summarizing the results of groundwater monitoring results and which evaluates groundwater flow directions and rates for the uppermost aquifer must be submitted to EGLE by March 1 of the following year.

Attachment A

Well Location Map

(Site II - WDI/MDWTP)

LEGEND:

OB-9 ⊞	EXISTING MONITORING WELL LOCATION
OB-54 ⊞	PROPOSED MC VI F/G WELL LOCATIONS
- - - - -	NEW CELL BOUNDARY LOCATION
— · — · —	OLD CELL BOUNDARY LOCATION
— · · —	PROPERTY LINE LOCATION
	EXISTING CONTOUR (2 FT INTERVAL)
	EXISTING STRUCTURE / BUILDING
PAVED / GRAVEL	EXISTING ROAD
+	GRID COORDINATES

NOTES:

1. THE BASE MAP WAS CREATED USING AN AERIAL SURVEY TAKEN IN DECEMBER 10, 2020.
   UPDATED WITH FLYOVER FROM 9-2-21.

SCALE 0' 100' 200' 400'

TIME PLOTTED: 5:42:44 PM
DATE PLOTTED: 10/4/2021
FILENAME: Z:\shared\proj\Projects\Commercial\US Ecology WDI\CAD\Site\Monitoring Plans\GROUNDWATER MONITORING WELL LOCATION MAP.dgn

DRAWING SIZE: 24" X 36"

DATE:	2-9-21
DESIGNED BY:	XZ
DRAWN BY:	BDA
CHECKED BY:	HS
APPROVED BY:	XZ

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Novi, Michigan 48377
248.486.5100 (fax)248.486.5050
www.cticompanies.com

REV	DATE	REVISION DESCRIPTION	DRN	APP

REVISIONS

WAYNE DISPOSAL SITE NO. 2
WAYNE, MICHIGAN

GROUNDWATER MONITORING WELL LOCATION MAP

PROJECT NUMBER 1218070066

SCALE 1" = 200'

DRAWING NO

Attachment B

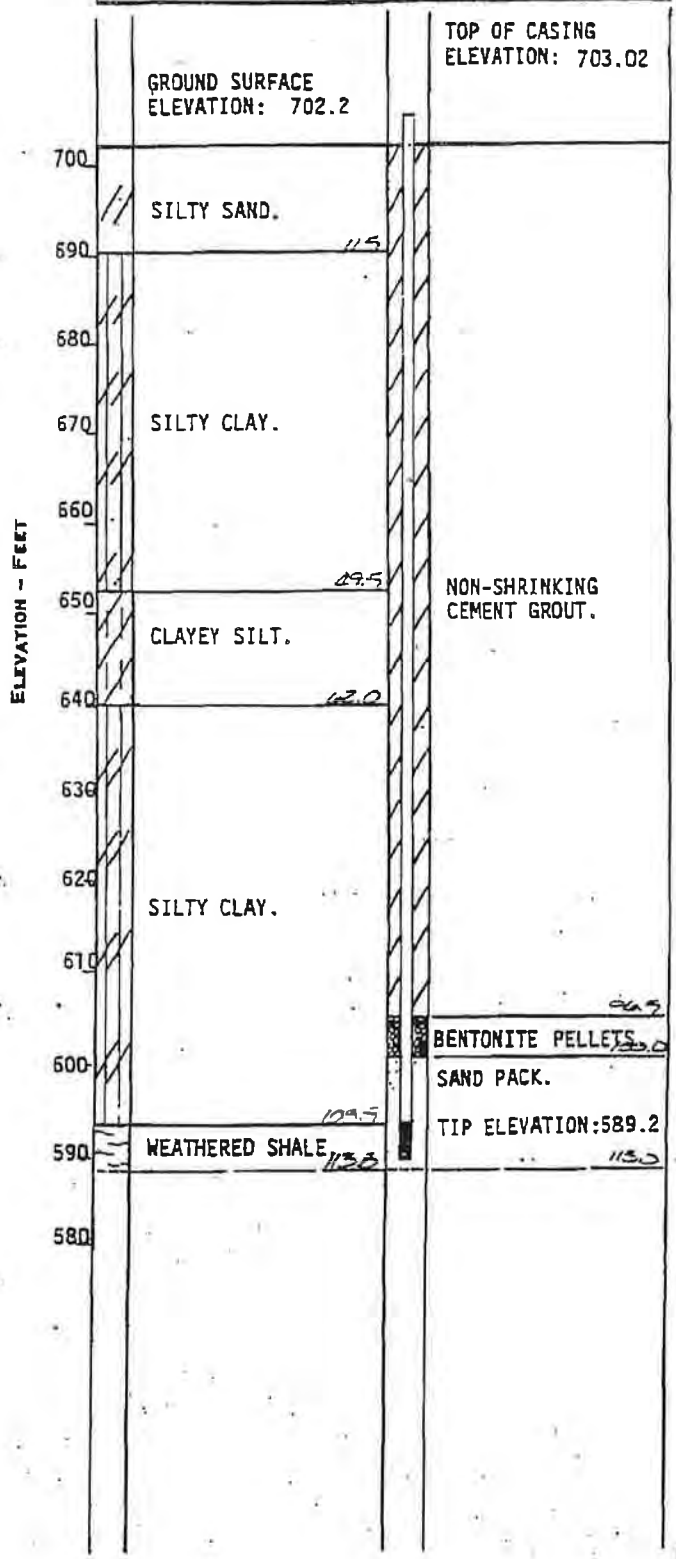
WDI Ground Water Monitoring Well Logs

(WDI)

LOG OF GROUNDWATER MONITORING WELL

CLASSIFICATIONS BY:
NEYER, TISEO & HINDO, LTD.

GENERALIZED SUBSURFACE PROFILE | WELL SCHEMATIC



GROUNDWATER DATA

DATE	GROUND-WATER ELEV. (FEET)	COMMENTS
9-24-84	654.69	
10-22-84	653.22	

CASING – DIAMETER: 2.0"
– LENGTH: 108.0'
– MATERIAL: PVC

SCREEN – DIAMETER: 2.0"
– LENGTH: 5.0"
– MESH: .006" slot
– MATERIAL: PVC

WELL STARTED: 9-11-84
WELL COMPLETED: 9-11-84
INSPECTOR: J. Serwik
DRILLER: J. Blank
CONTRACTOR: American Drilling
EQUIPMENT: CME-75

NOTES:
1. For details of the subsurface strata see Log of Test Boring No. OB-18.
2. Top of casing elevations and ground surface elevations provided by Wayne Disposal, Inc.

NEYER, TISEO & HINDO, LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL No. OB-18

LANDFILL SITE NO. 2

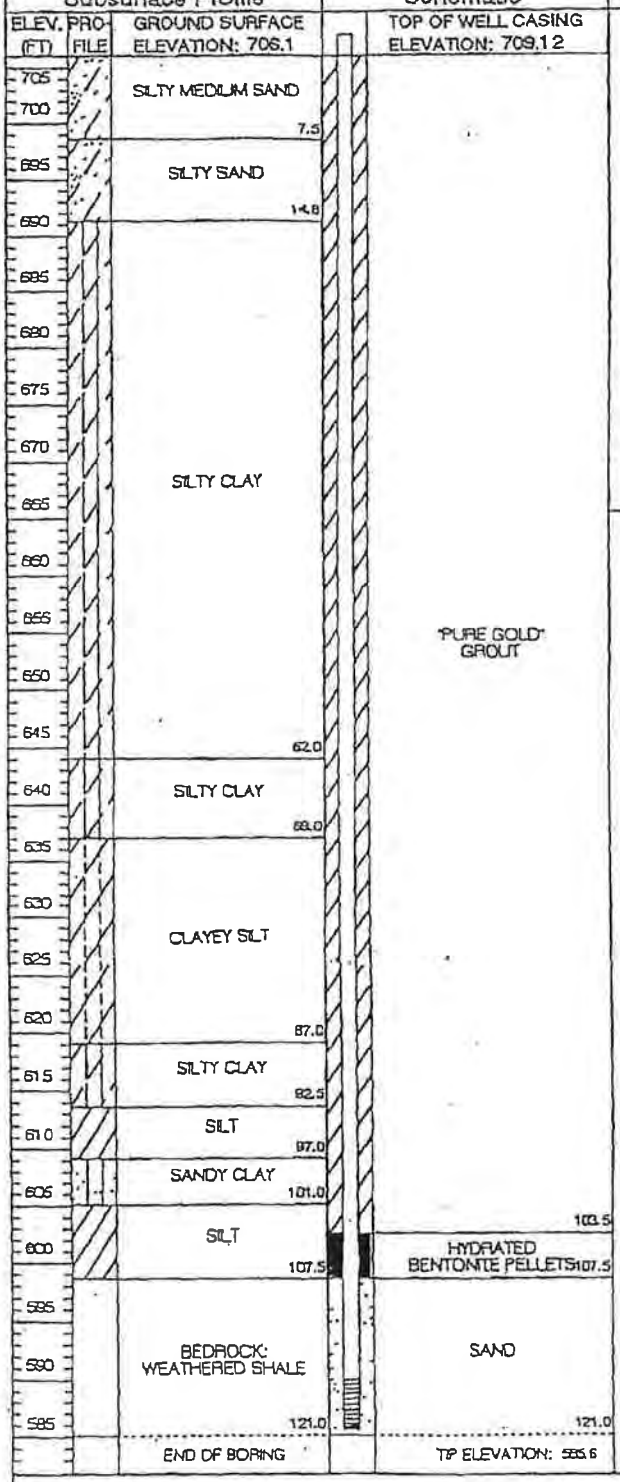
NTH Consultants, Ltd.

MONITORING WELL NO. OB-19R

Project Name : WAYNE DISPOSAL LANDFILL - SITE NO. 2 NTH Proj. No: 13-3051 01

Project Location : VAN BUREN TWP., WAYNE COUNTY, MICHIGAN Checked By : ACE

LOG OF MONITORING WELL



GROUNDWATER DATA

Date	Ground-water Elev.(ft)	Comments
12/01/94	654.50	Before Development

NOTES:

[1] FOR DETAILS OF SUBSURFACE STRATA FROM 0-90', SEE LOG OF TEST BORING OB-19; FOR 90-121', SEE LOG OF TEST BORING OB-19R

[2] TOP OF CASING & GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC

[3] WELL LOCATION: 6873.2 N, 5324.4 E

Started: 11/22/94
Completed: 11/22/94
Inspector: R. LEE
Driller: G. QUALLS
Contractor: GEO-TEK, INC.
Equipment: CME-850 ALL-TERRAIN DRILL RIG
Well Type: MONITORING

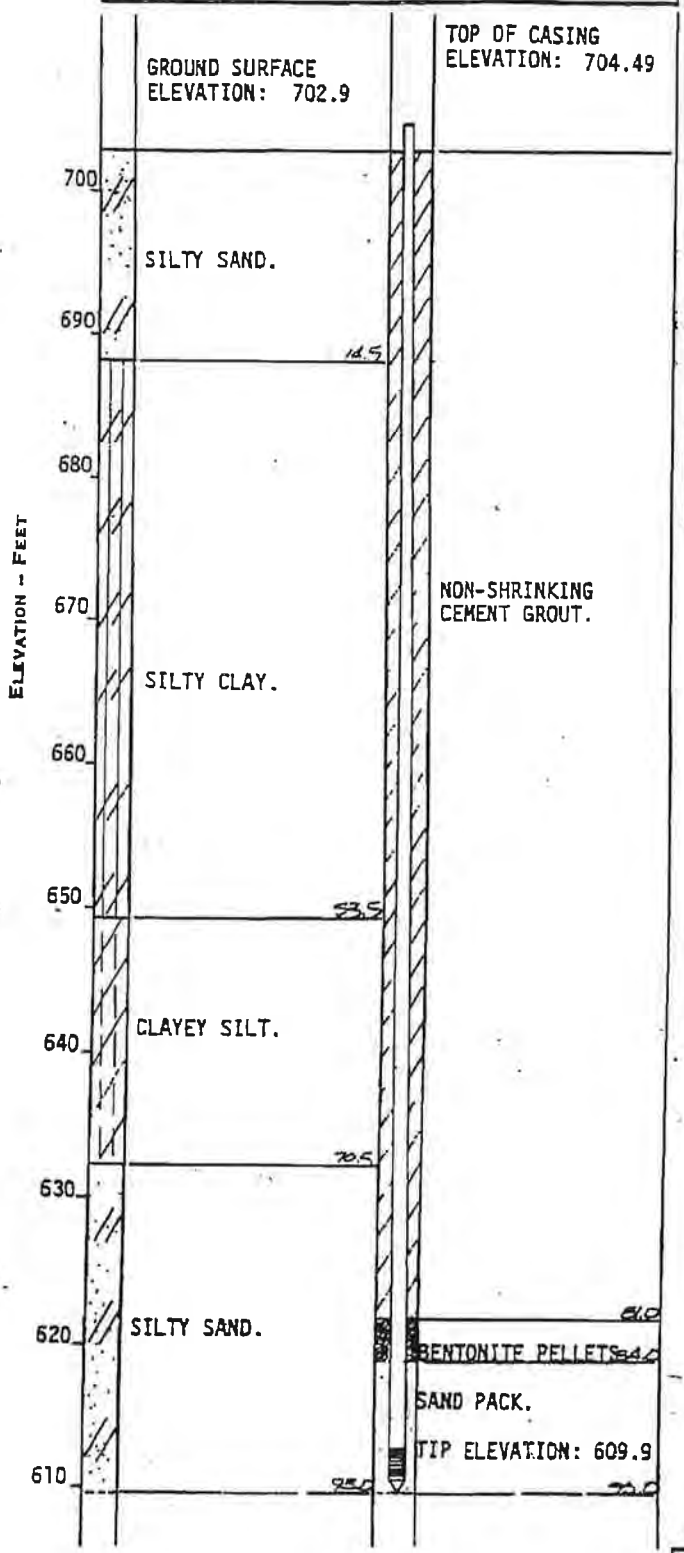
Casing Diameter: 2.0"
Casing Length: 118.0'
Casing Type: STAINLESS STEEL
Screen Diameter: 2.0"
Screen Length: 5.0'
Screen Mesh: 0.010"
Screen Type: STAINLESS STEEL

Figure No. A-2

LOG OF GROUNDWATER MONITORING WELL

CLASSIFICATIONS BY:
NEYER, TISEO & HINDO, LTD.

GENERALIZED SUBSURFACE PROFILE | WELL SCHEMATIC



GROUNDWATER DATA

DATE	GROUND-WATER ELEV: (FEET)	COMMENTS
9-12-84	653.24	
9-24-84	653.13	

CASING – DIAMETER: 2.0"
– LENGTH: 90.0'
– MATERIAL: Galvanized

SCREEN – DIAMETER: 2.0"
– LENGTH: 3.0'
– MESH: .007" slot
– MATERIAL: Stainless Steel

WELL STARTED: 8-1-84
WELL COMPLETED: 8-2-84
INSPECTOR: J. Serwik
DRILLER: J. Blank
CONTRACTOR: American Drilling
EQUIPMENT: CME-75

NOTES:
1. For details of the subsurface stra see Log of Test Boring No. OB-20.
2. Top of casing elevations and groun surface elevations provided by Way Disposal, Inc.

NEYER, TISEO & HINDO, LTD.
CONSULTING ENGINEERS

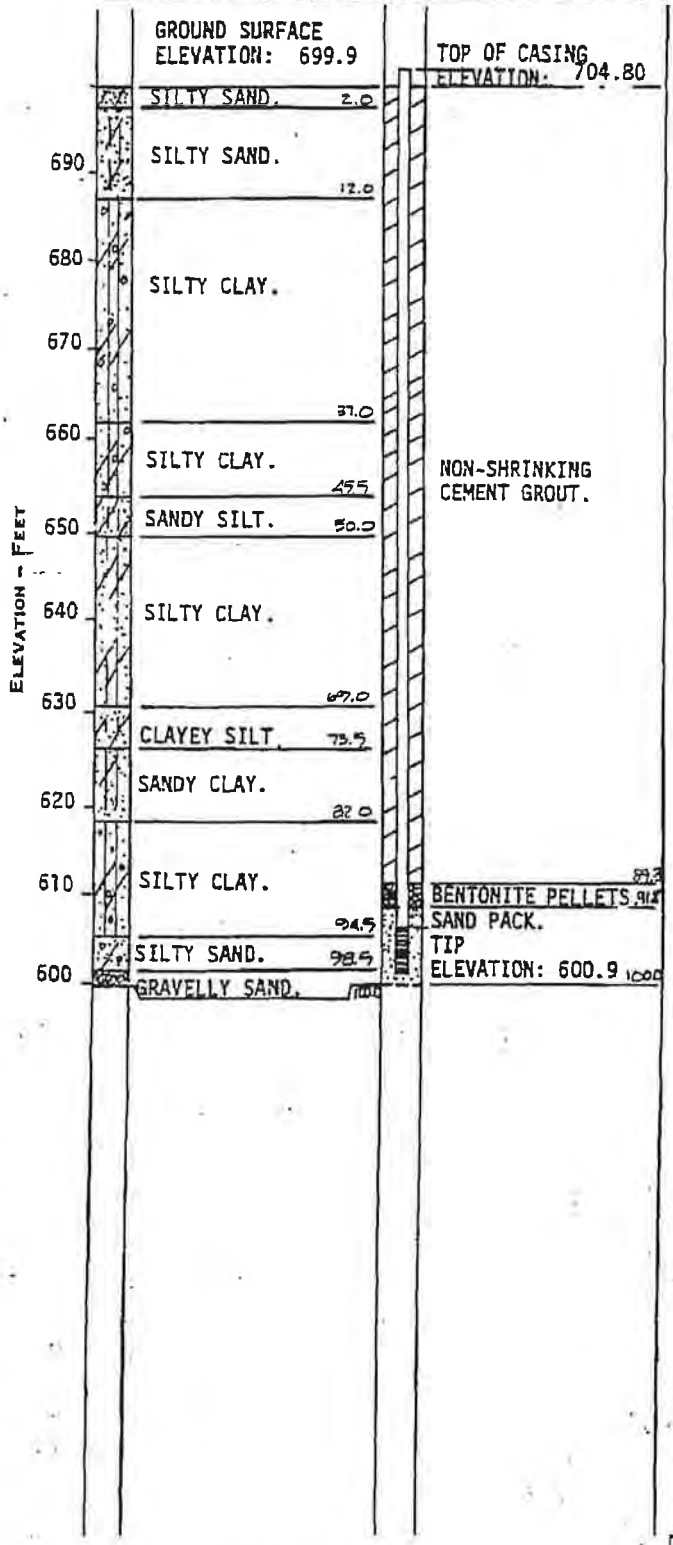
GROUNDWATER MONITORING WELL NO. OB-20

WAYNE DISPOSAL LANDFILL SITE NO. 2
VAN BUREN TOWNSHIP

LOG OF GROUNDWATER MONITORING WELL

CLASSIFICATIONS BY:
NEYER, TISEO & HINDO, LTD.

GENERALIZED SUBSURFACE PROFILE | WELL SCHEMATIC



GROUNDWATER DATA

DATE	GROUND-WATER ELEV. (FEET)	COMMENTS
9-12-84	652.64	
9-24-84	652.64	
10-22-84	652.44	

CASING – DIAMETER: 2.0"
– LENGTH: 94.0'
– MATERIAL: PVC

SCREEN – DIAMETER: 2.0"
– LENGTH: 5.0'
– MESH: .006" slot
– MATERIAL: PVC

WELL STARTED: 7-23-84
WELL COMPLETED: 7-24-84
INSPECTOR: J. Serwik
DRILLER: J. Blank
CONTRACTOR: American Drilling
EQUIPMENT: CME-75

NOTES:
1. For details of the subsurface strat see Log of Test Boring No. OB-21.
2. Top casing elevations and ground surface elevations provided by Wayn Disposal, Inc.

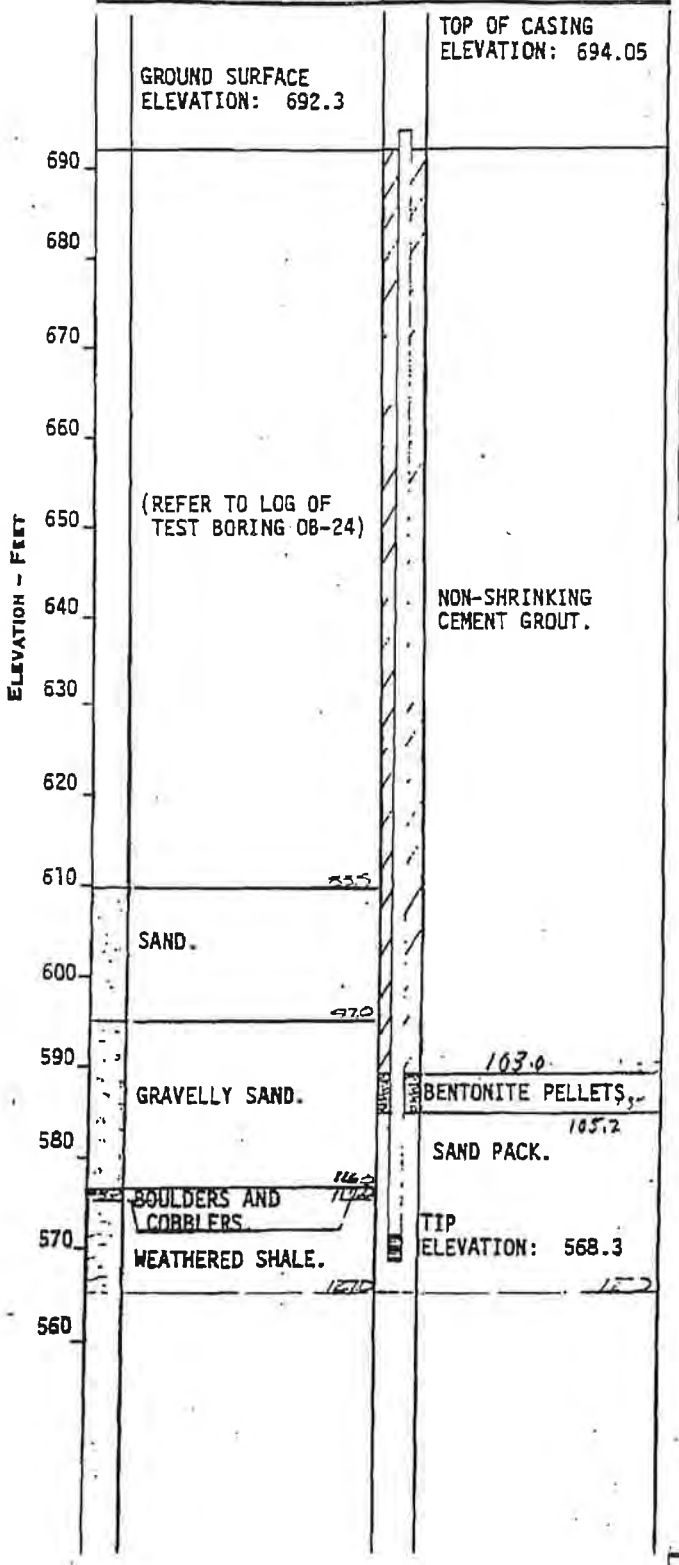
NEYER, TISEO & HINDO, LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL NO. OB-21

WAYNE DISPOSAL LANDFILL SITE NO. 2
VAN BUREN TOWNSHIP

LOG OF GROUNDWATER MONITORING WELL

CLASSIFICATIONS BY:
NEYER, TISEO & HINDO, LTD.



GROUNDWATER DATA

DATE	GROUNDWATER ELEV. (FEET)	COMMENTS
9-24-84	654.24	
10-22-84	653.32	

CASING – DIAMETER: 2.0"
– LENGTH: 119.0
– MATERIAL: PVC

SCREEN – DIAMETER: 2.0"
– LENGTH: 5.0'
– MESH: .006" slot
– MATERIAL: PVC

WELL STARTED: 9-14-84
WELL COMPLETED: 9-14-84
INSPECTOR: J. Serwik
DRILLER: J. Blank
CONTRACTOR: American
EQUIPMENT: CME-75

NOTES:
1. For details of the subsurface strat see Log of Test Boring No. OB-22.
2. Top of casing elevations and ground surface elevations provided by Wayn Disposal, Inc.

NEYER, TISEO & HINDO, LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL No. OB-22

WAYNE DISPOSAL LANDFILL SITE NO. 2
VAN BUREN TOWNSHIP

Project No:

Well ID: OB-23A

Project: Well Re-Location

Client: Wayne Disposal, Inc.

Enclosure:

Location: Site No. 2 Belleville, MI

Engineer: M. Takacs

SUBSURFACE PROFILE					
Depth	Symbol	Description	Depth/Elev.	Well Construction	Remarks
0		Ground Surface	0		
5		***sand:*** fine gray, silty with trace gravel and clay	700		
10			12		
15			688		
20					
25					
30					
35					
40					
45					
50		***Clay:*** gray, silty with trace sand and gravel			Casing 2" Stainless Steel
55					
60					
65					
70					
75					
80					
85					
90					
95			95		
100			605		
105					
110		***Sand:*** gray, medium to coarse with trace gravel			Annular Space pH neutral grout
115					
120					Screen 5 foot 2" diameter
125			125		Stainless Steel 7 Slot
130		***Shale:*** gray, weathered	571		

Drilled By: American Drilling

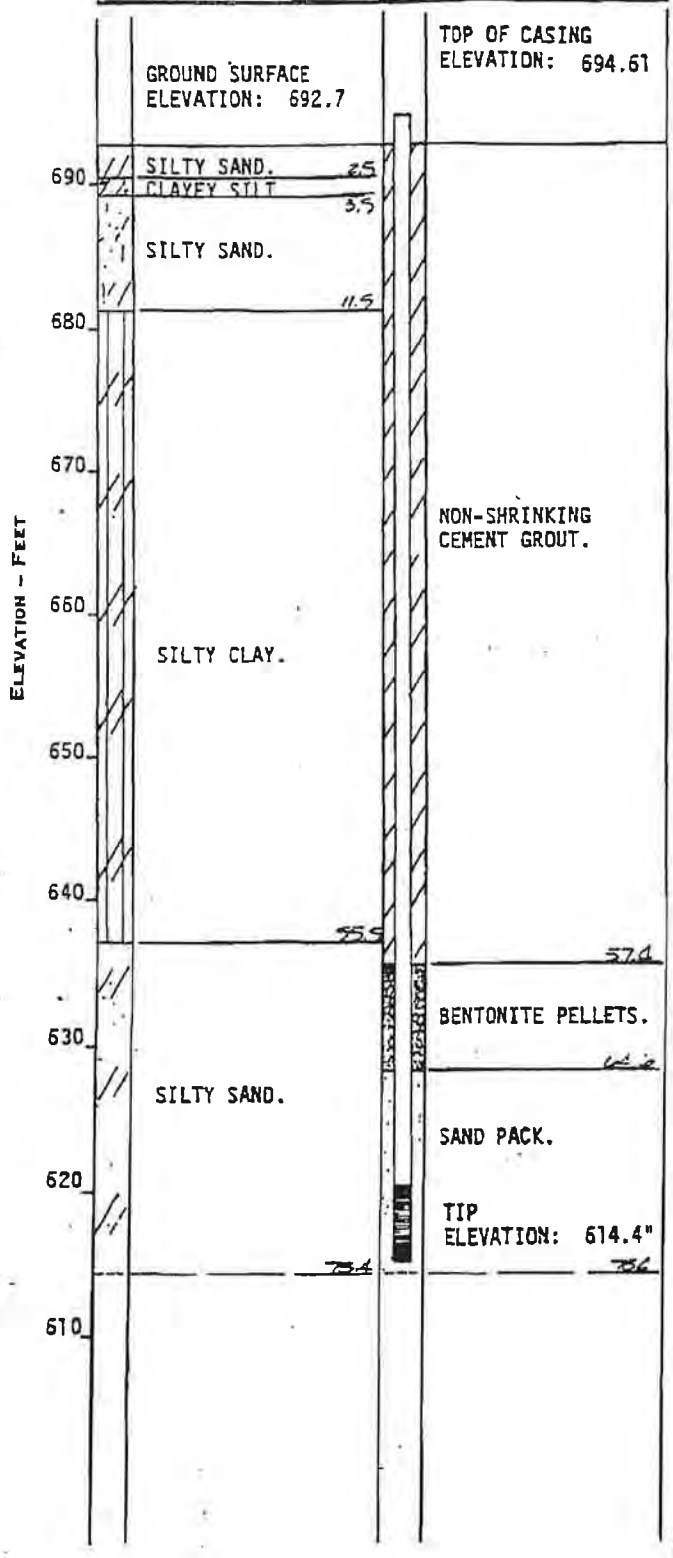
Drill Method: 6.25 inch HSA to EOB

Sheet: 1 of 1

LOG OF GROUNDWATER MONITORING WELL

CLASSIFICATIONS BY:
NEYER, TISEO & HINDO, LTD.

GENERALIZED SUBSURFACE PROFILE | WELL SCHEMATIC



GROUNDWATER DATA

DATE	GROUND-WATER ELEV. (FEET)	COMMENTS
9-12-84	653.62	
9-24-84	653.67	
10-22-84	653.30	

CASING	- DIAMETER:	2.0"
	- LENGTH:	73.3'
	- MATERIAL:	PVC
SCREEN	- DIAMETER:	2.0"
	- LENGTH:	5.0'
	- MESH:	.006" slot
	- MATERIAL:	PVC

WELL STARTED:	7-24-84
WELL COMPLETED:	7-24-84
INSPECTOR:	J. Serwik
DRILLER:	J. Blank
CONTRACTOR:	American Drilling
EQUIPMENT:	CME-75

NOTES:
1. For details of the subsurface strat see Log of Test Boring No. OB-24.
2. Top of casing elevations and ground surface elevations provided by Wayn Disposal, Inc.

NEYER, TISEO & HINDO, LTD.
CONSULTING ENGINEERS

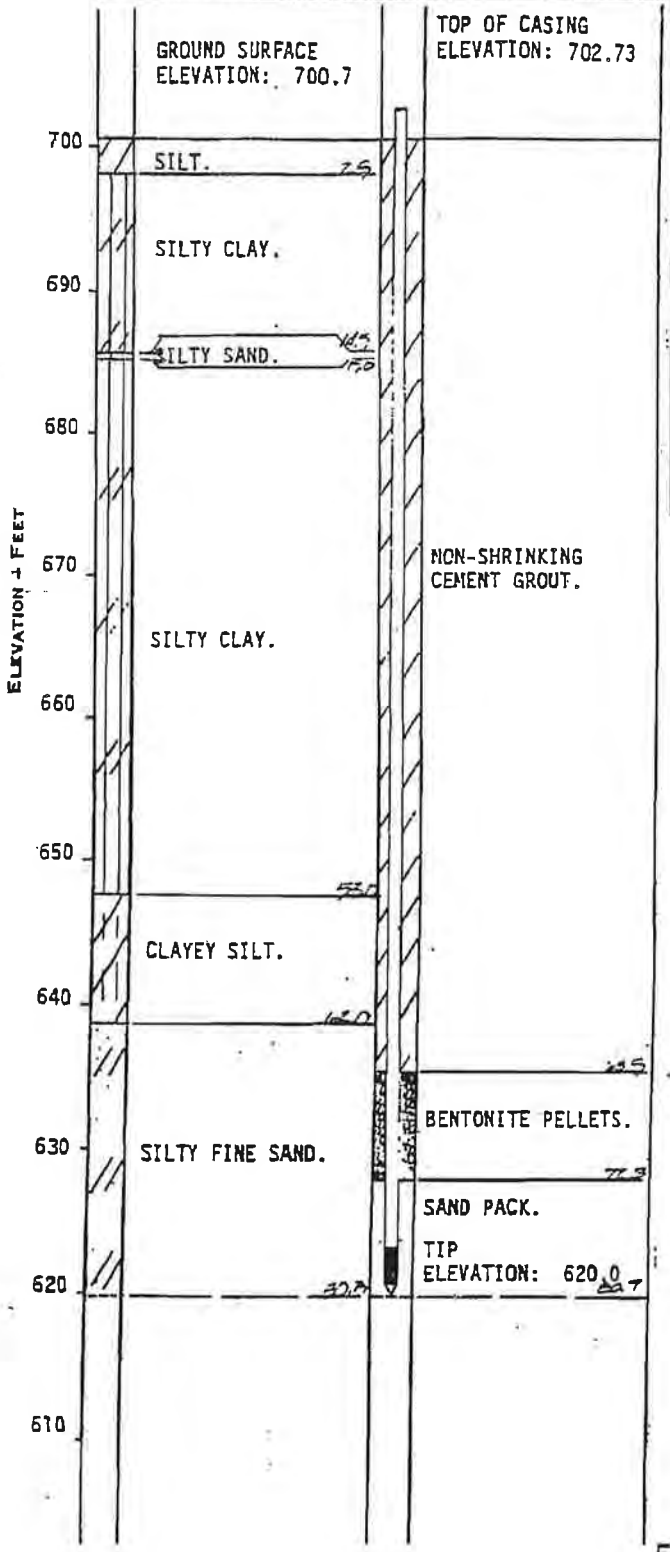
GROUNDWATER MONITORING WELL No. OB-24

WAYNE DISPOSAL LANDFILL SITE NO. 2

LOG OF GROUNDWATER MONITORING WELL

CLASSIFICATIONS BY:
NEYER, TISEO & HINDO, LTD.

GENERALIZED SUBSURFACE PROFILE | WELL SCHEMATIC



GROUNDWATER DATA

DATE	GROUND-WATER ELEV. (FEET)	COMMENTS
9-12-84	653.50	
9-24-84	653.86	
10-22-84	653.51	

CASING – DIAMETER: 2.0"
– LENGTH: 77.7
– MATERIAL: Galvanized

SCREEN – DIAMETER: 2.0"
– LENGTH: 3.0'
– MESH: .007" slot
– MATERIAL: Stainless Steel

WELL STARTED: 8-25-84
WELL COMPLETED: 8-25-84
INSPECTOR: J. Serwik
DRILLER: J. Blank
CONTRACTOR: American Drilling
EQUIPMENT: CME-75

NOTES:
1. For details of the subsurface strat. see Log of Test Boring No. OB-25.
2. Top of casing elevations and ground surface elevations provided by Wayne Disposal, Inc.

NEYER, TISEO & HINDO, LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL NO. OB-25

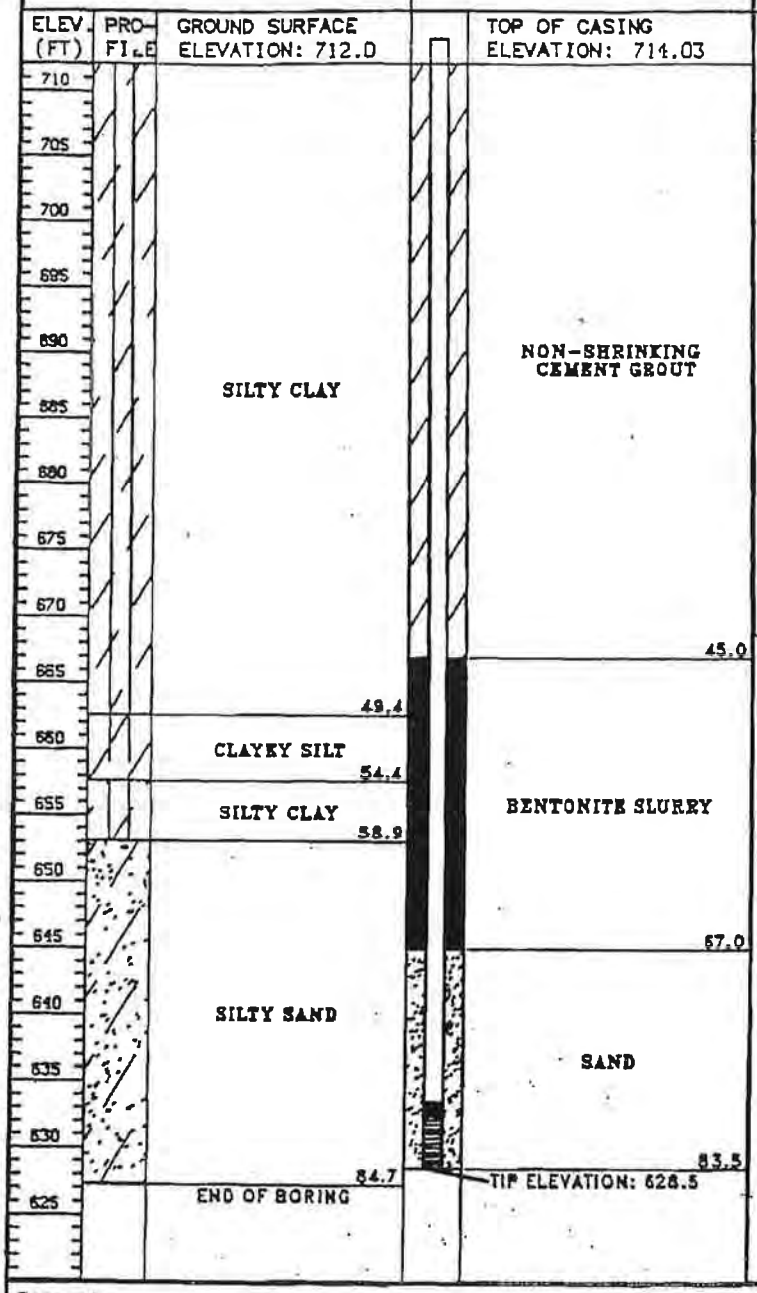
WAYNE DISPOSAL LANDFILL SITE NO. 2
VAN BUREN TOWNSHIP

NEYER, TISEO & HINDO, LTD.

MONITOR WELL NO. OB-26A

Project Name: WAYNE DISPOSAL LANDFILL – SITE NO. 2 — **NTH Pro. No.** 94315 OW
Project Location: VAN BUREN TWP., WAYNE COUNTY, MICHIGAN — **Chk. By:** RLB

LOG OF MONITOR INSTALLATION



GROUNDWATER DATA

Date	Groundwater Elev. (ft)	Comments
9/23/87	650.69	
9/24/87	650.62	
9/25/87	650.42	
9/28/87	650.58	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATA, SEE LOG OF TEST BORING NO. OB-26
[2] TOP OF CASING AND GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC.

Started:	9/18/87
Completed:	9/21/87
Inspector:	R. BURNS
Driller:	S REMPALSKI
Contractor:	MATECO DRILLING COMPANY
Equipment:	CME-550
Observation Type:	MONITORING WELL

Casing Diam.:	2"
Casing Length:	80.5'
Casing Type:	60.5' GALV. / 20' SS
Screen Diam.:	2"
Screen Length:	5'
Screen Mesh:	0.01"
Screen Type:	STAINLESS STEEL

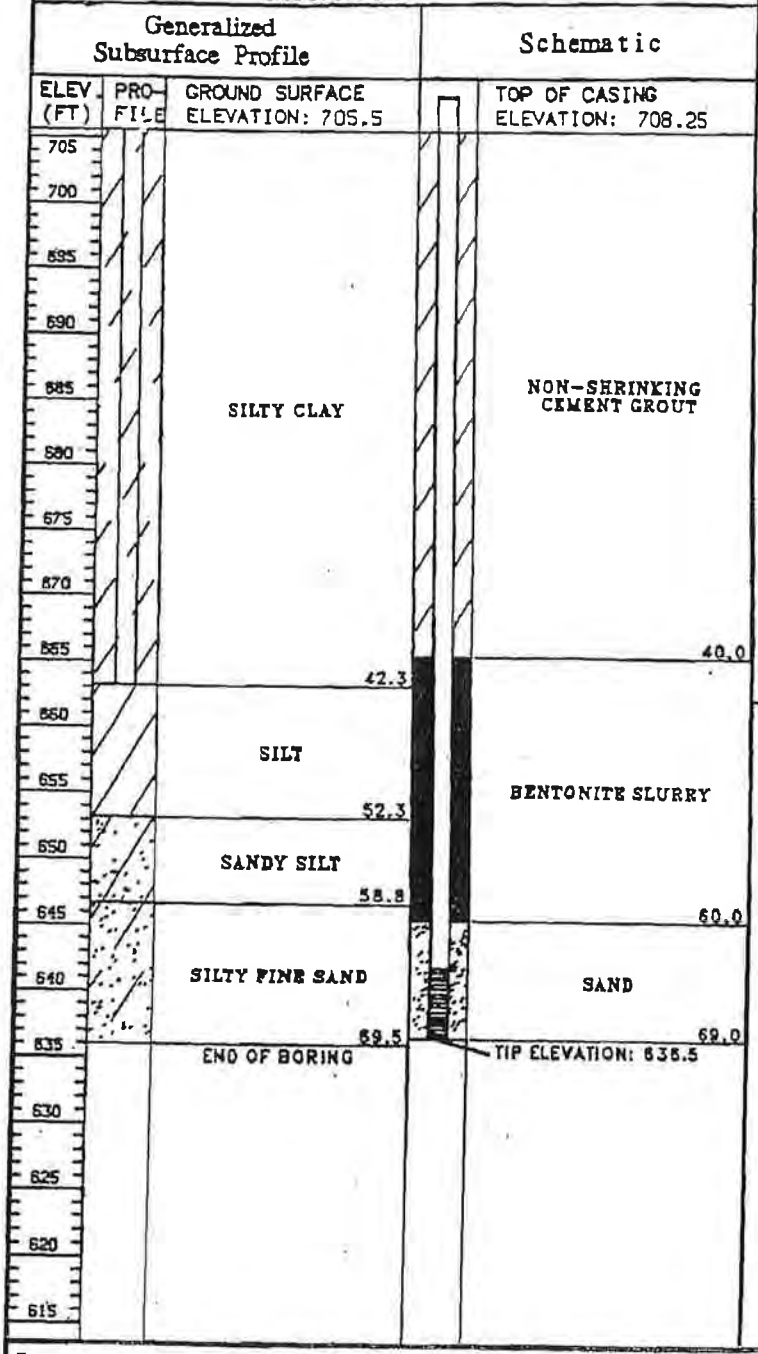
Figure No. 9

NEYER, TISEO & HINDO, LTD.

MONITOR WELL NO. OB-27A

Project Name: WAYNE DISPOSAL LANDFILL – SITE NO. 2 — NTH Pro. No. 94315 OW
Project Location: VAN BUREN TWP., WAYNE COUNTY, MICHIGAN — Chk. By: RLB

LOG OF MONITOR INSTALLATION



GROUNDWATER DATA

Date	Groundwater Elev. (ft)	Comments
10/7/87	658.75	
10/23/87	650.49	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATA, SEE LOG OF TEST BORING NO. OB-27
[2] TOP OF CASING AND GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC.

Started:	10/5/87
Completed:	10/5/87
Inspector:	R. BURNS
Driller:	S. REMPALSKI
Contractor:	MATECO DRILLING COMPANY
Equipment:	CME-550
Observation Type:	MONITORING WELL

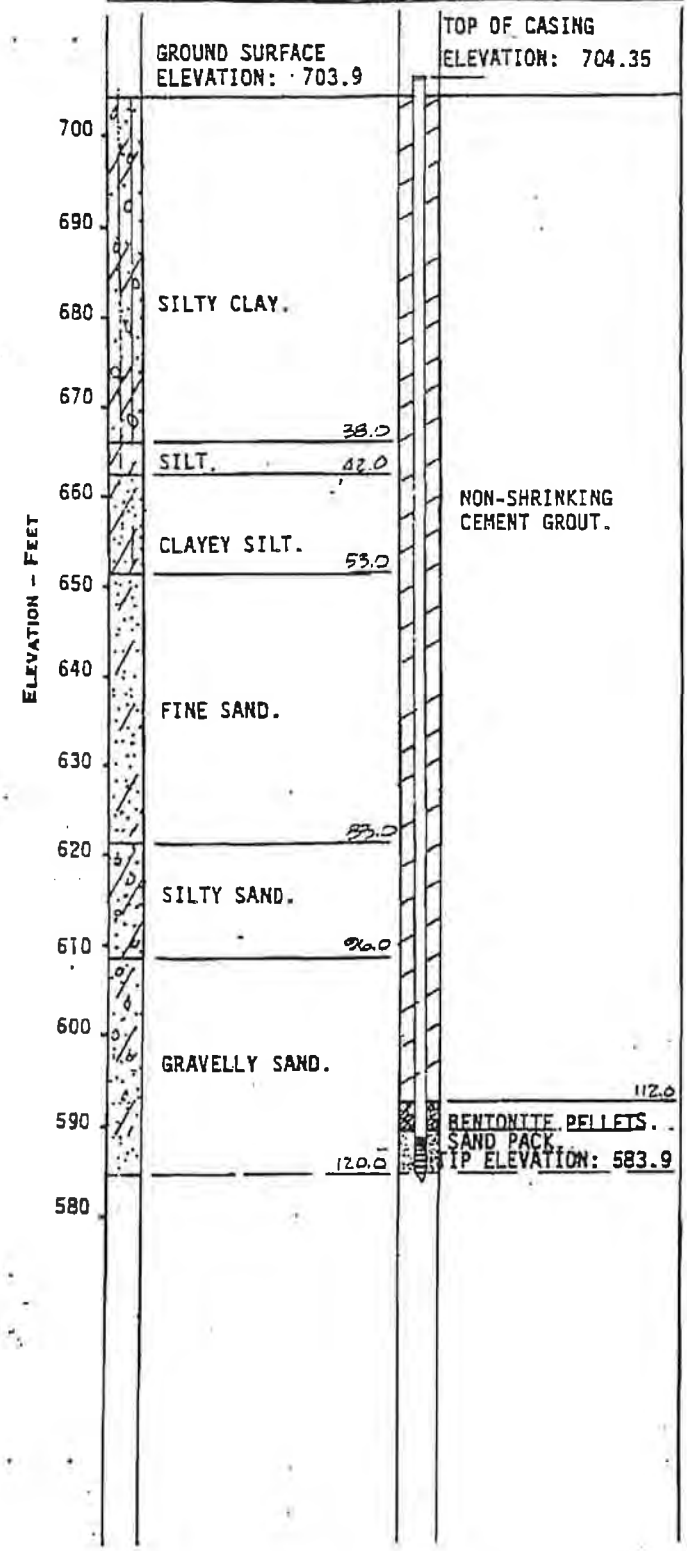
Casing Diam.:	2"
Casing Length:	67'
Casing Type:	47' GALV. / 20' SS
Screen Diam.:	2"
Screen Length:	5'
Screen Mesh:	0.01"
Screen Type:	STAINLESS STEEL

Figure No. 10

LOG OF GROUNDWATER MONITORING WELL

CLASSIFICATIONS BY:
NEYER, TISEO & HINDO, LTD.

GENERALIZED SUBSURFACE PROFILE | WELL SCHEMATIC



GROUNDWATER DATA

DATE	GROUND-WATER ELEV. (FEET)	COMMENTS
9-12-84	653.60	
9-24-84	653.69	
10-22-84	653.54	

CASING – DIAMETER: 2.0"
– LENGTH: 117.0
– MATERIAL: Galvanized

SCREEN – DIAMETER: 2.0"
– LENGTH: 3.0'
– MESH: .007" slot
– MATERIAL: Stainless Steel

WELL STARTED: 8-13-84
WELL COMPLETED: 8-14-84
INSPECTOR: J. Serwik
DRILLER: J. Blank
CONTRACTOR: American Drilling
EQUIPMENT: CME-75

NOTES:
1. For details of the subsurface stra see Log of Test Boring No. 28.
2. Top of casing elevations and groun surface elevations provided by Way Disposal, Inc.

115?

NEYER, TISEO & HINDO, LTD.
CONSULTING ENGINEERS

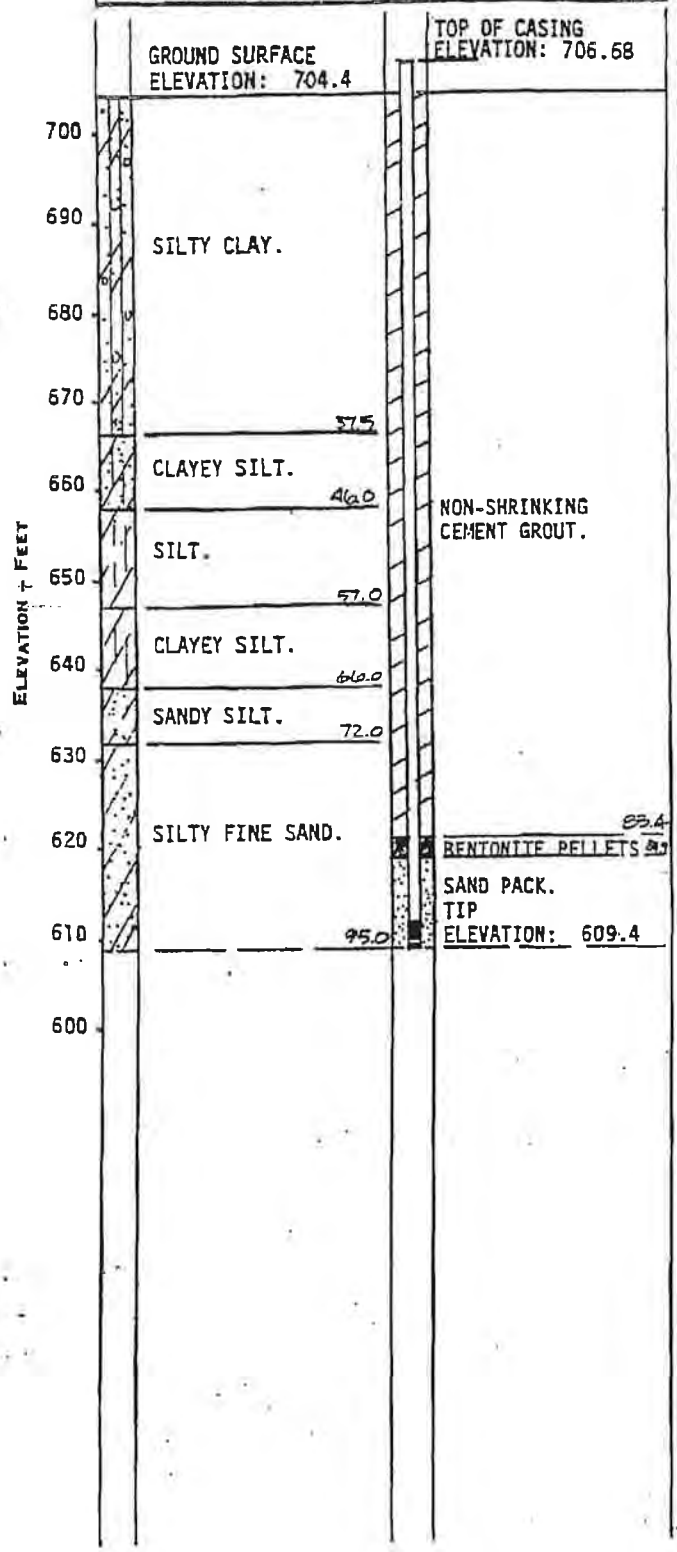
GROUNDWATER MONITORING WELL NO. DW-28

WAYNE DISPOSAL LANDFILL SITE NO. 2
VAN BUREN TOWNSHIP
WAYNE COUNTY, MICHIGAN

LOG OF GROUNDWATER MONITORING WELL

CLASSIFICATIONS BY:
NEYER, TISEO & HINDO, LTD.

GENERALIZED SUBSURFACE PROFILE | WELL SCHEMATIC



GROUNDWATER DATA

DATE	GROUND-WATER ELEV. (FEET)	COMMENTS
9-12-84	653.61	
9-24-84	653.63	
10-22-84	653.36	

CASING – DIAMETER: 2.0"
– LENGTH: 90.0'
– MATERIAL: PVC

SCREEN – DIAMETER: 2.0"
– LENGTH: 5.0'
– MESH: .006" slot
– MATERIAL: PVC

WELL STARTED: 7-30-84
WELL COMPLETED: 7-30-84
INSPECTOR: J. Serwik
DRILLER: J. Blank
CONTRACTOR: American Drilling
EQUIPMENT: CME-75

NOTES:
1. For details of the subsurface stra see Log of Test Boring No. OB-29.
2. Top of casing elevations and groun surface elevations provided by Wa Disposal, Inc.

NEYER, TISEO & HINDO, LTD.
CONSULTING ENGINEERS

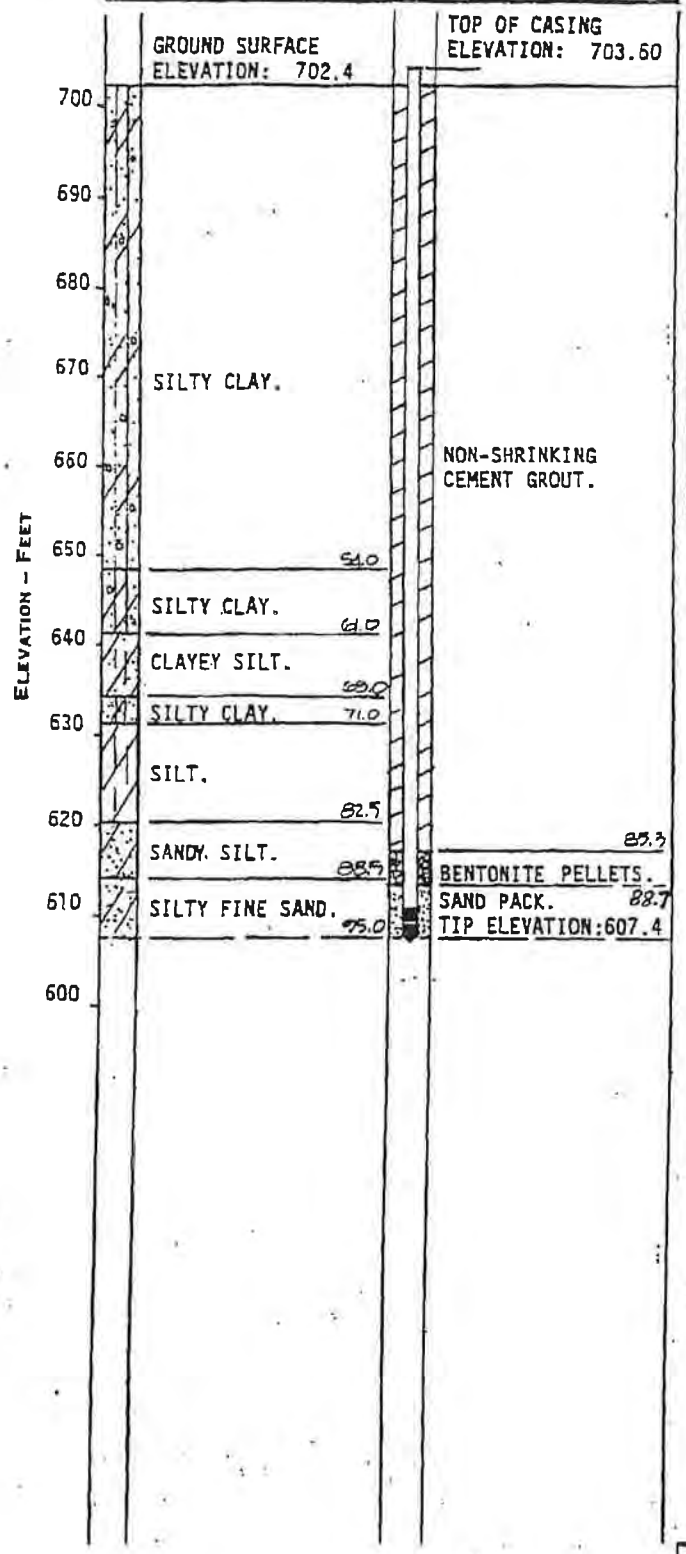
GROUNDWATER MONITORING WELL NO. OB-29

WAYNE DISPOSAL LANDFILL SITE NO. 2
VAN BUREN TOWNSHIP
WAYNE COUNTY, MICHIGAN

LOG OF GROUNDWATER MONITORING WELL

CLASSIFICATIONS BY:
NEYER, TISEO & HINDO, LTD.

GENERALIZED SUBSURFACE PROFILE | WELL SCHEMATIC



GROUNDWATER DATA

DATE	GROUND-WATER ELEV. (FEET)	COMMENTS
9-12-84	653.61	
9-24-84	653.81	
10-22-84	653.38	

CASING – DIAMETER: 2.0"
– LENGTH: 92.0'
– MATERIAL: Galvanized

SCREEN – DIAMETER: 2.0"
– LENGTH: 3.0'
– MESH: .007" slot
– MATERIAL: Stainless Steel

WELL STARTED: 8-29-84
WELL COMPLETED: 8-29-84
INSPECTOR: J. Serwik
DRILLER: J. Blank
CONTRACTOR: American Drilling
EQUIPMENT: CME-75

NOTES:
1. For details of the subsurface stra see Log of Test Boring No. OB-30.
2. Top of casing elevations and groun surface elevations provided by Way Disposal, Inc.

NEYER, TISEO & HINDO, LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL No. OB-30

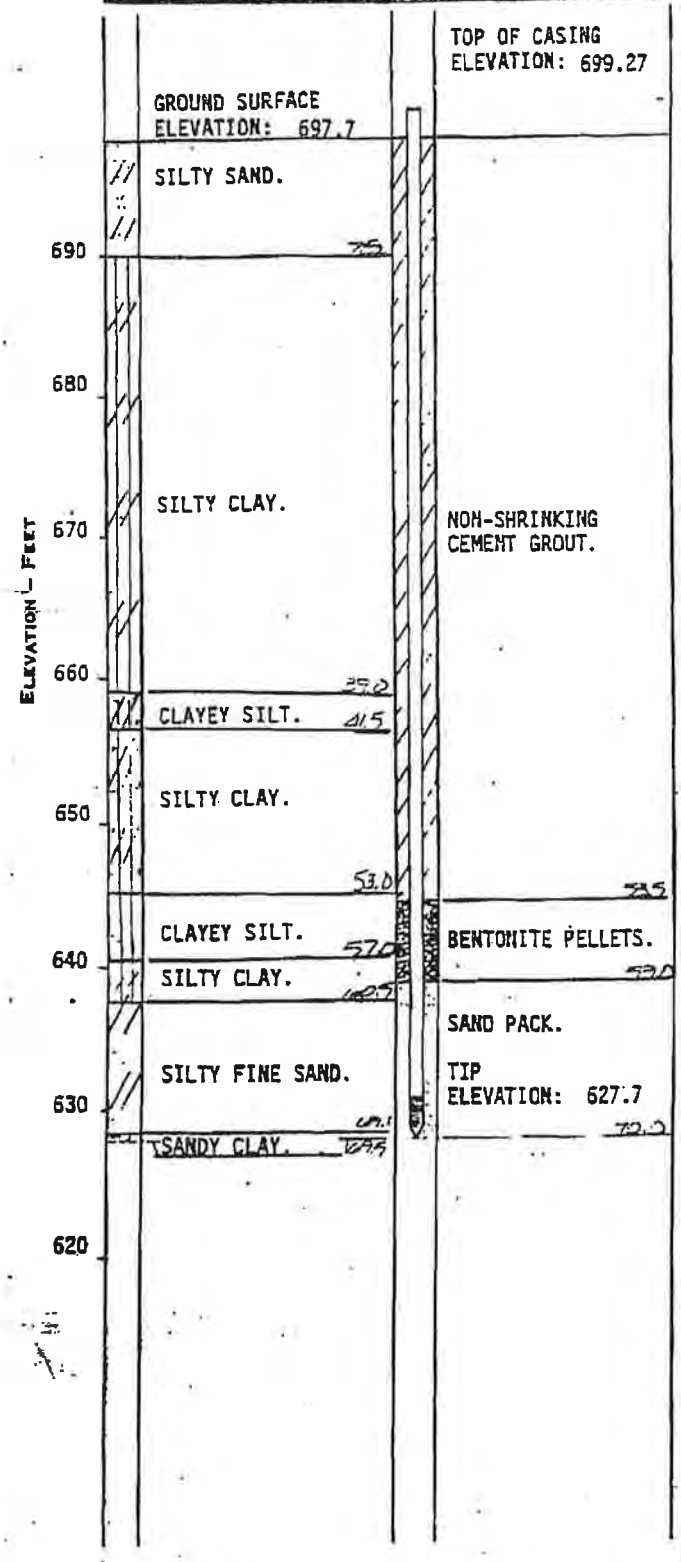
WAYNE DISPOSAL LANDFILL SITE NO. 2
VAN BUREN TOWNSHIP
WAYNE COUNTY, MICHIGAN

DATE: 10-8-84

LOG OF GROUNDWATER MONITORING WELL

CLASSIFICATIONS BY:
NEYER, TISEO & HINDO, LTD.

GENERALIZED SUBSURFACE PROFILE | WELL SCHEMATIC



GROUNDWATER DATA

DATE	GROUND-WATER ELEV. (FEET)	COMMENTS
9-24-84	655.60	
10-22-84	655.25	

CASING – DIAMETER: 2.0"
– LENGTH: 67.0'
– MATERIAL: Galvanized

SCREEN – DIAMETER: 2.0"
– LENGTH: 3.0'
– MESH: .007" slot
– MATERIAL: Stainless Steel

WELL STARTED: 9-18-84
WELL COMPLETED: 9-18-84
INSPECTOR: J. Serwik
DRILLER: J. Blank
CONTRACTOR: American Drilling
EQUIPMENT: CME-75

NOTES:
1. For details of the subsurface strat. see Log of Test Boring No. OB-31.
2. Top of casing elevations and ground surface elevations provided by Wayne Disposal, Inc.

NEYER, TISEO & HINDO, LTD.
CONSULTING ENGINEERS

GROUNDWATER MONITORING WELL NO. OB-31

WAYNE DISPOSAL LANDFILL SITE NO. 2
VAN BUREN TOWNSHIP
WAYNE COUNTY, MICHIGAN

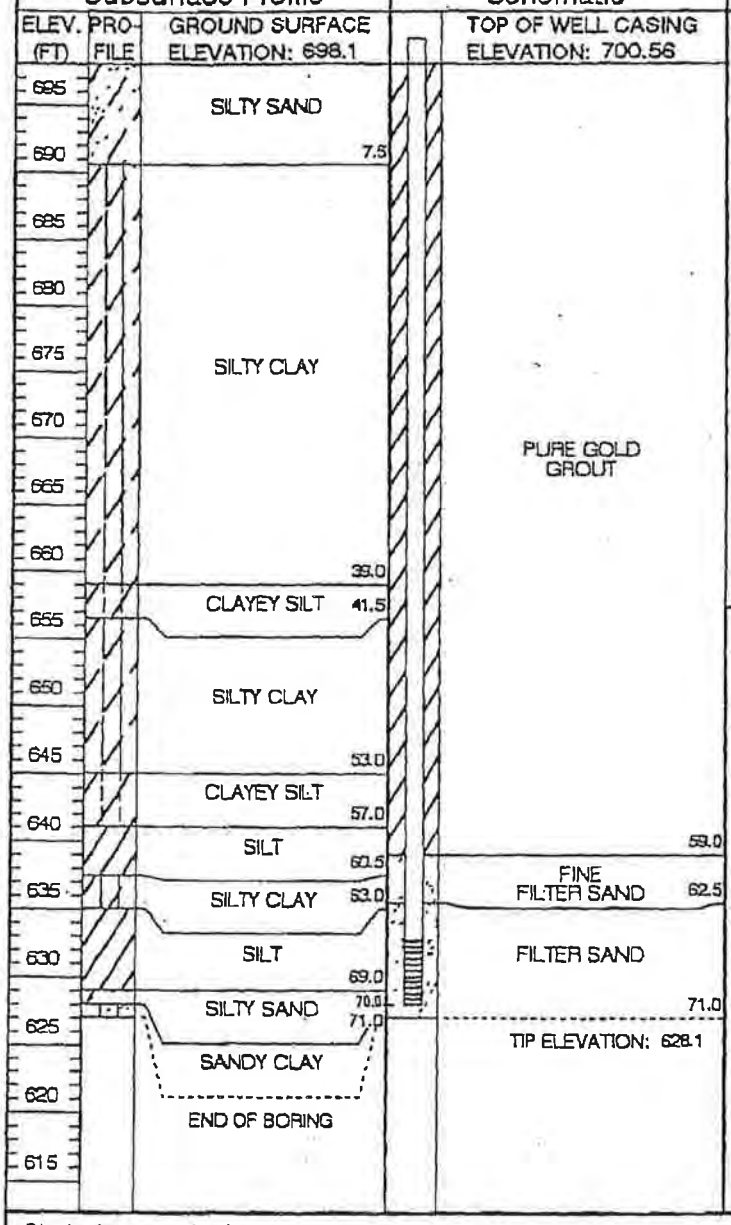
NTH Consultants, Ltd.

MONITORING WELL NO. OB-31AR

Project Name : WAYNE DISPOSAL, INC. - SITE NO. 2 NTH Proj. No: 13-3051 00

Project Location : VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN Checked By : ACE

LOG OF MONITORING WELL



GROUNDWATER DATA

Date	Ground-water Elev. (ft)	Comments
02/03/93	653.91	BEFORE DEVELOPMENT
02/09/93	656.36	BEFORE DEVELOPMENT
02/25/93	656.19	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATA, SEE LOG OF TEST BORING NO. OB-31AR.

[2] TOP OF CASING & GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC.

[3] WELL INSTALLED TO REPLACE MONITORING WELL NO. OB-31A.

[4] CENTRALIZERS WERE USED TO MAINTAIN THE VERTICALITY OF THE WELL ASSEMBLY IN THE BOREHOLE.

FIELD MEASUREMENTS DURING DRILLING:

pH: 8.53
SPEC. COND: 361 µmhos/cm

FIELD MEASUREMENTS AFTER DEVELOPMENT:

pH: 8.21
SPEC. COND: 309 µmhos/cm

Started: 02/02/93
Completed: 02/03/93
Inspector: C. ENDLER
Driller: G. QUALLS
Contractor: GEO-TEK, INC.
Equipment: CME-750 ALL-TERRAIN DRILLING RIG
Well Type: MONITORING

Casing Diameter: 2.0"
Casing Length: 67.5'
Casing Type: STAINLESS STEEL
Screen Diameter: 2.0"
Screen Length: 5.0'
Screen Mesh: 0.007"
Screen Type: STAINLESS STEEL

Figure No. A-4

NEYER, TISEO & HINDO, LTD.

MONITOR WELL NO. OB-32

Project Name: WAYNE DISPOSAL LANDFILL – SITE NO. 2 — NTH Pro. No. 94515 OW

Project Location: VAN BUREN TWP., WAYNE COUNTY, MICHIGAN — Chk. By: LLB

LOG OF MONITOR INSTALLATION

Generalized Subsurface Profile

ELEV (FT) | PRO-FILE | GROUND SURFACE ELEVATION: 697.8

- SILTY SAND — 7.5
- SILTY CLAY — 39.0
- CLAYEY SILT — 41.5
- SILTY CLAY — 53.0
- CLAYEY SILT — 57.0
- SILTY CLAY — 60.5
- SILTY FINE SAND — 69.1
- SANDY CLAY — 87.0
- SILTY CLAY — 113.0
- WEATHERED CLAYEY SHALE — 121.0
- SHALE — 133.0
- END OF BORING

Schematic

TOP OF CASING ELEVATION: 701.38

- NON-SHRINKING CEMENT GROUT — 90.0
- BENTONITE SLURRY — 120.0
- SAND — 132.5
- TIP ELEVATION: 565.3

GROUNDWATER DATA

Date	Groundwater Elev. (ft)	Comments
7/23/87	655.70	
7/28/87	651.35	
7/29/87	651.25	
7/31/87	651.15	
8/18/87	651.00	
8/21/87	650.72	
8/25/87	650.77	
8/31/87	651.10	
9/4/87	650.78	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATA, SEE LOG OF TEST BORING NO. OB-32.

[2] TOP OF CASING AND GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC.

Started:	7/21/87	Casing Diam.:	2"
Completed:	7/21/87	Casing Length:	127'
Inspector:	R. BURNS / M. TAKACS	Casing Type:	107.5' GALV. / 20' SS
Driller:	S. REMPALSKI	Screen Diam.:	2"
Contractor:	MATECO DRILLING COMPANY	Screen Length:	5'
Equipment:	CME-550	Screen Mesh:	0.007"
Observation Type:	MONITORING WELL	Screen Type:	STAINLESS STEEL

Figure No. 12

MONITORING WELL NO: OB-34A

NTH CONSULTANTS, LTD.

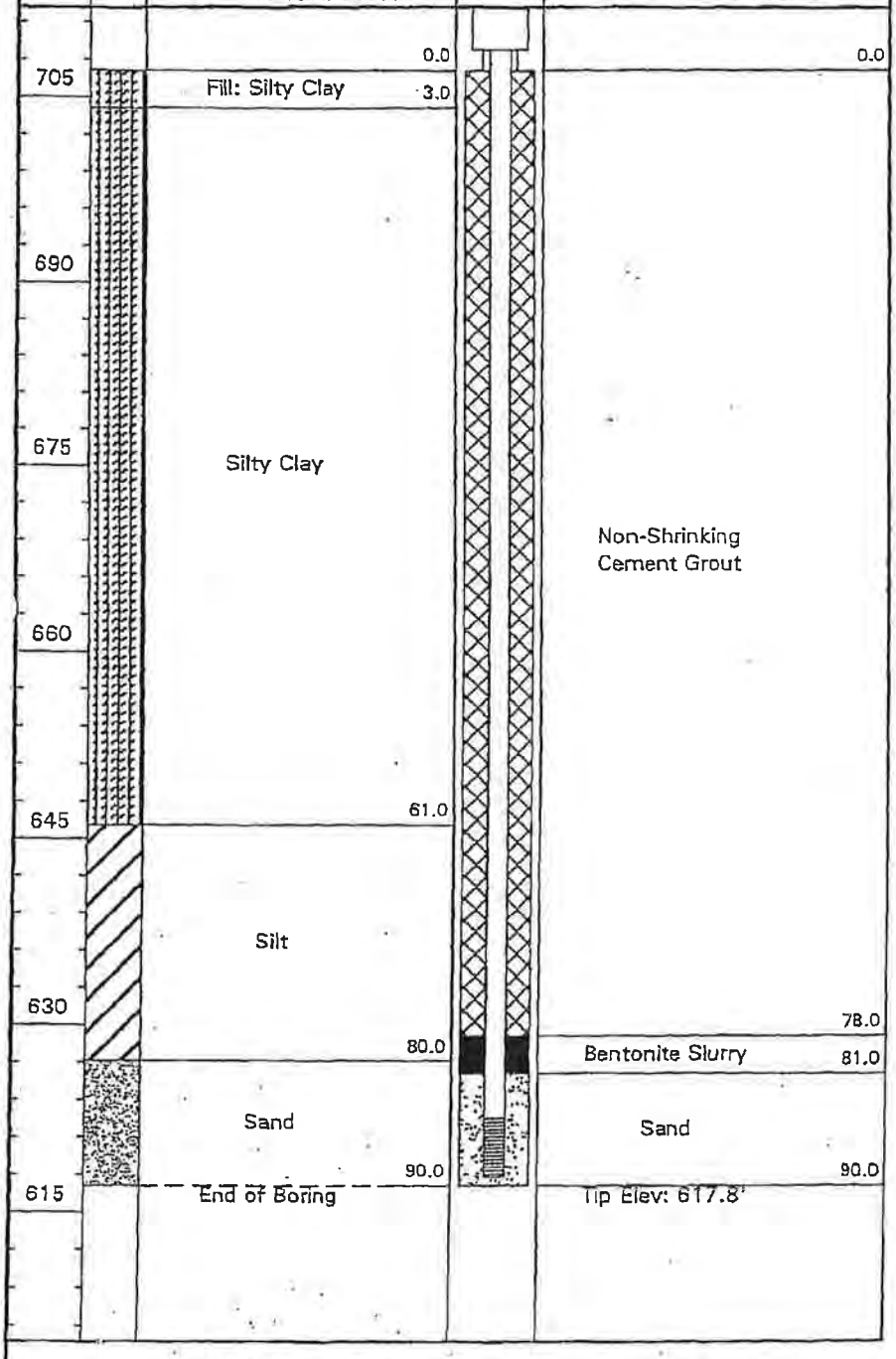
Project Name: *WAYNE DISPOSAL, INC.*

Project Location: *BELLEVILLE, MICHIGAN*

NTH Proj. No: *13-020395-01*

Checked By: RBM

LOG OF MONITORING WELL



GROUNDWATER DATA

DATE	ELEV. (ft.)	COMMENTS
06-24-03	n/a	due to use of drilling fluids

NOTES

[1] For details of subsurface strata, see Log of Test Boring OB-34A.

Started:	*06/23/03*	Casing Diameter:	*2.0 in*
Completed:	*06/24/03*	Casing Length:	*89.25 ft*
Inspector:	*K. Warning*	Casing Type:	*Stainless Steel*
Contractor:	*American Drilling & Testing Co.*	Screen Diameter:	*2.0 in*
Driller:	*R. Rumptz / H. Pace*	Screen Length:	*5.0 ft*
Equipment:	*CME-750 & CME-550*	Screen Mesh:	*0.007 in*
Well Type:	*Monitoring*	Screen Type:	*Stainless Steel*

FIGURE NO.

MONITORING WELL NO: OB-35A

NTH CONSULTANTS, LTD.

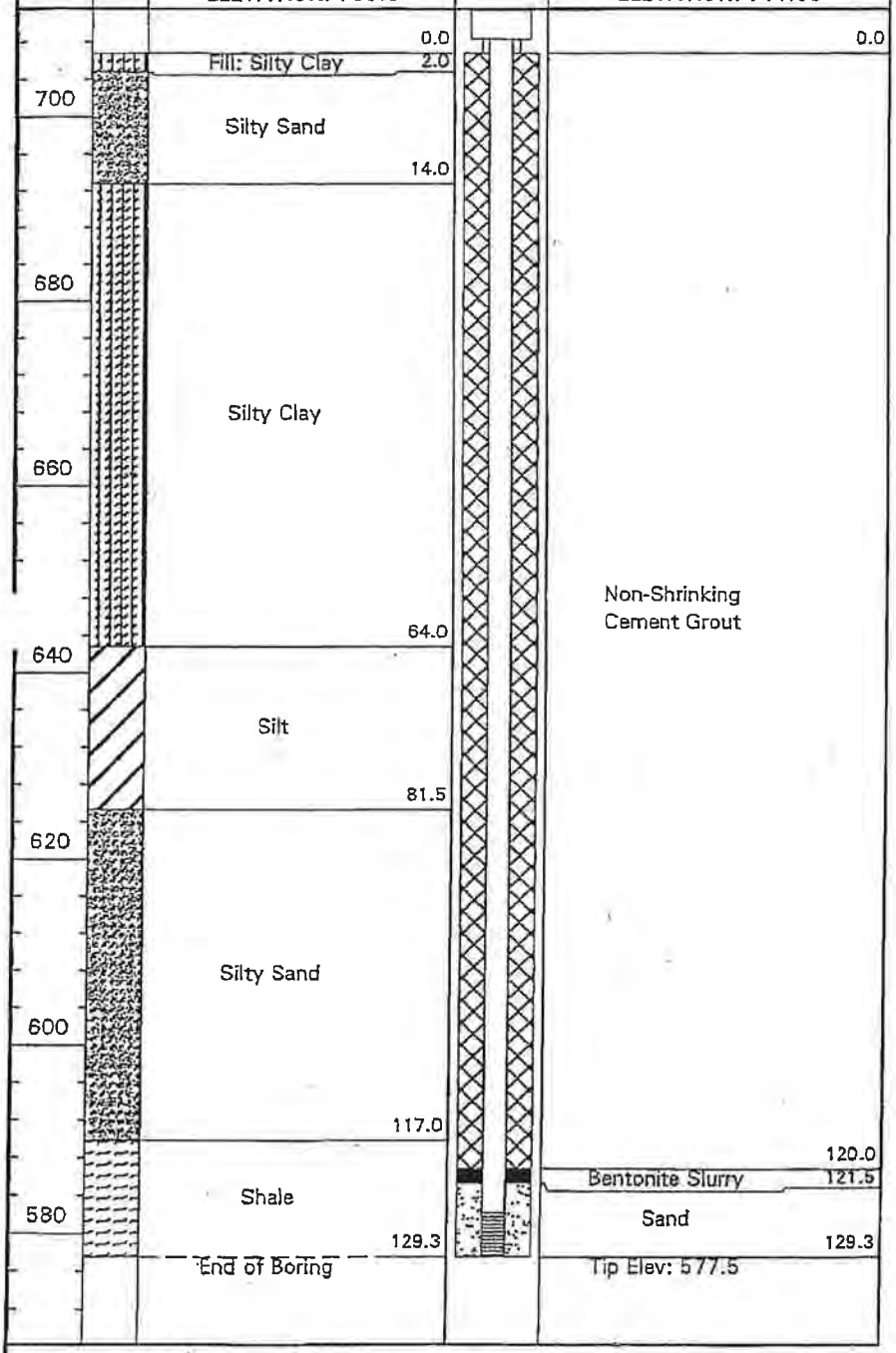
Project Name: *WAYNE DISPOSAL, INC.*

NTH Proj. No: *13-020395-01*

Project Location: *BELLEVILLE, MICHIGAN*

Checked By: RBM

LOG OF MONITORING WELL



GROUNDWATER DATA

DATE	ELEV. (ft.)	COMMENTS
06-24-03	n/a	due to use of drilling fluids

NOTES

[1] For details of subsurface strata, see Log of Test Boring OB-35A.

Started:	*06/19/03*	Casing Diameter:	*2.0 in*
Completed:	*06/20/03*	Casing Length:	*128.89 ft*
Inspector:	*K. Warning*	Casing Type:	*Stainless Steel*
Contractor:	*American Drilling & Testing Co.*	Screen Diameter:	*2.0 in*
Driller:	*R. Rumptz / H. Pace*	Screen Length:	*5.0 ft*
Equipment:	*CME-750 & CME-550*	Screen Mesh:	*0.007 in*
Well Type:	*Monitoring*	Screen Type:	*Stainless Steel*

FIGURE NO.

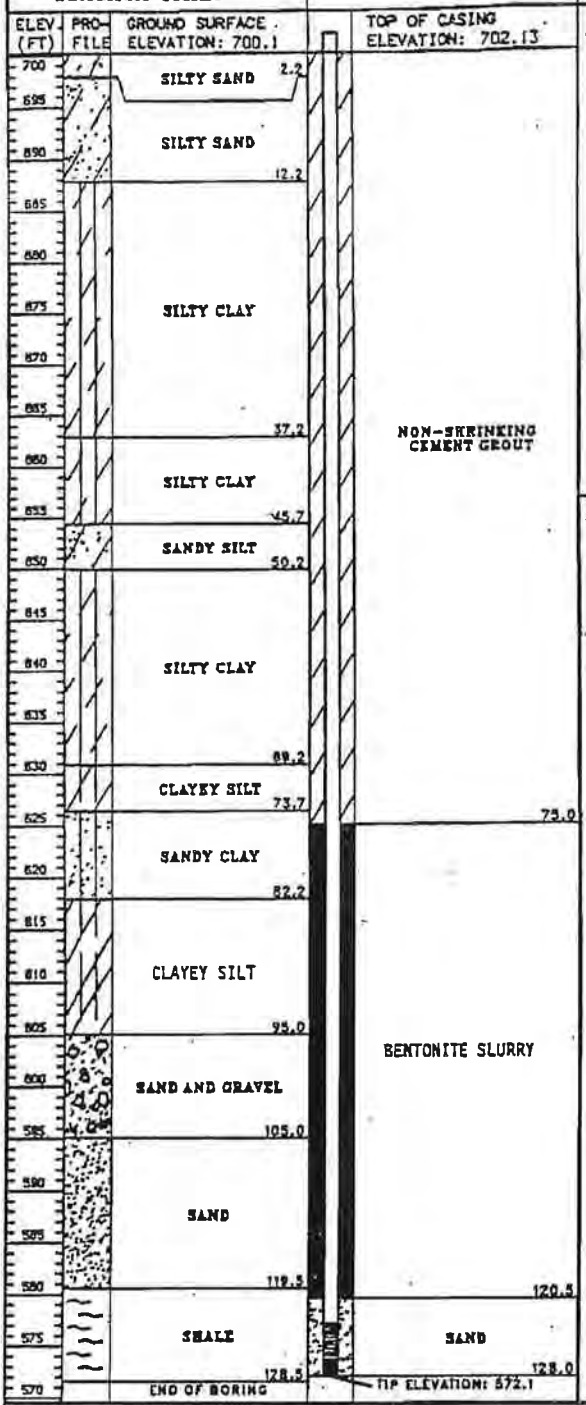
NEYER, TISEO & HINDO, LTD.

MONITOR WELL NO. OB-36

Project Name: WAYNE DISPOSAL LANDFILL – SITE NO. 2
Project Location: VAN BUREN TWP., WAYNE COUNTY, MICHIGAN

NTH Pro. No. 94315 OW
Chk. By: RLB

LOG OF MONITOR INSTALLATION



GROUNDWATER DATA

Date	Groundwater Elev. (ft)	Comments
10/22/87	649.70	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATA, SEE LOG OF TEST BORING NO. OB-36
[2] TOP OF CASING AND GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC.

Started:	10/1/87
Completed:	10/1/87
Inspector:	M. TAKACS / R. BURNS
Driller:	S. REMPALSKI
Contractor:	MATECO DRILLING COMPANY
Equipment:	CME-550
Observation Type:	MONITORING WELL

Casing Diam.:	2"
Casing Length:	125'
Casing Type:	70' GAVL / 55' SS
Screen Diam.:	2"
Screen Length:	5'
Screen Mesh:	0.007"
Screen Type:	STAINLESS STEEL

Figure No. 15

NEYER, TISEO & HINDO, LTD.

MONITOR WELL NO. OB-37

Project Name: WAYNE DISPOSAL LANDFILL - SITE NO. 2
Project Location: VAN BUREN TWP., WAYNE COUNTY, MICHIGAN

NTH Pro. No. 94315 OW
Chk. By: LLB

LOG OF MONITOR INSTALLATION

Generalized Subsurface Profile

ELEV. (FT) | PROFILE | GROUND SURFACE ELEVATION: 701.7

- SILT — 3.5
- SILTY CLAY — 15.5
- SILTY SAND — 16.0
- SILTY CLAY — 54.0
- CLAYEY SILT — 63.0
- SILTY FINE SAND — 91.0
- GRAVELLY SAND — 117.5
- SANDY GRAVEL — 121.0
- WEATHERED SHALE — 123.0
- SHALE — 130.0
- END OF BORING

Schematic

TOP OF CASING ELEVATION: 705.53

- NON-SHRINKING CEMENT GROUT — 95.0
- BENTONITE SLURRY — 122.0
- SAND — 128.0
- TIP ELEVATION: 572.7

GROUNDWATER DATA

Date	Ground-water Elev.(ft)	Comments
7/25/87	663.21	
7/28/87	652.10	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATA, SEE LOG OF TEST BORING NO. OB-37
[2] TOP OF CASING AND GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC.

Started: 9/21/87
Completed: 9/24/87
Inspector: R. BURNS
Driller: S. RUMPALSKI
Contractor: MATTCO DRILLING COMPANY
Equipment: CME-550
Observation Type: MONITORING WELL

Casing Diam.: 2"
Casing Length: 128.3'
Casing Type: 34.3' GALV. / 79' SS
Screen Diam.: 2"
Screen Length: 3.5'
Screen Mesh: 0.01"
Screen Type: STAINLESS STEEL

Figure No. 16

NEYER, TISEO & HINDO, LTD.

MONITOR WELL NO. OB-38

Project Name: WAYNE DISPOSAL LANDFILL - SITE NO. 2
Project Location: VAN BUREN TWP., WAYNE COUNTY, MICHIGAN

NTH Proj. No. 94315 OW
Chk. By: RLB

LOG OF MONITOR INSTALLATION

Generalized Subsurface Profile

ELEV (FT) | PRO-FILE | GROUND SURFACE ELEVATION: 711.8

SILTY CLAY — 49.7
CLAYEY SILT — 54.2
SILTY CLAY — 58.7
SILTY SAND — 84.5
GRAVELLY SAND — 87.0
SAND — 95.0
SILTY SAND — 105.0
GRAVELLY SAND — 121.0
GRAVEL — 126.0
SANDY GRAVEL — 130.0
WEATHERED SHALE — 132.0
SHALE — 138.0
END OF BORING

Schematic

TOP OF CASING ELEVATION: 714.02

NON-SHRINKING CEMENT GROUT — 60.0
BENTONITE SLURRY — 132.0
SAND — 138.4
TIP ELEVATION: 573.4

GROUNDWATER DATA

Date	Ground-water Elev. (ft)	Comments
9/18/87	653.12	
9/23/87	651.13	
9/24/87	651.02	
9/25/87	650.86	
9/28/87	650.70	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATA, SEE LOG OF TEST BORING NO. OB-38
[2] TOP OF CASING AND GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC.

Started:	9/9/87
Completed:	9/10/87
Inspector:	R. BURNS / M. TAKACS
Driller:	S. REMPALSKI
Contractor:	MATECO DRILLING COMPANY
Equipment:	CME-550
Observation Type:	MONITORING WELL

Casing Diam.:	2"
Casing Length:	137.1'
Casing Type:	30.1' GALV. / 87' SS
Screen Diam.:	2"
Screen Length:	3.5'
Screen Mesh:	0.01"
Screen Type:	STAINLESS STEEL

Figure No. 17

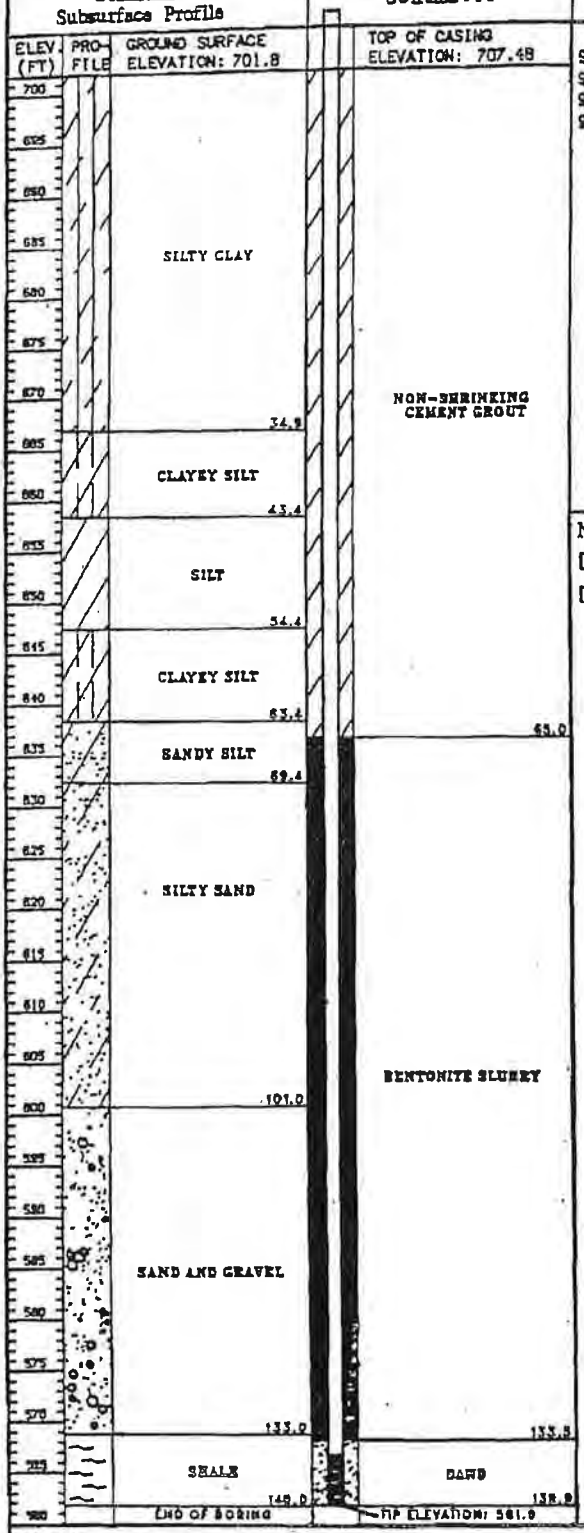
NEYER, TISEO & HINDO, LTD.

MONITOR WELL NO. OB-39

Project Name: WAYNE DISPOSAL LANDFILL – SITE NO. 2 NTH Pro. No. 9431S OW

Project Location: VAN BUREN TWP., WAYNE COUNTY, MICHIGAN Chk. By: RLB

LOG OF MONITOR INSTALLATION



GROUNDWATER DATA

Date	Ground-water Elev. (ft)	Comments
9/1/87	652.28	
9/4/87	651.50	
9/9/87	650.88	
9/22/87	650.50	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATA, SEE LOG OF TEST BORING NO. OB-39

[2] TOP OF CASING AND GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC.

Started:	8/31/87
Completed:	9/1/87
Inspector:	R. BURNS
Driller:	S. REMPALSKI
Contractor:	MATECO DRILLING COMPANY
Equipment:	CME-550
Observation Type:	MONITORING WELL

Casing Diam.:	2"
Casing Length:	140.4'
Casing Type:	65.4' GALV. / 75' SS
Screen Diam.:	2"
Screen Length:	5'
Screen Mesh:	0.007"
Screen Type:	STAINLESS STEEL

Figure No. 18

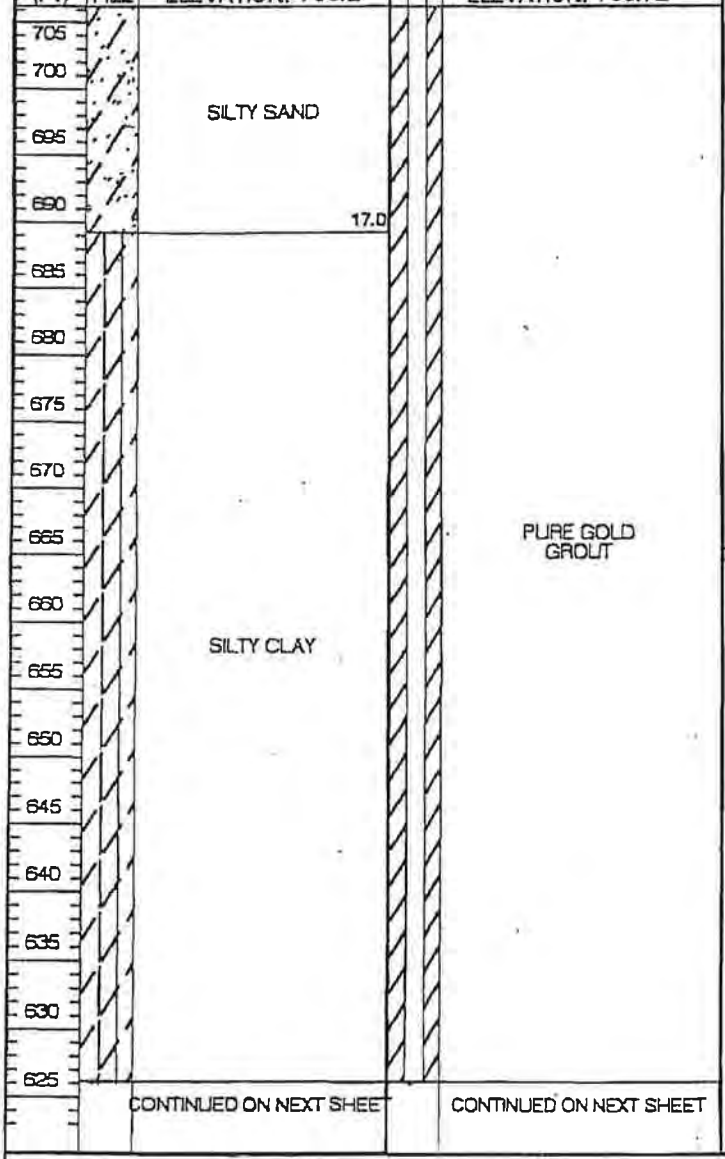
NTH Consultants, Ltd.

MONITORING WELL NO. OB-40R

Project Name : WAYNE DISPOSAL, INC. - SITE NO. 2 NTH Proj. No: 13-3051 00

Project Location : VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN Checked By : ACE

LOG OF MONITORING WELL



GROUNDWATER DATA

Date	Ground-water Elev. (ft)	Comments
02/01/93	659.72	BEFORE DEVELOPMENT
02/09/93	658.14	BEFORE DEVELOPMENT
02/25/93	656.69	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATA, SEE LOG OF TEST BORING NO. OB-40R.

[2] TOP OF CASING & GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC.

[3] WELL INSTALLED TO REPLACE MONITORING WELL NO. OB-40.

[4] CENTRALIZERS WERE USED TO MAINTAIN THE VERTICALITY OF THE WELL ASSEMBLY IN THE BOREHOLE.

FIELD MEASUREMENTS DURING DRILLING:

pH: 8.10
SPEC. COND: 310 µmhos/cm

FIELD MEASUREMENTS AFTER DEVELOPMENT:

pH: 8.03
SPEC. COND: 302 µmhos/cm

Started: 01/29/93
Completed: 02/01/93
Inspector: C. ENDLER
Driller: G. QUALLS
Contractor: GEO-TEK, INC.
Equipment: CME-750 ALL-TERRAIN DRILLING RIG
Well Type: MONITORING

Casing Diameter: 2.0"
Casing Length: 93.5'
Casing Type: STAINLESS STEEL
Screen Diameter: 2.0"
Screen Length: 5.0'
Screen Mesh: 0.007"
Screen Type: STAINLESS STEEL

Figure No. A-6a

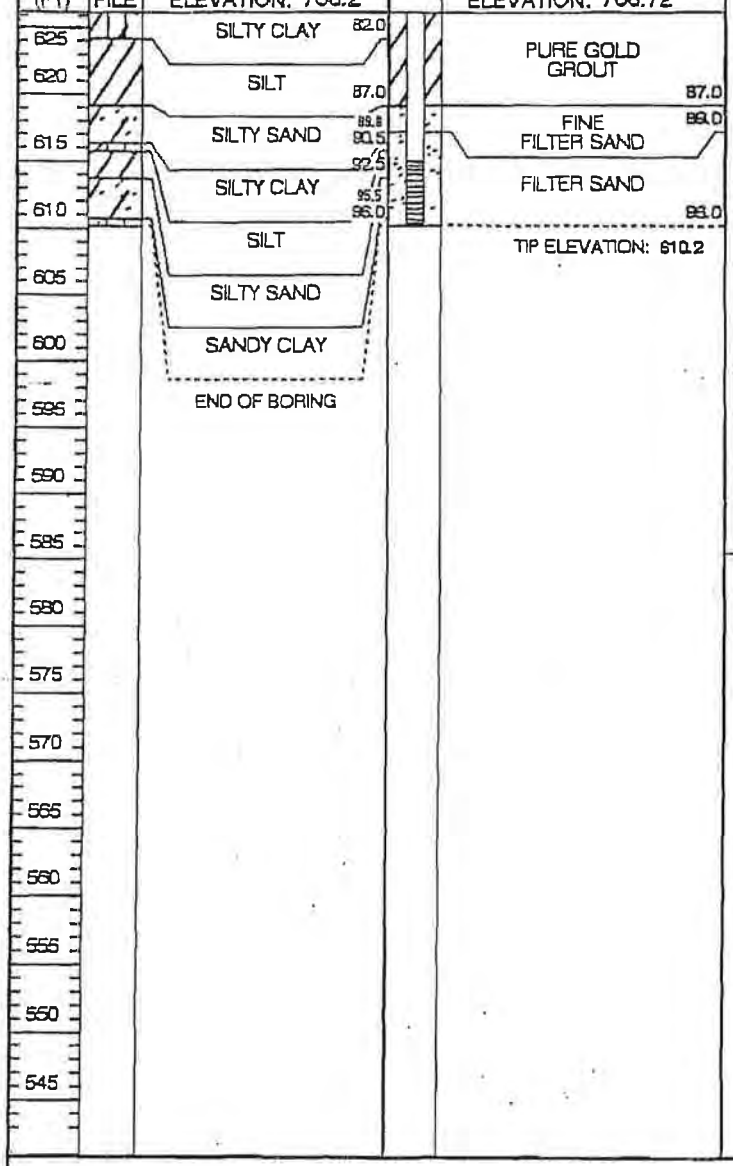
NTH Consultants, Ltd.

MONITORING WELL NO. OB-40R

Project Name : WAYNE DISPOSAL, INC. - SITE NO. 2 NTH Proj. No: 13-3051 00

Project Location : VAN BUREN TOWNSHIP, WAYNE COUNTY, MICHIGAN Checked By : ACE

LOG OF MONITORING WELL



GROUNDWATER DATA

Date	Groundwater Elev. (ft)	Comments
02/01/93	659.72	BEFORE DEVELOPMENT
02/09/93	658.14	BEFORE DEVELOPMENT
02/25/93	656.69	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATA, SEE LOG OF TEST BORING NO. OB-40R.

[2] TOP OF CASING & GROUND SURFACE ELEVATIONS PROVIDED BY WAYNE DISPOSAL, INC.

[3] WELL INSTALLED TO REPLACE MONITORING WELL NO. OB-40.

[4] CENTRALIZERS WERE USED TO MAINTAIN THE VERTICALITY OF THE WELL ASSEMBLY IN THE BOREHOLE.

FIELD MEASUREMENTS DURING DRILLING:

pH: 8.10
SPEC. COND: 310 µmhos/cm

FIELD MEASUREMENTS AFTER DEVELOPMENT:

pH: 8.03
SPEC. COND: 302 µmhos/cm

Started: 01/29/93
Completed: 02/01/93
Inspector: C. ENDLER
Driller: G. QUALLS
Contractor: GEO-TEK, INC.
Equipment: CME-750 ALL-TERRAIN DRILLING RIG
Well Type: MONITORING

Casing Diameter: 2.0"
Casing Length: 93.5'
Casing Type: STAINLESS STEEL
Screen Diameter: 2.0"
Screen Length: 5.0'
Screen Mesh: 0.007"
Screen Type: STAINLESS STEEL

Figure No. A-6b

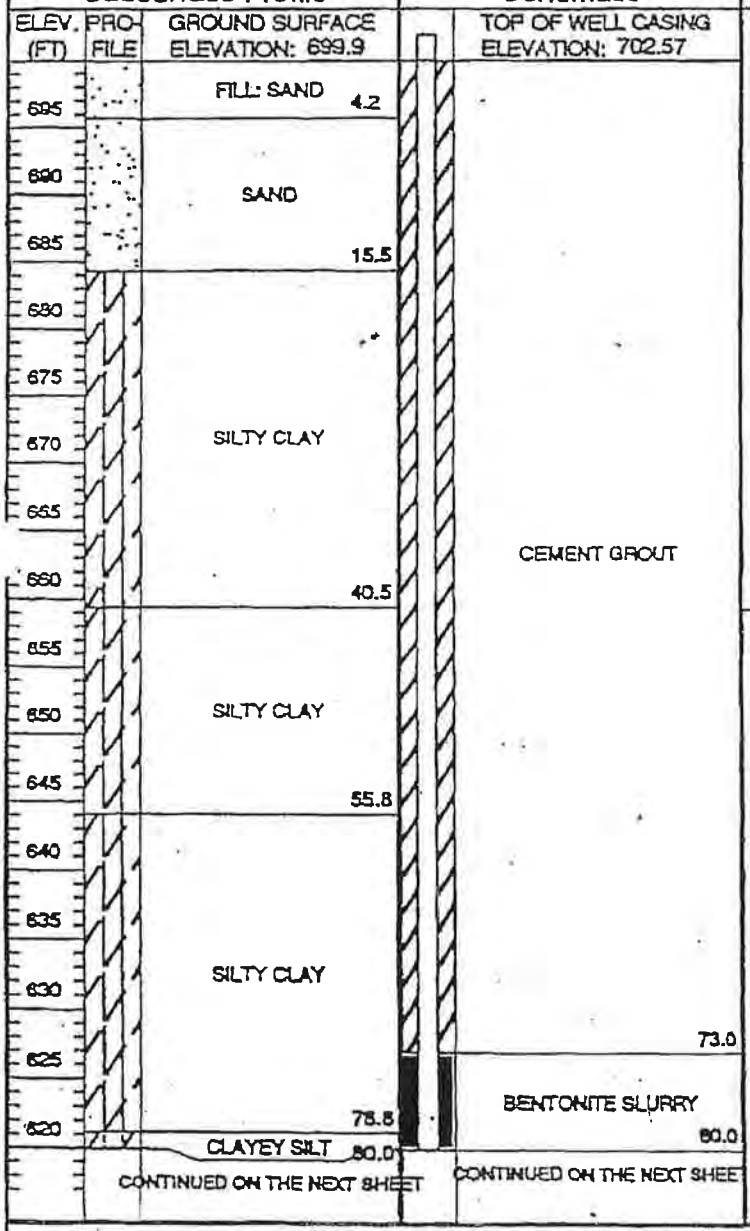
NTH Consultants, Ltd.

MONITORING WELL NO. OB-47

Project Name : MICHIGAN DISPOSAL, INCORPORATED — NTH Proj. No: 90323 OW

Project Location : VAN BUREN TWP, WAYNE COUNTY, MICHIGAN — Check By :

LOG OF MONITORING WELL



GROUNDWATER DATA

Date	Ground-water Elev. (ft)	Comments
07/12/90	652.96	
07/16/90	652.95	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATIGRAPHY, SEE LOG OF TEST BORING OB-47.

[2] WELL DEVELOPED WITH COMPRESSED AIR ON 07/16/90.

[3] TOP OF CASING AND GROUND SURFACE ELEVATIONS DETERMINED BY WDI PERSONNEL.

[4] DEPTH TO FIRST COUPLING IS 0.3 FEET BELOW GROUND SURFACE; SECOND COUPLING IS 10.3 FEET BELOW GROUND SURFACE.

Started: 07/02/90
Completed: 07/12/90
Inspector: G. CROCKFORD
Driller: M. PUFFPAFF
Contractor: ENVIRONMENTAL DRILLING & SERVICES, INC.
Equipment: FAILING F-7
Well Type: MONITORING WELL

Casing Diameter: 2" I.D.
Casing Length: 103 FT
Casing Type: 60' STAINLESS/43' GALVANIZED
Screen Diameter: 2"
Screen Length: 5'
Screen Mesh: .007
Screen Type: STAINLESS STEEL

Figure No. 2

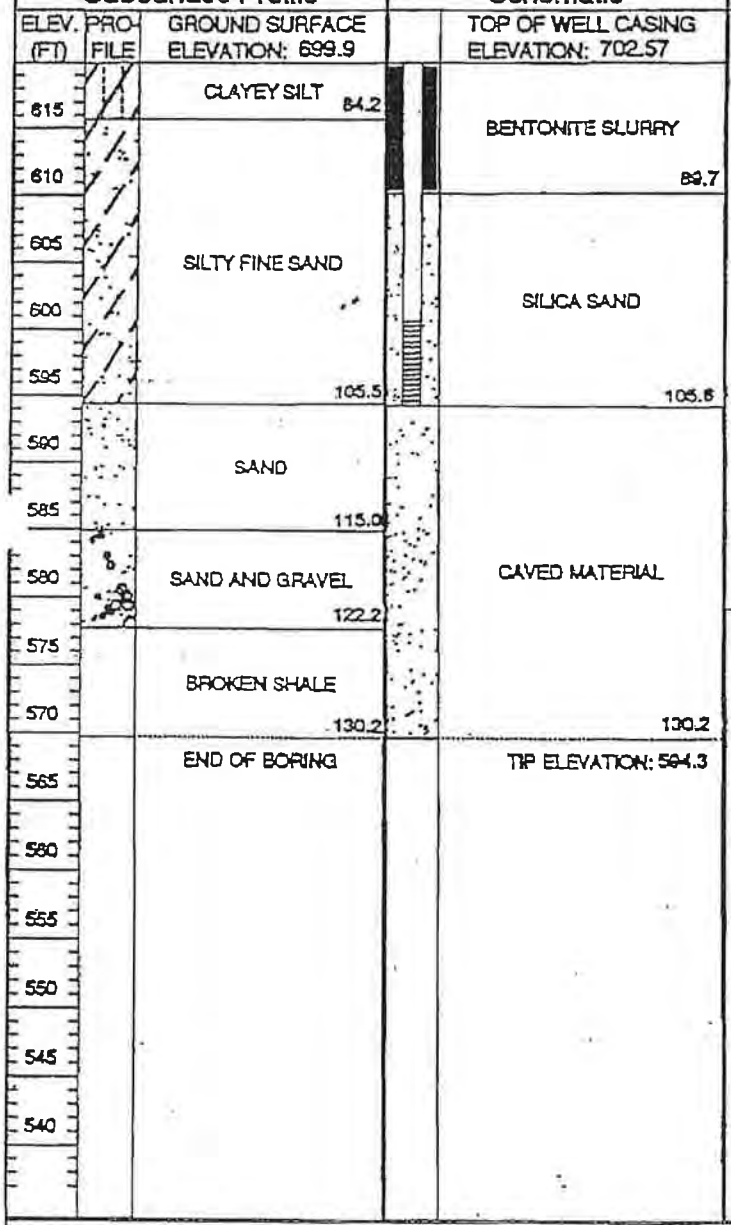
NTH Consultants, Ltd.

MONITORING WELL NO. OB-47

Project Name : MICHIGAN DISPOSAL, INCORPORATED — NTH Proj. No: 90323 OW

Project Location : VAN BUREN TWP, WAYNE COUNTY, MICHIGAN — Check By :

LOG OF MONITORING WELL



Generalized Subsurface Profile

Installation Schematic

GROUNDWATER DATA

Date	Ground-water Elev.(ft)	Comments
07/12/90	652.96	
07/16/90	652.95	

NOTES :

[1] FOR DETAILS OF SUBSURFACE STRATIGRAPHY, SEE LOG OF TEST BORING OB-47.

[2] WELL DEVELOPED WITH COMPRESSED AIR ON 07/16/90.

[3] TOP OF CASING AND GROUND SURFACE ELEVATIONS DETERMINED BY WDI PERSONNEL.

[4] DEPTH TO FIRST COUPLING IS 0.3 FEET BELOW GROUND SURFACE; SECOND COUPLING IS 10.3 FEET BELOW GROUND SURFACE.

Started: 07/02/90
Completed: 07/12/90
Inspector: G. CROCKFORD
Driller: M. PUFFPAFF
Contractor: ENVIRONMENTAL DRILLING & SERVICES, INC.
Equipment: FAILING F-7
Well Type: MONITORING WELL

Casing Diameter: 2" I.D.
Casing Length: 103 FT
Casing Type: 60' STAINLESS/43' GALVANIZED
Screen Diameter: 2"
Screen Length: 5'
Screen Mesh: .007"
Screen Type: STAINLESS STEEL

Figure No. 2

OBSERVATION WELL NO: WW OB-48

NTH CONSULTANTS, LTD.

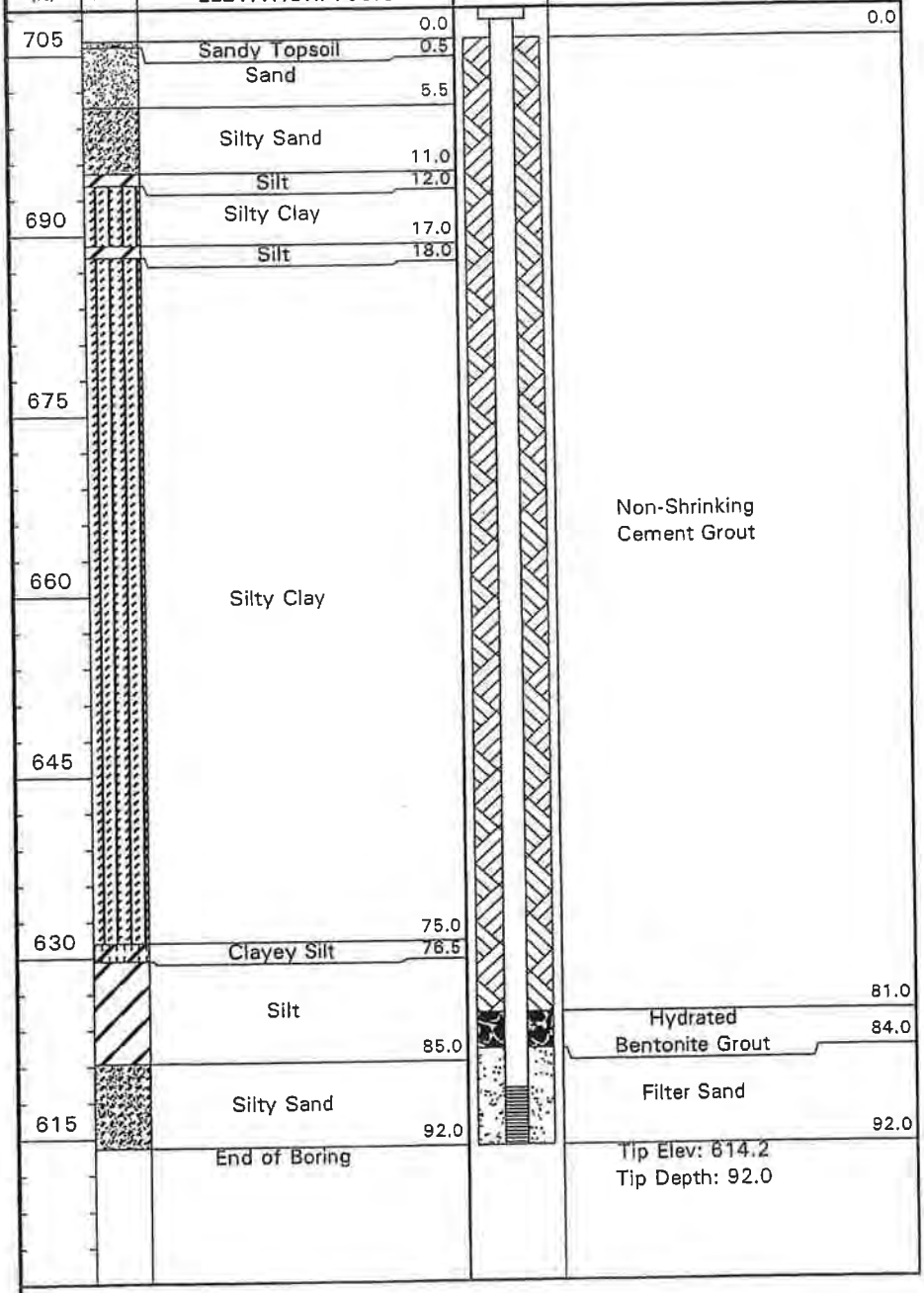
Project Name: *WAYNE DISPOSAL, INC. - WOOD LOT*

Project Location: *BELLEVILLE, MICHIGAN*

NTH Proj. No: *62-080376-01*

Checked By: dlp

LOG OF OBSERVATION WELL



GROUNDWATER DATA

DATE	ELEV. (ft.)	COMMENTS
12-07-08	655.21	
02-09-09	655.10	

NOTES

[1] For details of subsurface strata, see Log of Test Boring TB-W-1.

[2] Location Coordinates: E 3690.00
N 7660.02

Started:	*07-16-08*
Completed:	*07-16-08*
Inspector:	*M. McNamara*
Contractor:	*Mateco Drilling Co.*
Driller:	*J. Pitsch*
Equipment:	*CME-750 ATV Drill Rig*
Well Type:	*Observation*

Casing Diameter:	*2.0 in*
Casing Length:	*89.5 ft*
Casing Type:	*PVC*
Screen Diameter:	*2.0 in*
Screen Length:	*5.0 ft*
Screen Mesh:	*0.010 in*
Screen Type:	*PVC*

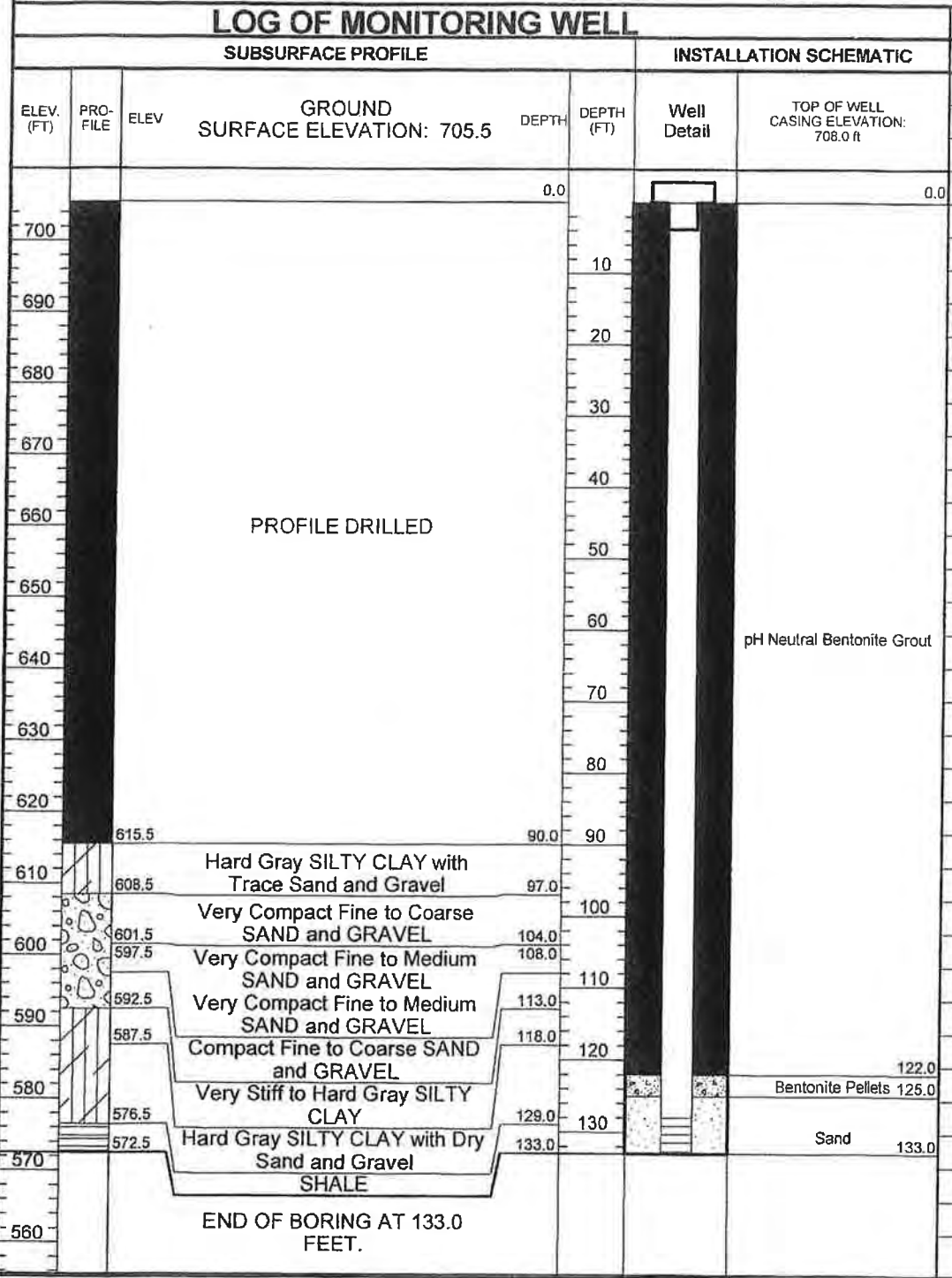
FIGURE NO. B-15

MONITORING WELL: MW-OB-49

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

LOG OF MONITORING WELL



GAS DATA		
DATE	ELEV (FT)	Gas Reading

Total Depth: *133.0 FT*
Installation Date: *5/7/2014*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Equipment: *CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.*

Notes:

Casing Diameter: *2"*
Casing Length: *130'*
Casing Type: *Stainless Steel*
Tip Elevation: *572.5*
GPS Coordinates:

Screen Diameter: *2"*
Screen Length: *5'*
Screen Mesh: *0.010"*
Screen Type: *Stainless Steel*

Well Type: *MONITORING WELL*

Figure No. 6

MONITORING WELL LOG MW 13-060921-20.GPJ NTH CORPORATE.GDT 8/6/14

MONITORING WELL: MW-OB-50

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

LOG OF MONITORING WELL

ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 712.0	DEPTH	DEPTH (FT)	Well Detail	TOP OF WELL CASING ELEVATION: 715.4 ft
				0.0			0.0
710			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel (Clay Recompact)		10		
700		693.0		19.0	20		
690		689.0	Loose Fine to Medium SILTY SAND	23.0			
			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		30		
680					40		
670			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		50		pH Neutral Bentonite Grout
660					60		
650		643.0		69.0	70		
640			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel				
		632.5	Wet, Gray CLAYEY SILT with Trace Sand	79.5	80		
630		631.0	Very Stiff Gray SANDY CLAY with Trace Silt and Gravel	81.0			
620			Hard to Very Hard Gray SILTY CLAY with Trace Sand and Gravel		90		
		617.0		95.0			
610		612.0	Medium Compact Gray CLAYEY SILT with Trace Sand and Gravel	100.0	100		100.0 Bentonite Pellets 102.0
		604.0	Very Compact Coarse SAND and GRAVEL	108.0			
600		602.0	Very Compact Medium to Coarse SAND and GRAVEL	110.0	110		Sand 110.0
			Very Compact Fine to Medium SAND with Little Gravel				
590			END OF BORING AT 110.0 FEET.				
580							

GAS DATA		
DATE	ELEV (FT)	Gas Reading

Total Depth: *110.0 FT*
Installation Date: *4/29/2014*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Equipment: *CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.*

Notes:

Casing Diameter: *2"*
Casing Length: *108.43'*
Casing Type: *PVC*
Tip Elevation: *602.43*
GPS Coordinates:

Screen Diameter: *2"*
Screen Length: *5'*
Screen Mesh: *0.007"*
Screen Type: *PVC*

Well Type: *MONITORING WELL*

Figure No. 7

MONITORING WELL LOG MW 13-060921-20.GPJ NTH CORPORATE.GDT 8/6/14

MONITORING WELL: MW-OB-51

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

LOG OF MONITORING WELL

SUBSURFACE PROFILE						INSTALLATION SCHEMATIC		GAS DATA		
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 715.5	DEPTH	DEPTH (FT)	Well Detail	TOP OF WELL CASING ELEVATION: 719.2 ft	DATE	ELEV (FT)	Gas Reading
				0.0			0.0			
710		711.0	Stiff Gray SILTY CLAY Cap Material	4.5	10					
		702.5	Dry Gray CLAYEY SILT with Trace Sand and Gravel and Trace Debris	13.0						
700			Very Stiff Gray SILTY CLAY with Trace Sand and Gravel		20					
690					30					
680			Very Stiff Gray SILTY CLAY with Trace Sand and Gravel							
		675.5		40.0	40					
670		671.5	Stiff Gray SILTY CLAY with Occasional Wet Silt Lenses	44.0						
			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		50		pH Neutral Bentonite Grout			
660		661.0		54.5						
		658.5	Dry SILT with Trace Clay	57.0	60					
650			Hard Gray SILTY CLAY with Numerous Dry Silt Seams							
		646.5		69.0	70					
640			Hard Gray SILTY CLAY with Numerous Dry Silt Seams							
			Wet Gray CLAYEY SILT		80					
630		631.5		84.0						
			Very Hard Gray SILTY CLAY with Trace Sand and Gravel		90					
620		616.5		99.0	100					
		612.5	Wet Gray SILT with Trace Sand	103.0			101.0 Bentonite Pellets 103.0			
610		605.5	Very Compact Medium to Coarse SAND and GRAVEL with Trace Silt	110.0	110		Sand 110.0			
600			Very Compact Medium to Coarse SAND and GRAVEL with Trace Silt							
590			END OF BORING AT 110.0 FEET.							
580										

Total Depth: *110.0 FT*
Installation Date: *4/24/2014*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Equipment: *CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.*

Notes:

Casing Diameter: *2"*
Casing Length: *108.69'*
Casing Type: *PVC*
Tip Elevation: *606.19*
GPS Coordinates:

Screen Diameter: *2"*
Screen Length: *5'*
Screen Mesh: *0.007"*
Screen Type: *PVC*

Well Type: *MONITORING WELL*

Figure No. 8

MONITORING WELL LOG MW 13-060921-20.GPJ NTH.CORPORATE.GDT 8/6/14

MONITORING WELL: MW-OB-52

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

LOG OF MONITORING WELL

ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 705.9	DEPTH	DEPTH (FT)	Well Detail	TOP OF WELL CASING ELEVATION: 709.2 ft
				0.0			0.0
700		702.9	FILL: Hard Brown and Gray SILTY CLAY with Trace Sand and Gravel and Trace Debris	3.0			
		698.9		7.0			
		696.9	FILL: Very Stiff Gray SILTY CLAY with Trace Sand and Gravel	9.0	10		
690		694.9	DEBRIS: Dry Paper, Cloth, Wood, Concrete, Brick and Plastic	11.0			
			Stiff Gray SILTY CLAY with Trace Sand and Gravel		20		
680			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		30		
670							pH Neutral Bentonite Grout
			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		40		
660							
					50		
650		651.4		54.5			
		650.9	Wet Very SILTY CLAY	55.0			
		647.9	Very Stiff Gray SILTY CLAY with Trace Sand and Gravel	58.0	60		
		643.9	Stiff, Wet, Very SILTY CLAY with Trace Sand	62.0			
640			Loose to Medium Compact Fine CLAYEY SAND with Trace Silt		70		
		632.9	Loose to Medium Compact Fine CLAYEY SAND with Trace Silt	73.0			74.0
630			Medium Compact to Compact Wet Fine SILTY SAND				Bentonite Pellets 77.0
		625.9		80.0	80		
			Very Compact Wet Fine SILTY SAND				Sand
620		620.9		85.0			85.0
			END OF BORING AT 85.0 FEET.				
610							

GAS DATA		
DATE	ELEV (FT)	Gas Reading

Total Depth: *85.0 FT*
Installation Date: *5/1/2014*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Equipment: *CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.*

Notes:

Casing Diameter: *2"*
Casing Length: *83.34'*
Casing Type: *PVC*
Tip Elevation: *620.9*
GPS Coordinates:

Screen Diameter: *2"*
Screen Length: *5'*
Screen Mesh: *0.007"*
Screen Type: *PVC*

Well Type: *MONITORING WELL*

Figure No. 9

MONITORING WELL LOG MW 13-060921-20.GPJ NTH CORPORATE.GDT 8/8/14

OBSERVATION WELL NO: WW-08 OB-53

NTH CONSULTANTS, LTD.

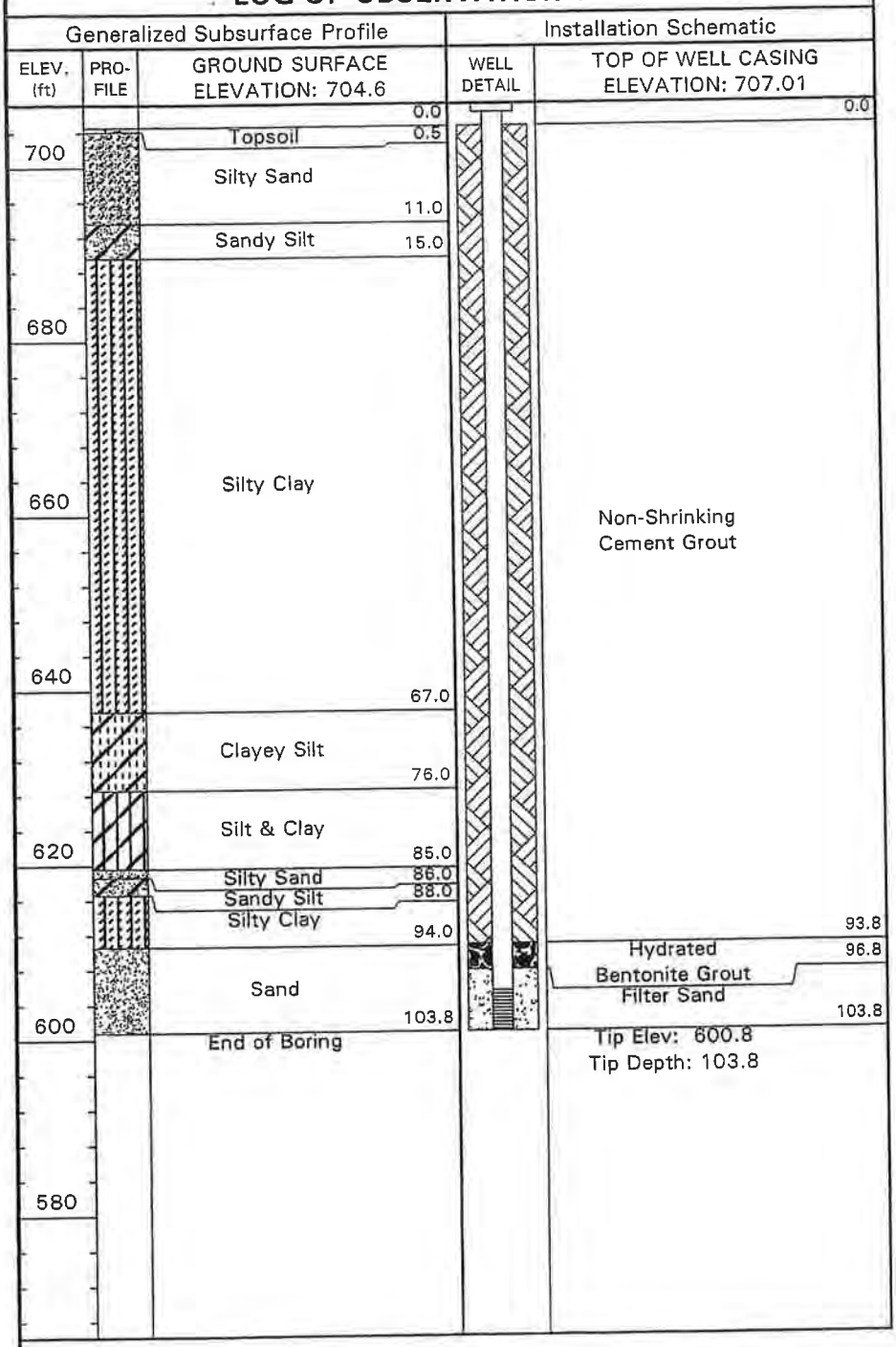
Project Name: *WAYNE DISPOSAL, INC. - WOOD LOT*

Project Location: *BELLEVILLE, MICHIGAN*

NTH Proj. No: *62-080376-01*

Checked By: dlp

LOG OF OBSERVATION WELL



GROUNDWATER DATA

DATE	ELEV. (ft.)	COMMENTS
12-07-08	652.79	
02-09-09	652.77	

NOTES

[1] Generalized subsurface profile based on adjacent test boring TB-W-10.

[2] Location Coordinates: E 3704.07
N 7052.42

Started:	*07-12-08*
Completed:	*07-12-08*
Inspector:	*M. McNamara*
Contractor:	*Mateco Drilling Co.*
Driller:	*J. Pitsch*
Equipment:	*CME-750 ATV Drill Rig*
Well Type:	*Observation*

Casing Diameter:	*2.0 in*
Casing Length:	*101.2 ft*
Casing Type:	*PVC*
Screen Diameter:	*2.0 in*
Screen Length:	*5.0 ft*
Screen Mesh:	*0.010 in*
Screen Type:	*PVC*

FIGURE NO. B-18

April 24, 2019 Project No. 19118008

Sylwia Scott
US Ecology
49350 North I-94 Service Drive
Belleville, MI 48111

WELL ABANDONMENT AND REPLACEMENT
WAYNE DISPOSAL, INC. SITE 2

Dear Ms. Scott:

Golder Associates Inc. (Golder) has prepared this correspondence to document the abandonment of three (3) observation wells and the installation of one (1) replacement well at the Wayne Disposal, Inc. (WDI) Site 2 property, located in Belleville, Michigan (Site). The well abandonment and replacement activities were required as a result of the encroachment of landfill activities on the well locations. Specifically, a waste transfer box is to be constructed over the location of two of the observation wells, while lateral expansion of the active landfill will occur over the location of the third abandonment. The workplan for well abandonment and replacement activities was approved by the Michigan Department of Environmental Quality on March 22, 2019.

FIELD ACTIVITIES

Well Installation

One replacement well (MW-OB-51-A) was installed to replace existing well MW-OB-51. The replacement well was installed using rotosonic drilling technology. As shown on the attached boring log and well construction diagram, the soil boring was advanced to 110 feet below ground surface (bgs) using 4-inch sonic drilling rods. Samples were collected continuously during drilling. Because of the potential for unknown debris materials to be present in the upper fifteen feet of the soil profile, 6-inch sonic rods were advanced outside the 4-inch rods (referred to as an “override casing”) to reduce the potential for drag-down impacts from the waste materials. The tip of the 6-inch override casing was advanced to 20 feet bgs. As shown on the boring log, waste materials were encountered between 13.5 and 14.5 feet bgs.

Soils were described during drilling and recorded in the field. The boring log includes soil type, color, grain size, and moisture content information for each soil type encountered. Following completion of the soil boring, the replacement monitoring well was constructed inside the drill rods before they were removed from the ground.

Replacement observation well MW-OB-51-A was contructed of 2-inch solid, flush-threaded polyvinyl chloride (PVC) risers fitted with a 5-foot-long, 0.010-inch slot PVC screen, with a bottom depth of 110 feet bgs. The top of the well casing was completed with a stickup of approximately 2.5 feet above ground surface. A nine-foot long, medium grained sand filter pack was placed in the annulus around the well screen. The drill rods were slowly

retracted from the borehole as the annular backfill was emplaced; the vibration from removal of the sonic rods assists with settlement of the backfill materials.

Following placement of the sand filter pack, a 3-foot thick bentonite pellet seal was placed on top of the filter sand to control grout penetration into the sand. The remainder of the well annulus was sealed with a thick, bentonite grout from the top of the bentonite pellet seal to two feet below ground surface. A lockable, steel protective casing was installed over the above-ground portion of the well casing. The base of the protective casing was set in a cement pad, which was sloped away from the protective casing to promote drainage away from the base of the well.

Well installation was started on March 25, 2019 and completed on March 26, 2019. Following installation, well MW-OB-51-A was developed by surging and purging with a submersible pump. Development activities were performed for three separate 45 minute intervals on March 27, 2019 (1 interval) and March 29, 2019 (2 intervals). The development was continued until the turbidity of the purged water was minimized.

Following completion of the monitoring well installation activities, the well was surveyed on March 29, 2019. Survey location and elevation data are shown on the attached boring log and well construction diagram.

Well Abandonment

A total of three (3) observation wells (OB-34A, OB-35A, and MW-OB-51) were abandoned by overdrilling using rotosonic drilling methods. In each case, the goals was the complete remove the well casing. However, prior to overdrilling, the well casing of each of the three wells was completely filled with bentonite grout in the event that the well casing was severed during extraction. In each case, six-inch or eight-inch rotosonic drill rods (the size of the rods used for abandonment was based on the borehole diameter of the original well installation). In each case, the drill rods were extended to the bottom depth of the original borehole. Well abandonment logs are attached with details of the abandonment activities.

For MW-OB-51, the well log indicated that “Trace Debris” was present in the upper 15 feet of the soil profile. Out of an abundance of precaution, a ten-inch override casing was placed to a tip depth of 20 feet bgs. The tip of the ten-inch rods were bedded into silty clay, based on the original boring log, to reduce the potential for drag-down of contaminants during the abandonment. Eight-inch diameter sonic rods were then extended to 110 feet below ground surface.

Once the target depth was reached, an attempt was made to remove the well casing by pulling from the surface. For well MW-OB-51, none of the PVC well materials were recovered. According to the driller, it is not uncommon for the sonic method to shatter the PVC well materials which accumulate at the bottom of the borehole as the abandoment proceeds. For well OB-34A, the upper 60 feet of stainless-steel well casing was removed from the ground, with the bottom 30 feet of not recovered and remaining in the ground. For well OB-35A, the upper 60 feet of stainless-steel well casing was severed and lost in the borehole, ultimately being driven to the bottom borehole at 129.3 feet bgs.

Following the removal of as much of the installed well components as possible, each borehole was then tremie grouted under low pressure using bentonite grout to provide a seal against to the natural geologic materials that were pentrated by the wellbore. The sonic rods were slowly removed from the borehole as the grout was being placed to allow the grout to completely fill the wellbore.

The bottom of the tremie pipe was kept in contact with the grout during introduction to prevent air pockets from forming during emplacement. In each case, the wellbore was sealed from the bottom of the wellbore up to approximately ground surface. The grout sealant was inspected for settlement at least twenty four (24) hours after placement, and additional grout or bentonite chips were added, as needed, where settlement was noted. Well abandonment details, including borehole diameter, total depth, grout type, and amout of grout used were documented in the field by Golder field personnel. These details are recorded on the attached borehole abandonment logs.

We appreciate the opportunity to submit this proposal to you and look forward to working with you on this project. If you have any questions regarding this proposal, please call the undersigned at 248-295-0135.

Sincerely,

Golder Associates Inc.

Adam C. Near, CPG
Project Geologist

Sean C. Paulsen, PG
Associate/Senior Consultant

ACN/SCP

Attachment: Boring log and well construction diagram MW-OB-51-A
Well abandonment records MW-OB-51, OB-34A, and OB-35A

RECORD OF BOREHOLE: MW-OB-51A

CLIENT:	US Ecology	START DATE:	March 25, 2019	ELEVATION:	717.8 ft
PROJECT:	US Ecology - Site 2	END DATE:	March 26, 2019	COORDINATES:	N: 6970.1 ft E: 4333.3 ft
PROJECT NO:	19118008			COORD SYS:	SP MI South FIPS 2113 Ft
LOCATION:	Belleville, MI	CONTRACTOR:	Stock Drilling	HORZ DATUM:	NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
0	LS 250 Mini-Sonic	Roto-Sonic (4-inch rods to 100', 6-inch rods to 20')	SILTY CLAY with organics.	CL-ML		0.0											0.0 - 1.0 ft bgs: Cement
1			SANDY CLAY, some gravel, some fine to medium sand, brown, moist.	CL		717.3 0.5											
2																	
3						714.8											
4			SILTY CLAY, some gravel, some fine to course sand, gray, moist.			3.0											
5							1	SC	100								
6																	
7																	
8																	
9						708.8											
10			SILTY CLAY with fine to coarse sand, some organics, trace gravel, gray to dark gray, moist.			9.0 707.8											
11			SILTY CLAY, some gravel, some fine to coarse sand, gray, moist. Debris (concrete, wood, brick, plastic), dry, from 13.5 to 14.5 feet bgs.			10.0											
12																	
13																	
14						703.3											
15			SILTY CLAY, trace gravel, trace fine to coarse sand, gray, moist. Silt partings at 61.1 and 63 feet bgs.			14.5	2	SC	100								1.0 - 98.0 ft bgs: Bentonite Grout
16																	
17																	2-inch flush-threaded solid PVC
18																	
19																	
20																	
21				CL-ML													
22																	
23																	
24																	
25							3	SC	100								
26																	
27																	
28																	
29																	
30																	
31																	
32																	
33																	
34																	
35							4	SC	100								
36																	
37																	
38																	
39																	
40			Continued on Next Page														

Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop

WATER CONTENT PERCENT: H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic; scale 0 20 40 60 80 100

SHEAR STRENGTH: X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U; scale 0 20 40 60 80 100

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 25, 2019

CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: MW-OB-51A

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI

START DATE: March 25, 2019
END DATE: March 26, 2019
CONTRACTOR: Stock Drilling

ELEVATION: 717.8 ft
COORDINATES: N: 6970.1 ft E: 4333.3 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DRILL RIG: LS 250 Mini-Sonic
DRILL METHOD: Roto-Sonic (4-inch rods to 100', 6-inch rods to 20')

DEPTH (ft)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	REC %	BLOWS	N-VALUE
41–64	SILTY CLAY, trace gravel, trace fine to coarse sand, gray, moist. Silt partings at 61.1 and 63 feet bgs.	CL-ML		5	SC	100		
				6	SC	100		
64			653.2	7	SC	100		
65–79	CLAYEY SILT, gray, very moist.	ML	64.6	8	SC	100		
80	Continued on Next Page							

WATER CONTENT PERCENT: H Plastic & Liquid Limits (%); ○ Water Content (%); NP Nonplastic; 0 20 40 60 80 100
SHEAR STRENGTH: X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U; 0 20 40 60 80 100

ADDITIONAL LAB TESTING
ADDITIONAL OBSERVATIONS
GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS
1.0 - 98.0 ft bgs: Bentonite Grout
2-inch flush-threaded solid PVC

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 25, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: MW-OB-51A

CLIENT:	US Ecology	START DATE:	March 25, 2019	ELEVATION:	717.8 ft
PROJECT:	US Ecology - Site 2	END DATE:	March 26, 2019	COORDINATES:	N: 6970.1 ft E: 4333.3 ft
PROJECT NO:	19118008			COORD SYS:	SP MI South FIPS 2113 Ft
LOCATION:	Belleville, MI	CONTRACTOR:	Stock Drilling	HORZ DATUM:	NAD83 VERT DATUM: NAVD88

DRILL RIG: LS 250 Mini-Sonic

DRILL METHOD: Roto-Sonic (4-inch rods to 100', 6-inch rods to 20')

DEPTH (ft)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES REC %	SAMPLES BLOWS	SAMPLES N-VALUE
81	CLAYEY SILT, gray, very moist.	ML	633.8					
84	SANDY CLAY, some gravel, some fine to coarse sand, gray, moist.	CL	84.0 / 632.8	9	SC	100		
85	SAND with gravel, loose, gray, wet.	SP	85.0					
86	SANDY CLAY, fine to medium grained, trace gravel, some silt, gray, dry.	CL	632.3					
87			85.5 / 630.2					
88	SAND, some silt, gray, moist.	SP	87.6					
89	SILTY CLAY, trace gravel, some fine to medium sand, hard, gray, dry, several dry silt partings. Wet silt seam at 93 feet bgs.	CL	629.8 / 88.0					
94				10	SC	100		
99			617.8					
100	SAND with gravel, trace silt, gray, wet.	SP	100.0					
105				11	SC	100		
110			607.8					
110	End of hole at 110.0 ft.							

WATER CONTENT PERCENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen; Q; U; 0 20 40 60 80 100

ADDITIONAL LAB TESTING

ADDITIONAL OBSERVATIONS

GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS

- 1.0 - 98.0 ft bgs: Bentonite Grout
- 2-inch flush-threaded solid PVC
- 98.0 - 101.0 ft bgs: Hydrated Bentonite Pellets
- 101.0 - 110.0 ft bgs: Medium Well Gravel
- 0.010-inch slotted PVC screen

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 25, 2019

CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: MW-OB-51

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI

DATE: March 26, 2019
CONTRACTOR: Stock Drilling

ELEVATION: 715.5 ft
COORDINATES: N: 6971.5 ft E: 4527.8 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
1	LS 250 Mini-Sonic	Roto-Sonic (6-inch rods)	See original NTH Consultants boring log for lithology. Well casing was over-drilled.			0.0									0.00 - 110.00 ft: PVC not recovered; driller noted that PVC pipe is usually destroyed during abandonment by sonic method and driven to bottom of borehole.		0.0 - 110.0 ft bgs: Bentonite Grout
40			Continued on Next Page														

Samples: Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop
Water Content Percent: H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic; 0 20 40 60 80 100
Shear Strength: X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U; 0 20 40 60 80 100

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 26, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: MW-OB-51

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI

DATE: March 26, 2019
CONTRACTOR: Stock Drilling

ELEVATION: 715.5 ft
COORDINATES: N: 6971.5 ft E: 4527.8 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE (Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop)	WATER CONTENT PERCENT (H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic)	SHEAR STRENGTH (X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
41–80	LS 250 Mini-Sonic	Roto-Sonic (6-inch rods)	See original NTH Consultants boring log for lithology. Well casing was over-drilled.									0 20 40 60 80 100	0 20 40 60 80 100				0.0 - 110.0 ft bgs: Bentonite Grout
			Continued on Next Page														

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 26, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: MW-OB-51

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI

DATE: March 26, 2019
CONTRACTOR: Stock Drilling

ELEVATION: 715.5 ft
COORDINATES: N: 6971.5 ft E: 4527.8 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
81–109	LS 250 Mini-Sonic	Roto-Sonic (6-inch rods)	See original NTH Consultants boring log for lithology. Well casing was over-drilled.		incorrect incorrect key key												0.0 - 110.0 ft bgs: Bentonite Grout
110			End of hole at 110.0 ft.			605.5											
111–120																	

Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop

WATER CONTENT PERCENT: H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SHEAR STRENGTH: X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U; 0 20 40 60 80 100

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 26, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: OB-34A

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI

DATE: March 28, 2019
CONTRACTOR: Stock Drilling

ELEVATION: 707.1 ft
COORDINATES: N: 7636.2 ft E: 5045.7 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
1–40	LS 250 Mini-Sonic	Roto-Sonic (6-inch rods)	See original NTH Consultants boring log for lithology. Well casing was over-drilled.			0.0									0.00 - 60.00 ft Filled well casing with grout prior to abandonment. Well casing cut at 60 feet bgs.		0.0 - 90.0 ft bgs: Bentonite Grout

Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop

WATER CONTENT PERCENT: H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SHEAR STRENGTH: X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U; 0 20 40 60 80 100

Continued on Next Page

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 28, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: OB-34A

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI

DATE: March 28, 2019
CONTRACTOR: Stock Drilling

ELEVATION: 707.1 ft
COORDINATES: N: 7636.2 ft E: 5045.7 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE (Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop)	WATER CONTENT PERCENT (H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic)	SHEAR STRENGTH (X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U)	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
41–80	LS 250 Mini-Sonic	Roto-Sonic (6-inch rods)	See original NTH Consultants boring log for lithology. Well casing was over-drilled.												60.00 - 90.00 ft: Bottom 30 feet of well casing remains in place at bottom of original borehole.		0.0 - 90.0 ft bgs: Bentonite Grout
			Continued on Next Page														

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 28, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: OB-34A

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI
DATE: March 28, 2019
CONTRACTOR: Stock Drilling
ELEVATION: 707.1 ft
COORDINATES: N: 7636.2 ft E: 5045.7 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
81–89	LS 250 Mini-Sonic	Roto-Sonic (6-inch rods)	See original NTH Consultants boring log for lithology. Well casing was over-drilled.														0.0 - 90.0 ft bgs: Bentonite Grout
90						617.1											
			End of hole at 90.0 ft.														

Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop

WATER CONTENT PERCENT: H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic; 0 20 40 60 80 100

SHEAR STRENGTH: X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U; 0 20 40 60 80 100

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 28, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: OB-35A

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI

DATE: March 28, 2019
CONTRACTOR: Stock Drilling

ELEVATION: 706.8 ft
COORDINATES: N: 7628.4 ft E: 5044.8 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
1	LS 250 Mini-Sonic	Roto-Sonic (6-inch rods)	See original NTH Consultants boring log for lithology. Well casing was over-drilled.			0.0									0.00 - 60.00 ft: Filled well casing with grout prior to abandonment. Well casing cut at 60 feet bgs. Upper 60 foot section shoved to bottom of hole.		0.0 - 129.3 ft bgs: Bentonite Grout
40			Continued on Next Page														

Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop

WATER CONTENT PERCENT: H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic

SHEAR STRENGTH: X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 28, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: OB-35A

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI
DATE: March 28, 2019
CONTRACTOR: Stock Drilling
ELEVATION: 706.8 ft
COORDINATES: N: 7628.4 ft E: 5044.8 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
41–80	LS 250 Mini-Sonic	Roto-Sonic (6-inch rods)	See original NTH Consultants boring log for lithology. Well casing was over-drilled.												60.00 - 130.00 ft: 70 feet of well casing remains in place at bottom of original borehole.		0.0 - 129.3 ft bgs: Bentonite Grout

Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop

WATER CONTENT PERCENT: H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic

SHEAR STRENGTH: X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U

Continued on Next Page

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 28, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: OB-35A

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI
DATE: March 28, 2019
CONTRACTOR: Stock Drilling
ELEVATION: 706.8 ft
COORDINATES: N: 7628.4 ft E: 5044.8 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
81–120	LS 250 Mini-Sonic	Roto-Sonic (6-inch rods)	See original NTH Consultants boring log for lithology. Well casing was over-drilled.														0.0 - 129.3 ft bgs: Bentonite Grout

Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop

WATER CONTENT PERCENT: H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic

SHEAR STRENGTH: X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U

Continued on Next Page

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 28, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: OB-35A

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI
DATE: March 28, 2019
CONTRACTOR: Stock Drilling
ELEVATION: 706.8 ft
COORDINATES: N: 7628.4 ft E: 5044.8 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DEPTH (ft)	DRILL RIG	DRILL METHOD	SOIL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
121–129	LS 250 Mini-Sonic	Roto-Sonic (6-inch rods)	See original NTH Consultants boring log for lithology. Well casing was over-drilled.		incorrect key	577.5											0.0 - 129.3 ft bgs: Bentonite Grout
130–160			End of hole at 129.3 ft.														

Hammer: ASTM D1586, Blows per 6 in 140-lb hammer, 30 in drop

WATER CONTENT PERCENT: H Plastic & Liquid Limits (%); O Water Content (%); NP Nonplastic; scale 0–100 (20, 40, 60, 80)

SHEAR STRENGTH: X Nat Vane; ⊗ Rem Vane; ■ Pocket Pen; ● Q; ○ U; scale 0–100 (20, 40, 60, 80)

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 28, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: MW-OB-51A

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI

START DATE: March 25, 2019
END DATE: March 26, 2019
CONTRACTOR: Stock Drilling

ELEVATION: 717.8 ft
COORDINATES: N: 6970.1 ft E: 4333.3 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DRILL RIG: LS 250 Mini-Sonic
DRILL METHOD: Roto-Sonic (4-inch rods to 100', 6-inch rods to 20')

DEPTH (ft)	DESCRIPTION	USCS	ELEV. / DEPTH (ft)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
0	SILTY CLAY with organics.	CL	0.0					
1	SANDY CLAY, some gravel, some fine to medium sand, brown, moist.	CL	717.3 0.5					
2								
3			714.8					
4	SILTY CLAY, some gravel, some fine to course sand, gray, moist.	CL-ML	3.0	1	SC	100		
5								
6								
7								
8								
9			708.8					
10	SILTY CLAY with fine to coarse sand, some organics, trace gravel, gray to dark gray, moist.		9.0 707.8					
11	SILTY CLAY, some gravel, some fine to coarse sand, gray, moist. Debris (concrete, wood, brick, plastic), dry, from 13.5 to 14.5 feet bgs.		10.0					
12								
13								
14			703.3					
15	SILTY CLAY, trace gravel, trace fine to coarse sand, gray, moist. Silt partings at 61.1 and 63 feet bgs.		14.5	2	SC	100		
16								
17								
18								
19								
20								
21								
22								
23								
24								
25				3	SC	100		
26								
27								
28								
29								
30								
31								
32								
33								
34								
35				4	SC	100		
36								
37								
38								
39								
40	Continued on Next Page							

SAMPLES: Hammer ASTM D1586 Blows per 6 in 140-lb hammer 30 in drop

WATER CONTENT PERCENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic

SHEAR STRENGTH: Fall Vane; Rem Vane; Pocket Pen

ADDITIONAL LAB TESTING

ADDITIONAL OBSERVATIONS

GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS

0.0 - 1.0 ft bgs: Cement

1.0 - 98.0 ft bgs: Bentonite Grout

2-inch flush-threaded solid PVC

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent
CHECKED: Sean Paulsen

DATE: Mar 25, 2019
DATE: Apr 18, 2019

RECORD OF BOREHOLE: MW-OB-51A

CLIENT: US Ecology
PROJECT: US Ecology - Site 2
PROJECT NO: 19118008
LOCATION: Belleville, MI

START DATE: March 25, 2019
END DATE: March 26, 2019
CONTRACTOR: Stock Drilling

ELEVATION: 717.8 ft
COORDINATES: N: 6970.1 ft E: 4333.3 ft
COORD SYS: SP MI South FIPS 2113 Ft
HORZ DATUM: NAD83 VERT DATUM: NAVD88

DRILL RIG: LS 250 Mini-Sonic
DRILL METHOD: Roto-Sonic (4-inch rods to 100', 6-inch rods to 20')

DEPTH (ft)	DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	REC %	BLOWS	N-VALUE	WATER CONTENT PERCENT	SHEAR STRENGTH	ADDITIONAL LAB TESTING	ADDITIONAL OBSERVATIONS	GROUNDWATER OBSERVATIONS	CONSTRUCTION AND INSTALLATION DETAILS
41–80	SILTY CLAY, trace gravel, trace fine to coarse sand, gray, moist. Silt partings at 61.1 and 63 feet bgs.	CL-ML			5	SC	100								1.0 - 98.0 ft bgs: Bentonite Grout; 2-inch flush-threaded solid PVC
					6	SC	100								
64	CLAYEY SILT, gray, very moist	ML		653.2 / 64.6	7	SC	100								
					8	SC	100								
80	Continued on Next Page														

Hammer: ASTM D1586 Blows per 6 in 140-lb hammer, 30 in drop
WATER CONTENT PERCENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic
SHEAR STRENGTH: Nat Vane; Rem Vane; Pocket Pen

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 25, 2019
CHECKED: Sean Paulsen DATE: Apr 18, 2019

RECORD OF BOREHOLE: MW-OB-51A

CLIENT:	US Ecology	START DATE:	March 25, 2019	ELEVATION:	717.8 ft
PROJECT:	US Ecology - Site 2	END DATE:	March 26, 2019	COORDINATES:	N: 6970.1 ft E: 4333.3 ft
PROJECT NO:	19118008			COORD SYS:	SP MI South FIPS 2113 Ft
LOCATION:	Belleville, MI	CONTRACTOR:	Stock Drilling	HORZ DATUM:	NAD83 VERT DATUM: NAVD88

DRILL RIG: LS 250 Mini-Sonic

DRILL METHOD: Roto-Sonic (4-inch rods to 100', 6-inch rods to 20')

DEPTH (ft)	DESCRIPTION	USCS	ELEV / DEPTH (ft)	NUMBER	TYPE	REC %	BLOWS	N-VALUE
81–84	CLAYEY SILT, gray, very moist	ML	633.8					
84–85	SANDY CLAY, some gravel, some fine to coarse sand, gray, moist	CL	84.0 / 632.8	9	SC	100		
85	SAND with gravel, loose, gray, wet	SP	85.0					
86–87	SANDY CLAY, fine to medium grained, trace gravel, some silt, gray, dry.	CL	632.3 / 85.5 / 630.2					
88	SAND, some silt, gray, moist.	SP	87.6					
89–99	SILTY CLAY, trace gravel, some fine to medium sand, hard, gray, dry, several dry silt partings. Wet silt seam at 93 feet bgs.	CL	629.8 / 88.0 / 617.8	10	SC	100		
100–109	SAND with gravel, trace silt, gray, wet	SP	100.0 / 607.8	11	SC	100		
110	End of hole at 110.0 ft.							
111–120								

WATER CONTENT PERCENT: Plastic & Liquid Limits (%); Water Content (%); NP Nonplastic

SHEAR STRENGTH: Hat Vane; Rem Vane; Pocket Pen

ADDITIONAL LAB TESTING

ADDITIONAL OBSERVATIONS

GROUNDWATER OBSERVATIONS

CONSTRUCTION AND INSTALLATION DETAILS

- 1.0 - 98.0 ft bgs: Bentonite Grout
- 2-inch flush-threaded solid PVC
- 98.0 - 101.0 ft bgs: Hydrated Bentonite Pellets
- 101.0 - 110.0 ft bgs: Medium Well Gravel
- 0.010-inch slotted PVC screen

DEPTH SCALE: 1:212

REV: A

GOLDER

LOGGED: Dayna Kent DATE: Mar 25, 2019

CHECKED: Sean Paulsen DATE: Apr 18, 2019

NTH Consultants, Ltd.
Infrastructure Engineering
and Environmental Services

41780 Six Mile Road
Northville, MI 48168-3459
248.553.6300
248.324.5178 Fax

Mr. Michael Takacs
U.S. Ecology, Inc.
49350 I-94 N. Service Drive
Belleville, Michigan 48111

August 18, 2014
NTH Project No. 13-060921-20

RE: Report on Monitoring Well Installation
Wayne Disposal, Inc. – MC VI-G, Phase 2
Van Buren Township, Wayne County, Michigan

Dear Mr. Takacs:

NTH Consultants Ltd. (NTH) has prepared this report to document the installation of new monitoring wells OB-49 to OB-52 at the Wayne Disposal landfill site in Van Buren Township, Wayne County, Michigan. This submittal also includes attachments consisting of an updated well location map, test boring soil data, and groundwater well installation logs.

MONITORING WELL LOCATIONS

A total of four wells were installed in accordance with the "phased" monitoring program for Master Cell VI-G (MC VI-G). Monitoring well OB-49 is intended as a replacement for the previously abandoned bedrock well W-10D, located near the northwestern corner of MC VI-G. The other three wells (OB-50 to OB-52) are intended to serve as interim monitoring locations along the southern limit of MC VI-G and will remain until landfill cell construction proceeds farther south.

To establish appropriate locations for the wells, U.S. Ecology's on-site surveyor, Mr. Adam Delisle, staked the locations for monitoring wells OB-50 to OB-52 based on historical information on the limits of closed Master Cell I (MC I). As discussed with U.S. Ecology prior to drilling, the goal was to install the wells south of the new cell (MC VI-G, Phase 2) and outside the waste limits of MC I. The survey also provided ground elevations and location coordinates for the proposed well locations based on the established site coordinate system and benchmarks. The surveyor also located subsurface utilities to provide the necessary clearance during the drilling activities.

During drilling at the staked locations for OB-50 and OB-51, no evidence of waste was encountered, thereby confirming that these well locations are apparently outside the waste limits of MC I. The planned wells were therefore completed within these borings. At the proposed location of OB-52, a thin layer (2 feet) of waste debris (i.e., cloth, rubber, and plastic) was encountered at a depth of 7 feet below ground surface (bgs). No other signs of waste or fill materials were observed throughout the remainder of this boring. Based on the shallow depth and limited thickness of waste encountered, this debris was considered to be incidental fill and did not indicate that the boring was located within the actual limits of the former landfill. We also note that the debris was encountered well above the depth where

groundwater was encountered (i.e., 54.5 feet bgs) and even farther above the target groundwater monitoring zone (85 feet bgs).

The following sections provide details regarding the well installation, construction, and development methods.

MONITORING WELL INSTALLATION

The four monitoring wells (OB-49 to OB-52) were installed by our subcontractor, Mateco Drilling Company (Mateco) on April 24 through May 7, 2014, under the full-time observation of an NTH field representative. To facilitate well installation, Mateco completed test borings using a CME 55 all-terrain drilling rig equipped with 4¼-inch inside diameter hollow-stem augers. The borings were completed to depths of 85 feet to 133 feet bgs, corresponding to elevations 620.9 to 572.5 feet, respectively. During drilling, Mateco obtained soil samples using a split-barrel sampler, generally at 5-foot intervals to the end of the borings. NTH's field engineer logged each test boring based on field classification of the soil samples recovered. Our field engineer also recorded groundwater conditions encountered and other pertinent observations.

Test boring OB-49 was drilled through all soil zones and extended approximately 3 feet into the underlying shale bedrock. Based on the subsurface conditions encountered, test borings OB-50 to OB-52 were terminated after encountering a suitable zone of saturated granular soil within the basal till unit, which is considered the "uppermost aquifer" for groundwater monitoring purposes at the site. Two common saturated granular zones were encountered at test boring locations OB-50 and OB-51. A layer of wet silt was encountered ranging in elevation from 631.5 to 646.5 feet, and a layer of wet sand and gravel was encountered at approximate elevations of 602 to 612.5 feet. These granular units were separated by a layer of very hard gray silty clay till approximately 14 to 15 feet in thickness. Test boring OB-52 encountered continuous saturated granular soils at approximately elevation 643.9 feet and was terminated in a layer of saturated fine sand at an approximate elevation of 620.9 feet.

The subsurface conditions encountered at the drilling locations have been evaluated and are presented as Logs of Test Boring, Figure Nos. 1 through 4, in the Appendix. Note that the stratification lines shown on the logs represent the approximate boundary between soil types; however, the transition may be more gradual than what is shown. The descriptions of the soils presented on the logs are based on visual identification and classification of the soils encountered in the field.

The boring logs also present information regarding sample data, standard penetration test (SPT) results, groundwater conditions observed in the boring, personnel and equipment involved, and other pertinent data. General Notes defining the nomenclature used in the soil descriptions on the boring logs and elsewhere in this report are presented as Figure No. 5 in the Appendix.

Upon advancing each boring to the desired depth, 2-inch diameter well assemblies were installed. Monitoring well OB-49 was constructed with stainless steel well casing and a 5-foot long, 10-slot stainless steel well screen. The other three wells (OB-50 to OB-52) were constructed using Schedule 40 PVC riser pipe and 5-foot long, 7-slot Schedule 40 PVC well screens. The wells were finished at approximately 2 to 3.5 feet above grade with compression caps in place to prevent entry of foreign materials.

Following verification of the well depth, washed silica sand was placed in the annular space around each well screen ranging from 2 to 3 feet above the top of the well screen as the augers were retracted. Approximately 2 feet of bentonite pellets were then placed on top of the sand filter pack to provide a seal over the pack. A pH-neutral bentonite grout mix was then placed over the pack and into the remaining open annulus. The batches of bentonite grout were mixed in a 55-gallon drum using the pump affixed to the drill rig to obtain uniform consistency. The bentonite grout was pumped through the inside of the augers via tremie method using threaded 1-inch PVC pipe sections, which continued until grout was observed flowing from the top of the augers. As each auger flight was removed, additional grout was added to the borehole. Prior to their site departure, Mateco added bentonite grout to fill the remainder of the borehole annulus to ground surface at each location as some settlement had occurred.

After installation, the on-site surveyor obtained survey information on each of the four new monitoring wells. The survey information included location coordinates, ground surface elevation and top-of-casing elevation, referenced to the site datum. To document the subsurface soil profile and well construction activities, we have prepared Logs of Monitoring Well for OB-49 to OB-52, presented as Figure Nos. 6 through 9, in the Appendix. The well locations are depicted on the Groundwater Monitoring Well Location Map, also included in the Appendix.

We understand that after the wells were installed and developed, protective covers were installed by on-site personnel.

WELL DEVELOPMENT

Mateco developed each well using pumping and surging methods until clear, relatively turbid-free discharge water was observed. Field measurements of temperature, pH, and conductivity were taken periodically during the development of each well. These measurements were recorded and the wells were considered developed once the mentioned parameters stabilized and the discharge was clear. The stabilized, final field measurements for each well are summarized below.

Well	Temperature (°C)	pH	Conductivity (mS)
OB-49	14.1	8.08	416
OB-50	14.2	7.63	516
OB-51	14.0	7.55	530
OB-52	13.7	8.05	344

We trust this report provides the information needed at this time. Please let us know if you have any questions regarding the information included in this submittal. You can contact us at (248) 324-5277.

Sincerely,

NTH Consultants, Ltd.

Michael R. McNamara
Sr. Staff Geologist

Alan C. Erickson, P.E.
Principal Engineer

MRM/ACE/dc/mam

Attachments

cc: Mike Porath – U.S. Ecology, Inc.

LOG OF TEST BORING NO: TB-OB-49

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE						SOIL SAMPLE DATA							
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 705.5	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
705					5								
700					10								
695					15								
690			PROFILE DRILLED		20								
685					25								
680		675.5			30								

Total Depth: *133 FT*
Drilling Start Date: *5/6/14*
Drilling End Date: *5/7/17*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Drilling Method:
CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.

Water Level Observation:
Groundwater encountered at 97'.

Notes:
** = pocket penetrometer value*

Plugging Procedure:
Stainless Steel Well Installation.

Approximate GPS Coordinates:
N: 7042.9 E: 3700.4

Figure No. 1

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-49

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE					SOIL SAMPLE DATA							
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 705.5	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
675													
670					35								
665					40								
660					45								
655			PROFILE DRILLED		50								
650					55								
645					60								
640					65								

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-49

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE						SOIL SAMPLE DATA							
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 705.5	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
		637.5											
					70								
635													
					75								
630													
			PROFILE DRILLED										
					80								
625													
					85								
620													
		615.5		90.0	90								
615			Hard Gray SILTY CLAY with Trace Sand and Gravel			S-1	10 24 31 42	55	12				*9000
						S-2	10 8 16 22	24	10				*9000
					95	S-3	18 18 26 13	44	8				*9000
610		608.5		97.0		S-4	20 33 36 9	69	12				-
					100	S-5	30 31 36	67	12				-
605			Very Compact Fine to Coarse SAND and GRAVEL										
		601.5		104.0									
			Very Compact Fine to Medium SAND and GRAVEL		105	S-6	24 44 50/4"	94	6				-
600													

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-49

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE						SOIL SAMPLE DATA							
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 705.5	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
		599.5	Very Compact Fine to Medium SAND and GRAVEL										
		597.5		108.0									
					110	S-7	36 26 22	48					
595			Compact Fine to Coarse SAND and GRAVEL										
		592.5		113.0									
					115	S-8	12 22 30	52	12				*8000
590			Very Stiff to Hard Gray SILTY CLAY										
		587.5		118.0									
					120	S-9	22 26 34	60	6				*8000
585			Hard Gray SILTY CLAY with Dry Sand and Gravel										
						S-10	30 50/5"		6				*8000
					125								
580													
		576.5		129.0		S-11	50/0"						
					130								
575			SHALE										
		572.5		133.0									
			END OF BORING AT 133.0 FEET.										
570													
565													

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-50

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE					SOIL SAMPLE DATA								
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 712.0	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
710					5	S-1	3 7 7	14	12				*9000
705			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel (Clay Recompact)		10	S-2	3 3 6	9	8				*9000
700					15	S-3	3 3 4	7	2				-
695		693.0		19.0	20	S-4	3 3 4	7					
690			Loose Fine to Medium SILTY SAND										
		689.0		23.0	25	S-5	4 4 7	11	12				*8000
685			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel										
		682.0			30	S-6	6 9 14	23	16				*9000

Total Depth: *110 FT*
Drilling Start Date: *4/29/14*
Drilling End Date: *4/30/14*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Drilling Method:
CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.

Water Level Observation:
Groundwater encountered at 69'.

Notes:
** = pocket penetrometer value*

Plugging Procedure:
2" PVC Well Installation.

Approximate GPS Coordinates:
N: 6973.9 E: 4147.3

Figure No. 2

LOG OF TEST BORING NO: TB-OB-50

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE					SOIL SAMPLE DATA								
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 712.0	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
680					35	S-7	5 7 10	17	15				*7000
675					40	S-8	7 11 13	24	16				*9000
670					45	S-9	6 8 12	20	16				*6500
665			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		50	S-10	6 8 14	22	16				*9000
660					55	S-11	7 10 15	25	16				*8500
655					60	S-12	6 9 12	21	6				*7000
650					65	S-13	4 4 7	11	16				*5000
645													

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-50

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE					SOIL SAMPLE DATA								
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 712.0	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
		644.0	Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel										
		643.0		69.0	70	S-14	7 8 13	21	10				-
640			Wet, Gray CLAYEY SILT with Trace Sand		75	S-15	3 2 4	6	10				-
635		632.5		79.5	80	S-16	5 7 12	19					
		631.0	Very Stiff Gray SANDY CLAY with Trace Silt and Gravel	81.0									
630					85	S-17	5 8 22	30	8				*9000
625			Hard to Very Hard Gray SILTY CLAY with Trace Sand and Gravel		90	S-18	10 16 22	38	16				*8500
620		617.0		95.0	95	S-19	9 11 16	27	14				-
615			Medium Compact Gray CLAYEY SILT with Trace Sand and Gravel		100	S-20	19 25 31	56	14				-
610		612.0	Very Compact Coarse SAND and GRAVEL	100.0	105	S-21	14 27 33	60	10				-

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-50

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE						SOIL SAMPLE DATA							
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 712.0	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
605		606.0	Very Compact Medium to Coarse SAND and GRAVEL										
		604.0		108.0									
		602.0	Very Compact Fine to Medium SAND with Little Gravel	110.0	110	S-22	18 22 33	55	8				-
			END OF BORING AT 110.0 FEET.										
600													
595													
590													
585													
580													
575													
570													

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-51

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE					SOIL SAMPLE DATA								
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 715.5	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
715			Stiff Gray SILTY CLAY Cap Material										
		711.0		4.5	5	S-1	2 6 7	13	6				*8500
710			Dry Gray CLAYEY SILT with Trace Sand and Gravel and Trace Debris		10	S-2	8 8 10	18	12				
705		702.5		13.0	15	S-3	5 5 7	12	12				*7000
700			Very Stiff Gray SILTY CLAY with Trace Sand and Gravel		20	S-4	4 4 5	9	12				*6000
695					25	S-5	4 6 7	13	12				*7000
690		685.5			30	S-6	3 4 7	11	14				*6000

Total Depth: *110 FT*
Drilling Start Date: *4/24/14*
Drilling End Date: *4/25/14*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Drilling Method:
CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.

Water Level Observation:
Groundwater encountered at 66.3'.

Notes:
** = pocket penetrometer value*
WOH = weight of hammer

Plugging Procedure:
2" PVC Well Installation.

Approximate GPS Coordinates:
N: 6971.5 E: 4527.8

Figure No. 3

LOG OF TEST BORING NO: TB-OB-51

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE					SOIL SAMPLE DATA								
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 715.5	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
685			Very Stiff Gray SILTY CLAY with Trace Sand and Gravel		35	S-7	5 6 9	15	14				*6000
680					40	S-8	3 4 6	10	14				*7000
675		675.5		40.0									
			Stiff Gray SILTY CLAY with Occasional Wet Silt Lenses		45	S-9	4 7 13	20	15				*7000
670		671.5		44.0									
			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		50	S-10	4 7 11	18	13				*9000
665					55	S-11	7 11 20	31	14				-
660		661.0		54.5									
			Dry SILT with Trace Clay		60	S-12	4 8 14	22	14				*9000
655		658.5		57.0									
			Hard Gray SILTY CLAY with Numerous Dry Silt Seams		65	S-13	WOH WOH WOH	0	10				*7000
650													

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-51

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE					SOIL SAMPLE DATA								
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 715.5	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
		647.5 646.5	Hard Gray SILTY CLAY with Numerous Dry Silt Seams	69.0									
645					70	S-14	5 9 15	24	10				-
640			Wet Gray CLAYEY SILT		75	S-15	6 9 12	21	10				-
635					80	S-16	5 5 6	11	10				-
630		631.5		84.0	85	S-17	19 22 30	52	12				*9000
625			Very Hard Gray SILTY CLAY with Trace Sand and Gravel		90	S-18	15 23 26	49	18				*9000
620					95	S-19	17 23 33	56	15				*9000
615		616.5	Wet Gray SILT with Trace Sand	99.0	100	S-20	12 13 18	31	14				-
610		612.5	Very Compact Medium to Coarse SAND and GRAVEL with Trace Silt	103.0	105	S-21	15 21 33	54	18				-

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-51

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE						SOIL SAMPLE DATA							
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 715.5	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
		609.5											
			Very Compact Medium to Coarse SAND and GRAVEL with Trace Silt										
		605.5		110.0	110	S-22	50		6				
605			END OF BORING AT 110.0 FEET.										
600													
595													
590													
585													
580													
575													

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-52

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE					SOIL SAMPLE DATA								
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 705.9	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
705		702.9	FILL: Hard Brown and Gray SILTY CLAY with Trace Sand and Gravel and Trace Debris	3.0									
			FILL: Very Stiff Gray SILTY CLAY with Trace Sand and Gravel		5	S-1	2 3 3	6	14				*6500
700		698.9		7.0									
		696.9	DEBRIS: Dry Paper, Cloth, Wood, Concrete, Brick and Plastic	9.0									
			Stiff Gray SILTY CLAY with Trace Sand and Gravel		10	S-2	2 2 3	5	8				*3000
695		694.9		11.0									
					15	S-3	2 3 5	8	9				*8000
690					20	S-4	3 3 5	8	12				*6000
			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel										
685					25	S-5	4 6 9	15	15				*6500
680													
		675.9			30	S-6	4 6 9	15	12				*7000

Total Depth: *85 FT*
Drilling Start Date: *5/1/14*
Drilling End Date: *5/2/14*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Drilling Method:
CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.

Water Level Observation:
Groundwater encountered at 54.5'.

Notes:
** = pocket penetrometer value*

Plugging Procedure:
2" PVC Well Installation.

Approximate GPS Coordinates:
N: 6915.9 E: 4956.7

Figure No. 4

LOG OF TEST BORING NO: TB-OB-52

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE					SOIL SAMPLE DATA								
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 705.9	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
675					35	S-7	3 7 11	18	14				*7000
670					40	S-8	5 8 13	21					*9000
665			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		45	S-9	5 8 12	20	18				*9000
660					50	S-10	3 4 6	10	15				*5000
655		651.4		54.5									
		650.9	Wet Very SILTY CLAY	55.0	55	S-11	5 6 9	15	14				*5500
650			Very Stiff Gray SILTY CLAY with Trace Sand and Gravel										
		647.9		58.0									
			Stiff, Wet, Very SILTY CLAY with Trace Sand		60	S-12	2 2 4	6	12				*2500
645		643.9		62.0									
			Loose to Medium Compact Fine CLAYEY SAND with Trace Silt		65	S-13	2 4 7	11	12				-
640													

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

LOG OF TEST BORING NO: TB-OB-52

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

SUBSURFACE PROFILE						SOIL SAMPLE DATA							
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 705.9	DEPTH	DEPTH (FT)	SAMPLE TYPE/NO.	BLOWS/ 6-INCHES	STD. PEN RESIST. (N)	REC (in)	FIELD TEST (ppm)	MOIST. CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP ST (PSF)
		637.9											
			Loose to Medium Compact Fine CLAYEY SAND with Trace Silt		70	S-14	4 4 5	9	14				-
635		632.9		73.0									
			Medium Compact to Compact Wet Fine SILTY SAND		75	S-15	5 7 13	20	12				-
630													
		625.9		80.0	80	S-16	7 15 21	36	12				
625			Very Compact Wet Fine SILTY SAND										
		620.9		85.0	85	S-17	17 33 34	67	12				-
620			END OF BORING AT 85.0 FEET.										
615													
610													
605													

LOG OF TEST BORING 13-060921-20.GPJ NTH CORPORATE.GDT 8/18/14

NTH Consultants, Ltd.

A Neyer, Tiseo & Hindo Company

GENERAL NOTES

TERMINOLOGY

Unless otherwise noted, all terms utilized herein refer to the Standard Definitions presented in ASTM D 653.

PARTICLE SIZES

Boulders	-	Greater than 12 inches (305mm)
Cobbles	-	3 inches (76.2mm) to 12 inches (305mm)
Gravel - Coarse	-	3/4 inches (19.05 mm) to 3 inches (76.2mm)
Fine	-	No. 4 - 3/16 inches (4.75mm) to 3/4 inches (19.05 mm)
Sand - Coarse	-	No. 10 (2.00mm) to No. 4 (4.75mm)
Medium	-	No. 40 (0.425mm) to No. 10 (2.00mm)
Fine	-	No. 200 (0.074mm) to No. 40 (0.425mm)
Silt	-	0.005mm to 0.074mm
Clay	-	Less than 0.005mm

CLASSIFICATION

The major soil constituent is the principal noun, i.e., clay, silt, sand, gravel. The second major soil constituent and other minor constituents are reported as follows:

Second Major Constituent (percent by weight)	Minor Constituents (percent by weight)
Trace - 1 to 12%	Trace - 1 to 12%
Adjective - 12 to 35% (clayey, silty, etc.)	Little - 12 to 23%
And - Over 35%	Some - 23 to 33%

COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modified; i.e., silty clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils; i.e., silty clay, trace of sand, little gravel.

Consistency	Unconfined Compressive Strength (psf)	Approximate Range of (N)
Very Soft	Below 500	0 - 2
Soft	500 - 1000	3 - 4
Medium	1000 - 2000	5 - 8
Stiff	2000 - 4000	9 - 15
Very Stiff	4000 - 8000	16 - 30
Hard	8000 - 16000	31 - 50
Very Hard	Over 16000	Over 50

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

COHESIONLESS SOILS

Density Classification	Relative Density %	Approximate Range of (N)
Very Loose	0 - 15	0 - 4
Loose	16 - 35	5 - 10
Medium Compact	36 - 65	11 - 30
Compact	66 - 85	31 - 50
Very Compact	86 - 100	Over 50

Relative density of cohesionless soils is based upon the evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

SAMPLE DESIGNATIONS

AS - Auger Sample - directly from auger flight
BS - Miscellaneous Sample - bottle or bag
S - Split Spoon Sample - ASTM D 1586
LS - Split Spoon Sample S with Liner Insert 3 inches in length
ST - Shelby Tube Sample - 3 inch diameter unless otherwise noted
PS - Piston Sample - 3 inch diameter unless otherwise noted
RC - Rock Core - NX core unless otherwise noted
CS - Continuous Sample - from rock core barrel or continuous sampling device
VS - Vane Shear

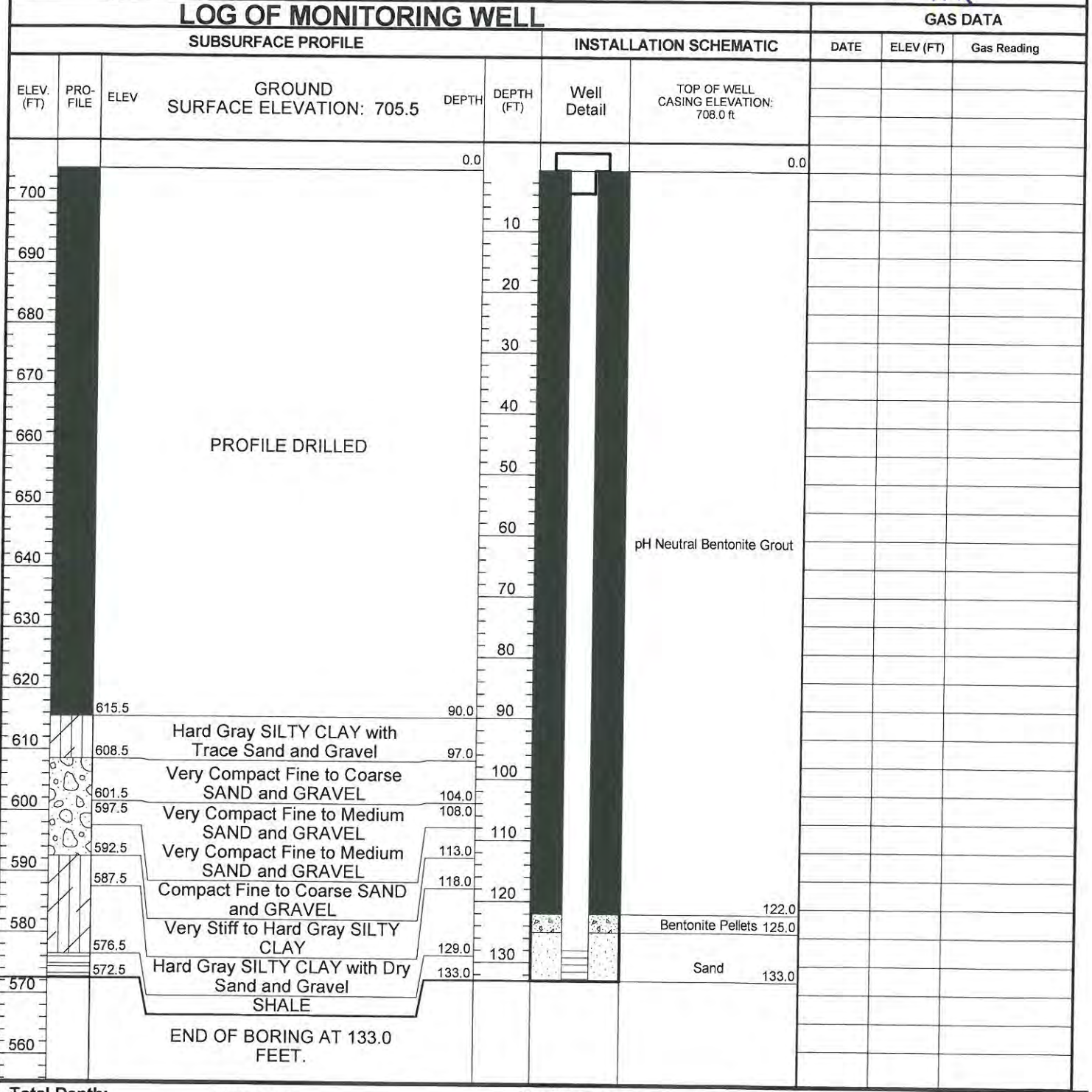
STANDARD PENETRATION TEST (ASTM D 1586) - A 2.0" outside-diameter, 1-3/8" inside-diameter, split barrel sampler is driven into undisturbed soil by means of a 140-pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven three successive 6-inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).

MONITORING WELL: MW-OB-49

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

LOG OF MONITORING WELL



Total Depth: *133.0 FT*
Installation Date: *5/7/2014*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Equipment: *CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.*

Notes:

Casing Diameter: *2"*
Casing Length: *130'*
Casing Type: *Stainless Steel*
Tip Elevation: *572.5*
GPS Coordinates:

Screen Diameter: *2"*
Screen Length: *5'*
Screen Mesh: *0.010"*
Screen Type: *Stainless Steel*

Well Type: *MONITORING WELL*

Figure No. 6

MONITORING WELL LOG MW 13-060921-20.GPJ NTH CORPORATE.GDT 8/6/14

MONITORING WELL: MW-OB-50

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

LOG OF MONITORING WELL

SUBSURFACE PROFILE						INSTALLATION SCHEMATIC		GAS DATA		
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 712.0	DEPTH	DEPTH (FT)	Well Detail	TOP OF WELL CASING ELEVATION: 715.4 ft	DATE	ELEV (FT)	Gas Reading
710		712.0		0.0	0		0.0			
			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel (Clay Recompact)		10					
700		693.0		19.0	20					
690		689.0	Loose Fine to Medium SILTY SAND	23.0						
			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		30					
680					40					
670										
			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		50		pH Neutral Bentonite Grout			
660										
650					60					
		643.0		69.0	70					
640			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel							
		632.5	Wet, Gray CLAYEY SILT with Trace Sand	79.5	80					
630		631.0	Very Stiff Gray SANDY CLAY with Trace Silt and Gravel	81.0						
			Hard to Very Hard Gray SILTY CLAY with Trace Sand and Gravel		90					
620		617.0		95.0						
		612.0	Medium Compact Gray CLAYEY SILT with Trace Sand and Gravel	100.0	100		100.0			
610							Bentonite Pellets 102.0			
		604.0	Very Compact Coarse SAND and GRAVEL	108.0						
		602.0	Very Compact Medium to Coarse SAND and GRAVEL	110.0	110		Sand 110.0			
600			Very Compact Fine to Medium SAND with Little Gravel							
590			END OF BORING AT 110.0 FEET.							
580										

Total Depth: *110.0 FT*
Installation Date: *4/29/2014*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Equipment: *CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.*

Notes:

Casing Diameter: *2"*
Casing Length: *108.43'*
Casing Type: *PVC*
Tip Elevation: *602.43*
GPS Coordinates:

Screen Diameter: *2"*
Screen Length: *5'*
Screen Mesh: *0.007"*
Screen Type: *PVC*

Well Type: *MONITORING WELL*

Figure No. 7

MONITORING WELL LOG MW 13-060921-20.GPJ NTH CORPORATE.GDT 8/6/14

MONITORING WELL: MW-OB-51

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

LOG OF MONITORING WELL

SUBSURFACE PROFILE						INSTALLATION SCHEMATIC		GAS DATA		
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 715.5	DEPTH	DEPTH (FT)	Well Detail	TOP OF WELL CASING ELEVATION: 719.2 ft	DATE	ELEV (FT)	Gas Reading
				0.0			0.0			
710		711.0	Stiff Gray SILTY CLAY Cap Material	4.5	10					
		702.5	Dry Gray CLAYEY SILT with Trace Sand and Gravel and Trace Debris	13.0						
700			Very Stiff Gray SILTY CLAY with Trace Sand and Gravel		20					
690					30					
680			Very Stiff Gray SILTY CLAY with Trace Sand and Gravel							
		675.5		40.0	40					
670		671.5	Stiff Gray SILTY CLAY with Occasional Wet Silt Lenses	44.0						
			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		50		pH Neutral Bentonite Grout			
660		661.0		54.5						
		658.5	Dry SILT with Trace Clay	57.0	60					
650			Hard Gray SILTY CLAY with Numerous Dry Silt Seams							
		646.5		69.0	70					
640			Hard Gray SILTY CLAY with Numerous Dry Silt Seams							
			Wet Gray CLAYEY SILT		80					
630		631.5		84.0						
			Very Hard Gray SILTY CLAY with Trace Sand and Gravel		90					
620		616.5		99.0	100					
		612.5	Wet Gray SILT with Trace Sand	103.0			101.0 Bentonite Pellets 103.0			
610		605.5	Very Compact Medium to Coarse SAND and GRAVEL with Trace Silt	110.0	110		Sand 110.0			
600			Very Compact Medium to Coarse SAND and GRAVEL with Trace Silt							
590			END OF BORING AT 110.0 FEET.							
580										

MONITORING WELL LOG MW 13-060921-20.GPJ NTH CORPORATE.GDT 8/6/14

Total Depth: *110.0 FT*
Installation Date: *4/24/2014*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Equipment: *CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.*

Notes:

Casing Diameter: *2"*
Casing Length: *108.69'*
Casing Type: *PVC*
Tip Elevation: *606.19*
GPS Coordinates:

Screen Diameter: *2"*
Screen Length: *5'*
Screen Mesh: *0.007"*
Screen Type: *PVC*

Well Type: *MONITORING WELL*

Figure No. 8

MONITORING WELL: MW-OB-52

Project Name: WDI Groundwater Wells
Project Location: Belleville, Michigan

NTH Consultants, Ltd.
NTH Proj. No.: 13-060921-20
Checked By: CRK

LOG OF MONITORING WELL

SUBSURFACE PROFILE						INSTALLATION SCHEMATIC		GAS DATA		
ELEV. (FT)	PRO-FILE	ELEV	GROUND SURFACE ELEVATION: 705.9	DEPTH	DEPTH (FT)	Well Detail	TOP OF WELL CASING ELEVATION: 709.2 ft	DATE	ELEV (FT)	Gas Reading
				0.0			0.0			
700		702.9	FILL: Hard Brown and Gray SILTY CLAY with Trace Sand and Gravel and Trace Debris	3.0						
		698.9		7.0						
		696.9	FILL: Very Stiff Gray SILTY CLAY with Trace Sand and Gravel	9.0	10					
		694.9	DEBRIS: Dry Paper, Cloth, Wood, Concrete, Brick and Plastic	11.0						
690			Stiff Gray SILTY CLAY with Trace Sand and Gravel		20					
680			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		30					
670					40		pH Neutral Bentonite Grout			
660			Very Stiff to Hard Gray SILTY CLAY with Trace Sand and Gravel		50					
650		651.4		54.5						
		650.9	Wet Very SILTY CLAY	55.0						
		647.9	Very Stiff Gray SILTY CLAY with Trace Sand and Gravel	58.0	60					
		643.9	Stiff, Wet, Very SILTY CLAY with Trace Sand	62.0						
640			Loose to Medium Compact Fine CLAYEY SAND with Trace Silt		70					
		632.9	Loose to Medium Compact Fine CLAYEY SAND with Trace Silt	73.0			74.0			
630			Medium Compact to Compact Wet Fine SILTY SAND				Bentonite Pellets 77.0			
		625.9		80.0	80					
620		620.9	Very Compact Wet Fine SILTY SAND	85.0			Sand 85.0			
			END OF BORING AT 85.0 FEET.							
610										

Total Depth: *85.0 FT*
Installation Date: *5/1/2014*
Inspector: *M. McNamara*
Contractor: *Mateco*
Driller: *Gary Swift*
Equipment: *CME-55 track mounted ATV rig with 4-1/4" I.D. HSA to EOB.*

Notes:

Casing Diameter: *2"*
Casing Length: *83.34'*
Casing Type: *PVC*
Tip Elevation: *620.9*
GPS Coordinates:

Screen Diameter: *2"*
Screen Length: *5'*
Screen Mesh: *0.007"*
Screen Type: *PVC*

Well Type: *MONITORING WELL*

Figure No. 9

MONITORING WELL LOG MW 13-060921-20.GPJ NTH CORPORATE.GDT 8/6/14

Wayne Disposal Monitoring Well Inspection/Damage Report

Inspector: _____ **Date:** _____

Place a check-mark for any of the items that are not acceptable and provide comments below

Submit this form immediately to the site manager and the regulatory affairs manager or their designee

**OB-54, 55, 58,59 to be installed as phases of landfill construction occur.

I. Monitoring Equipment

Groundwater

Inspect individual well security devices (caps, covers, locks) for malfunctions, deterioration, vandalism, or damage.

Inspect observable portion of well casing for deterioration or damage such as cracks, casing alignment (damage from vehicle contact), insect or animal infestation.

Check grout at base of casing for proper seal to prevent surface water infiltration down on the side of the casing.

Inspect/operate pump and pump control unit for damage deterioration and malfunction.

	Indicate Unacceptable Condition with X							
Well ID	**Lock**	**Seal**	**Pro. Casing**	**Markings**	**Pump**	**Casing**	**Details of Problems Encountered**	**Actions Required to Remedy**
OB-1A								
OB-2A								
OB-3								
OB-4								
OB-5								
OB-6/56								
OB-7								
OB-8/60								
OB-9								
OB-10								
OB-11A								
OB-12R								
OB-13/57								
OB-14								
OB-15								
OB-16								
OB-18								
OB-19R								
OB-20								
OB-21								
OB-22								
OB-23A								
OB-24								
OB-25								
OB-26A								
OB-27A								
OB-28								
OB-29								
OB-30								
OB-31AR								
OB-32								
OB-36								
OB-37								
OB-38								
OB-39								
OB-40R								
OB-41								
OB-42								
OB-43								
OB-44								
OB-45								
OB-46								
OB-47								
OB-48								
OB-49								
OB-50								
OB-51A								
OB-52								
OB-53								

Attachment C

Chain of Custody &
Monitoring Well Damage Report

CHAIN-OF-CUSTODY Analytical Request Document

Pace Analytical

Chain-of-Custody is a LEGAL DOCUMENT - Complete all relevent fields

LAB USE ONLY- Affix Workorder/Login Label Here or List Pace Workorder Number or MTJL Log-in Number Here

ALL SHADED AREAS are for LAB USE ONLY

Company:	Billing Information:
Address:	
Report To:	Email To:
Copy To:	Site Collection Info/Address: 49350 N. I-94 Service Drive
Customer Project Name/Number:	State: County/City: Time Zone Collected: [ ] PT [ ] MT [ ] CT [ ] ET
Phone: Email:	Site/Facility ID #: / Compliance Monitoring? [ ] Yes [ ] No
Collected By (print):	Purchase Order #: Quote #: / DW PWS ID #: DW Location Code:
Collected By (signature):	Turnaround Date Required: / Immediately Packed on Ice: [ ] Yes [ ] No
Sample Disposal: [ ] Dispose as appropriate [ ] Return [ ] Archive: _____ [ ] Hold:_____	Rush: [ ] Same Day [ ] Next Day [ ] 2 Day [ ] 3 Day [ ] 4 Day [ ] 5 Day (Expedite Charges Apply) / Field Filtered (if applicable): [ ] Yes [ ] No Analysis: _____

* Matrix Codes (Insert in Matrix box below): Drinking Water (DW), Ground Water (GW), Wastewater (WW), Product (P), Soil/Solid (SL), Oil (OL), Wipe (WP), Air (AR), Tissue (TS), Bioassay (B), Vapor (V), Other (OT)

Container Preservative Type **

Lab Project Manager:

** Preservative Types: (1) nitric acid, (2) sulfuric acid, (3) hydrochloric acid, (4) sodium hydroxide, (5) zinc acetate, (6) methanol, (7) sodium bisulfate, (8) sodium thiosulfate, (9) hexane, (A) ascorbic acid, (B) ammonium sulfate, (C) ammonium hydroxide, (D) TSP, (U) Unpreserved, (O) Other _____

Analyses

Lab Profile/Line:

Lab Sample Receipt Checklist:

Custody Seals Present/Intact	Y N NA
Custody Signatures Present	Y N NA
Collector Signature Present	Y N NA
Bottles Intact	Y N NA
Correct Bottles	Y N NA
Sufficient Volume	Y N NA
Samples Received on Ice	Y N NA
VOA - Headspace Acceptable	Y N NA
USDA Regulated Soils	Y N NA
Samples in Holding Time	Y N NA
Residual Chlorine Present	Y N NA
Cl Strips: _____	
Sample pH Acceptable	Y N NA
pH Strips: _____	
Sulfide Present	Y N NA
Lead Acetate Strips: _____	

LAB USE ONLY:
Lab Sample # / Comments:

Customer Sample ID	Matrix *	Comp / Grab	Collected (or Composite Start) Date	Collected (or Composite Start) Time	Composite End Date	Composite End Time	Res Cl	# of Ctns

Customer Remarks / Special Conditions / Possible Hazards:

Type of Ice Used: Wet Blue Dry None

Packing Material Used:

Radchem sample(s) screened (<500 cpm): Y N NA

SHORT HOLDS PRESENT (<72 hours): Y N N/A

Lab Tracking #:

Samples received via: FEDEX UPS Client Courier Pace Courier

Lab Sample Temperature Info:
Temp Blank Received: Y N NA
Therm ID#: _____
Cooler 1 Temp Upon Receipt: _____oC
Cooler 1 Therm Corr. Factor: _____oC
Cooler 1 Corrected Temp: _____oC
Comments:

Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:
Relinquished by/Company: (Signature)	Date/Time:	Received by/Company: (Signature)	Date/Time:

MTJL LAB USE ONLY

Table #:
Acctnum:
Template:
Prelogin:
PM:
PB:

Trip Blank Received: Y N NA
HCL MeOH TSP Other

Non Conformance(s): YES / NO

Page: _____ of: _____

Chain of Custody Record

Page 1 of 1

ALS ENVIRONMENTAL
3352 1258th Avenue
Holland, MI 49424
(616) 399-6070

ALS Project Manager:	Les Arnold	ALS Work Order #:	

Customer Information		Project Information			Parameter/Method Request for Analysis
Purchase Order		Project Name		A	
Work Order		Project Number		B	
Company Name		Bill To Company		C	
Send Report To		Invoice Attn.		D	
Address		Address		E	
				F	
City/State/Zip		City/State/Zip		G	
Phone		Phone		H	
Cell		Fax		I	
e-Mail Address				J	

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles		A	B	C	D	E	F	G	H	I	J	Comments
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

Field Comments:

Sampler(s): Please Print & Sign	Shipment Method:	Required Turnaround Time: (Check Box)
		☐ 10 Wk Days ☐ 5 Wk Days ☐ 3 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☐ Other _____

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):	ALS Cooler ID	Cooler Temp

QC Package: ☐ Level II: Standard QC ☐ Level III: Raw Data ☐ Level IV: SW846 Methods/CLP like ☐ Other: _____

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-None (4°C)

Attachment D

Operating Procedures for the Water Level Indicator

INSTRUCTION MANUAL

ET-89

ELECTRIC TAPE

Attachment D

KECK INSTRUMENTS, INC

KECK TAPE GUARD

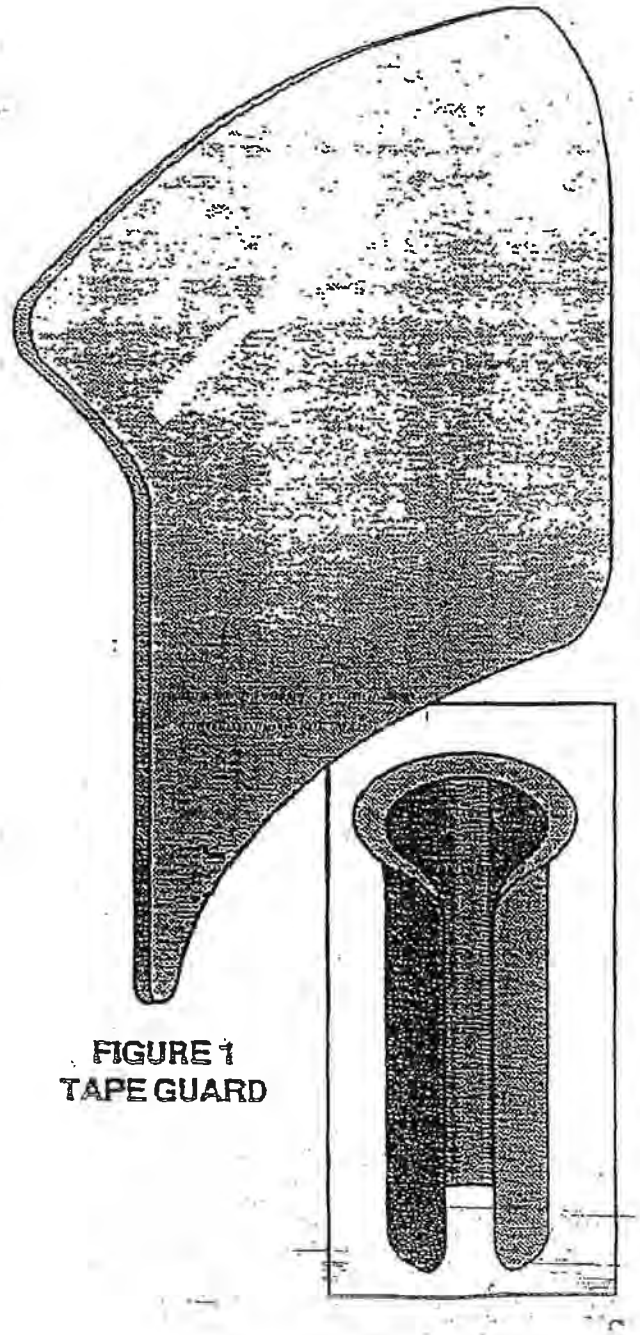


FIGURE 1
TAPE GUARD

The Keck "Tape Guard" was developed to protect instrumentation, tapes and sample tubing from the wearing edges of well casing. Made of smooth flexible polystyrene, the "Tape Guard" easily adapts to any 2" or 4" well.

Instructions

Simply compress the "Tape Guard" and insert

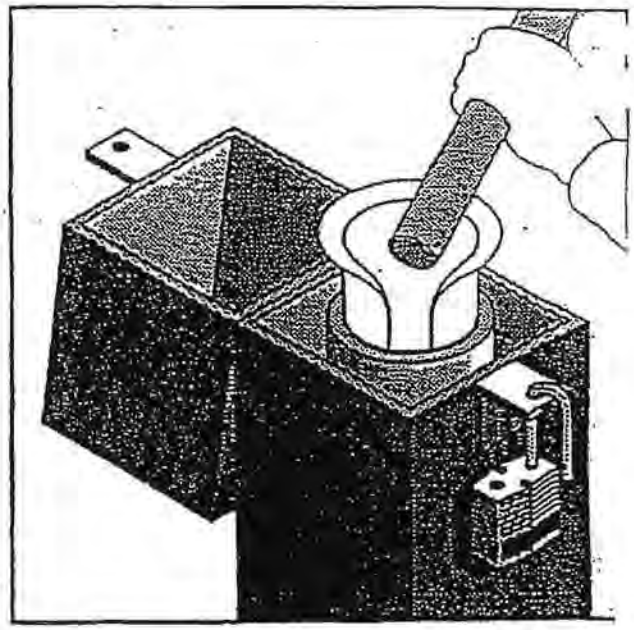


FIGURE 2
TAPE GUARD USAGE

into the opening of any 2" to 4" well pipe. Allow instrumentation, tubing or tape to ride on the smooth surface of the "Tape Guard" to prevent wear.

ET-89

The Keck Instruments ET-89 is a portable reel mounted device used to accurately measure water levels in a borehole. Water levels are detected by a 5/8" O.D. stainless steel probe attached to a 100 FT. Tefzel coated engineer's tape. The tape is graduated in 100ths of a foot with metric divisions on the reverse side. The ET-89 relies on fluid conductivity to determine the presence of water and emits on audible signal with light. Controls include a sensitivity adjustment to eliminate false readings due to cascading water or casing effect and a battery test switch.

Operational Procedure

1. Turn the instrument "On" and check the battery voltage by pressing the "Batt Test" button. A dim red light indicates a low battery and should be replaced.
2. Lower the probe down the well to the water surface, the light and buzzer should be activated. At this point adjust the probe sensitivity counter-clockwise until the light and buzzer turn off.
3. With the probe still in contact with the water, adjust the probe sensitivity until the light and buzzer barely activate. In this setting the probe will detect water level and not be effected by condensation from the casing well.
4. Water level measurements can now be taken from the top of the casing.
5. After completion of water level measurements the device should be properly stored.

Maintenance and Cleaning Procedures

1. Remove the three faceplate screws.
2. Release the faceplate using the sensitivity knob to pull the components out of the reel.
3. Make note of the battery location on the circuit board and the position in reel cavity.
4. Remove the 9 volt battery from the connector by grasping the battery and the black connector. Replace with new battery.
5. Position the battery in the notch of the circuit board and align the battery with the recessed slot in the reel.
6. Place the faceplate in the reel and replace the three retaining screws. Do not over tighten these screws.

Decontamination and Cleaning

The ET-89 can be cleaned with any detergent or lab soap such as Liquinox that does not effect polypropylene. The reel should not be submerged at any time but can be wiped with a damp cloth.

Please call our technical staff if further assistance is required at 1-800-542-5681.

Attachment E

Summary of Monitoring Well Information

GROUNDWATER MONITORING WELL INFORMATION

WELL ID	PROGRAM(S)	STRATUM SCREENED
OB-1A	SWMA	Uppermost usable aquifer; lower bedrock
OB-2A	SWMA/MCIX	Uppermost usable aquifer; upper glacial sand
OB-3	SWMA	Uppermost usable aquifer; upper glacial sand
OB-4	SWMA	Uppermost usable aquifer; upper glacial sand
OB-5	SWMA	Uppermost usable aquifer; upper glacial sand
OB-6/OB-56	SWMA/HWMA*	Uppermost usable aquifer; upper glacial sand
OB-7	SWMA/MCIX	Uppermost usable aquifer; upper glacial sand
OB-8/OB-60	SWMA/HWMA*	Uppermost usable aquifer; upper glacial sand
OB-9	SWMA	Uppermost usable aquifer; upper glacial sand
OB-10	SWMA	Uppermost usable aquifer; upper glacial sand
OB-11A	SWMA/MCIX	Uppermost usable aquifer; upper glacial sand
OB-12R	SWMA	Uppermost usable aquifer; upper glacial sand
OB-13/OB-57	SWMA/HWMA*	Uppermost usable aquifer; upper glacial sand
OB-14	SWMA	Uppermost usable aquifer; upper glacial sand
OB-15	SWMA	Uppermost usable aquifer; upper glacial sand
OB-16	SWMA	Uppermost usable aquifer; upper glacial sand
OB-18	HWMA (WDI/MDWTP)	Uppermost usable aquifer; lower bedrock
OB-19R	HWMA (WDI/MDWTP)	Uppermost usable aquifer; upper glacial sand
OB-20	HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-21	HWMA(WDI/MDWTP)/TSCA	Uppermost usable aquifer; upper glacial sand
OB-22	HWMA	Uppermost usable aquifer; lower bedrock
OB-23A	HWMA(WDI/MDWTP)/TSCA	Uppermost usable aquifer; upper glacial sand
OB-24	HWMA(WDI/MDWTP)/TSCA	Uppermost usable aquifer; upper glacial sand
OB-25	HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-26A	HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-27A	HWMA	Uppermost usable aquifer; upper glacial sand
OB-28	HWMA	Uppermost usable aquifer; upper glacial sand
OB-29	HWMA	Uppermost usable aquifer; upper glacial sand
OB-30	HWMA	Uppermost usable aquifer; upper glacial sand
OB-31AR	HWMA/MCIX	Uppermost usable aquifer; upper glacial sand
OB-32	HWMA/MCIX	Uppermost usable aquifer; lower bedrock
OB-36	HWMA (WDI/MDWTP)	Uppermost usable aquifer; lower bedrock
OB-37	HWMA	Uppermost usable aquifer; lower bedrock
OB-38	HWMA	Uppermost usable aquifer; lower bedrock
OB-39	HWMA	Uppermost usable aquifer; lower bedrock
OB-40R	HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-41	MCIX	Uppermost usable aquifer; lower bedrock
OB-42	MCIX	Uppermost usable aquifer; upper glacial sand
OB-43	MCIX	Uppermost usable aquifer; upper glacial sand
OB-44	MCIX	Uppermost usable aquifer; upper glacial sand
OB-45	SWMA/MCIX	Uppermost usable aquifer; upper glacial sand
OB-46	MCIX	Uppermost usable aquifer; upper glacial sand
OB-47	HWMA (WDI/MDWTP)	Uppermost usable aquifer; upper glacial sand
OB-48	HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-49	HWMA/TSCA	Uppermost usable aquifer; lower bedrock
OB-50	HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-51A	HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-52	HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-53	HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-54	Future HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-55	Future HWMA/TSCA	Uppermost usable aquifer; lower bedrock
OB-58	Future HWMA/TSCA	Uppermost usable aquifer; upper glacial sand
OB-59	Future HWMA/TSCA	Uppermost usable aquifer; lower bedrock
P-1	HWMA (MDWTP)	Upper shallow perched groundwater
P-2R	HWMA (MDWTP)	Upper shallow perched groundwater
P-3R	HWMA (MDWTP)	Upper shallow perched groundwater
P-4R	HWMA (MDWTP)	Upper shallow perched groundwater
P-5	HWMA (MDWTP)	Upper shallow perched groundwater
P-7	HWMA (MDWTP)	Upper shallow perched groundwater

* to become HWMA well when Cell G Phase 1 wells are abandined

Attachment F

WELL WIZARD
Dedicated Sampling Systems

Installation, Operation and Maintenance User's Guide
Part No 34999

WELL WIZARD®

Dedicated sampling systems

Installation, Operation, and Maintenance User's Guide

Part No. 34999

QED

Ground Water Specialists™

6095 Jackson Rd.
P.O. Box 3726
Ann Arbor, MI 48106
800-624-2026 In Michigan 313-995-2547
In California 510-930-7610 or 800-366-7610

CONTENTS

1

INTRODUCING WELL WIZARD

To monitor the quality of ground water, you need an efficient way to collect unbiased samples. Well Wizard is a total system for meeting all your ground water monitoring needs–with the flexibility to meet your special requirements. This chapter describes the components of the Well Wizard system.

The Well Wizard system includes both *dedicated* and *portable* components. The water-contacting components are dedicated; you permanently install them in each well. The control elements are portable; you transport them from well to well.

Dedicated Components

Dedicated Well Wizard components include:

- A sampling pump.
- Pump tubing.
- An optional inlet screen.
- A well cap.
- An optional pneumatic static water-level probe.
- An optional packer.
- An optional purge pump.

The following sections describe these components.

Sampling Pump

A Well Wizard sampling pump is an air-actuated bladder pump that you permanently position in the well.

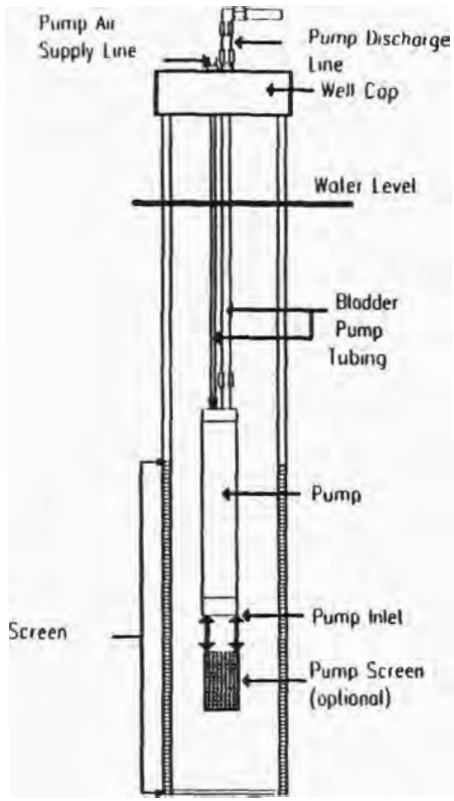


Figure 1-1: Well Wizard Pump Installed in a Well

As Figure 1-1 shows, you normally position the pump inlet midway in the screen section of the well, suspending it by two tubes that supply air to the pump and convey the water sample to the well cap. Whenever possible, pumps are shipped already preassembled to the tubing and the well cap assembly.

Several types of Well Wizard bladder pumps are available.

1100 Series Pumps

The 1100 series pumps include four major components:

- Upper-end check valve assembly (polyvinyl chloride (PVC) or Teflon™),
- Lower-end check valve assembly (PVC or Teflon).
- Bladder cartridge (Teflon).
- Pump body (PVC or Teflon).

You can totally disassemble this pump without tools by unscrewing each end cap and pushing the bladder cartridge out of the pump body (for more information, refer to the instructions included with the field-replaceable bladder kit). The weep hole on the water-discharge fitting aids cold-weather operation by allowing the water discharge line to drain after use.

1200 Series Pumps

The 1200 series pumps include two major components:

- Bladder cartridge assembly (either Teflon and stainless steel or PVC and stainless steel).
- Pump body (stainless steel).

You can partially disassemble this pump (for more information, refer to the instructions included with the field-replaceable bladder kit). The pump body covers the weep hole on the upper portion of the bladder cartridge to aid cold-weather operation, so you may sometimes see water dribble from the pump body.

1500 Series Pumps

The 1500 series pumps are the same as the 1200 series Well Wizard pumps except that they are much longer. They're available in stainless steel with PVC or stainless steel with Teflon. Also known as *Power Pumps*, these pumps save you from needing both a purge pump and a sampling pump in deep wells with moderate purge volumes, by delivering higher flow rates.

How Bladder Pumps Work

The bladder pump has two alternating cycles (refer to Figure 1-2):

- **During the discharge cycle,** air forced into the space between the pump body and the pump bladder squeezes the water inside the bladder into the exit/entrance holes of the fill rod. As air pressure increases, liquid–having no place else to go–is forced up the discharge line and to the surface. The bottom check ball is forced down by the air pressure in the pump; this seals the inlet so that no water can enter the bladder chamber.
- **During the refill cycle,** with no air pressure holding it down, the water pressure pushes the bottom check ball up, allowing the water to reenter the bladder chamber. The bladder expands as it refills with water. The top check ball seals because of the force of the water pressure in the discharge tubing.

Caution: Although you can operate a Well Wizard pump *dry* without damaging it, the bladder can be punctured if you pump sand. So be sure to use an inlet screen in wells with high sand and sediment content, or when the inlet of the pump is placed within 2 feet of the bottom of the well. Remember, the Well Wizard 10-year warranty is void if you don't use an inlet screen.

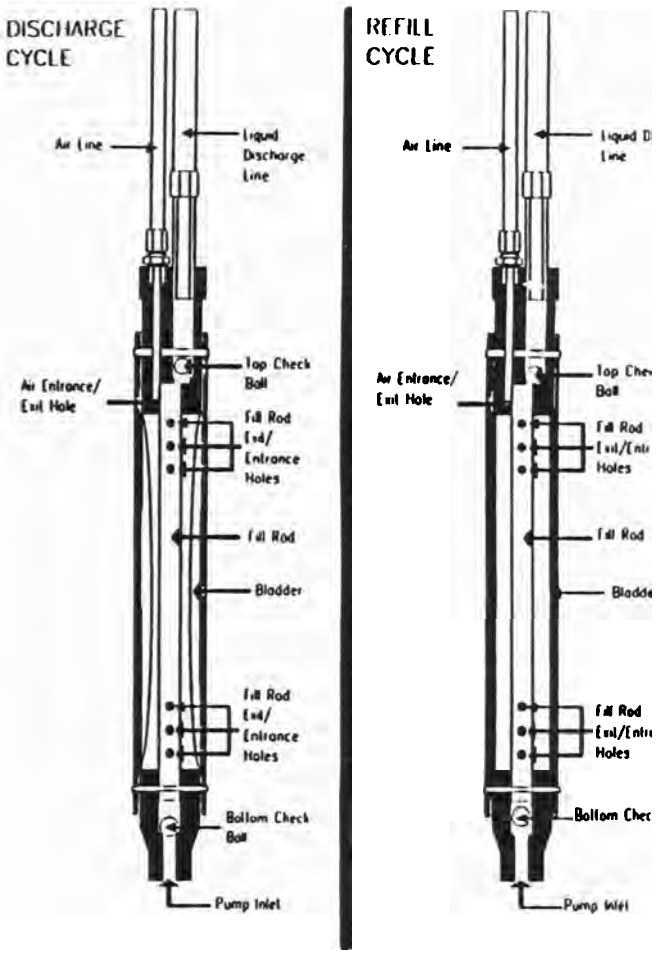


Figure 1-2: Bladder Pump Cycles

Pump Tubing

A ground water sample is only as good as the tubing it runs through. Your Well Wizard was shipped with one of the following types of superior-quality tubing:

- Polyethylene.
- Teflon-lined polyethylene.
- Teflon.

Most tubing is supplied as a bonded pair (air supply and discharge), to save time and avoid tube entanglement.

Unless your order specified that you wanted *bulk* tubing, the tubing for your Well Wizard bladder pump is pre-cut to the correct length for your well. If you also have a Purge Mizer, you'll need to fit and trim its tubing; if you have a Purge Master, that tubing is pre-cut but not connected to the pump or cap. Instructions for these procedures are in Chapter 2, "Installing the Components."

Inlet Screen

An inlet screen can protect the bladder in your Well Wizard pump by preventing sand from contacting the bladder. If you install a screen on your dedicated Well Wizard bladder pump, QED warrantees the pump for a full 10 years.

Well Cap

You fit a well cap to the top of the well casing to suspend the pump and tubing. There are two terminal fittings inside the basic well cap (see Figure 1-3):

- A compression *through fitting* for the discharge line.

- A short brass *quick-connect nipple* for the pump air-supply line.

The *protected* well cap has a lid with a lock pin. You can record well identification and reference date information on the cap label. The *unprotected* well cap is meant for wells located within a user-supplied protected standpipe.

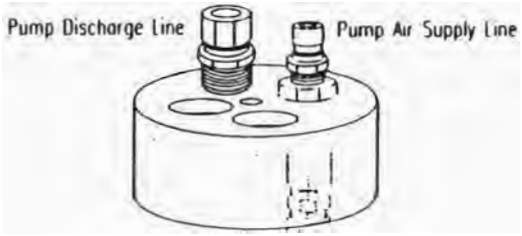


Figure 1-3: Well Cap

Pneumatic Static Water-Level Probe

You can permanently mount an *optional* static water-level probe inside the well. Then you can use a portable instrument to pneumatically measure the submergence of the probe.

Packer & Purge Pump

In conjunction with dedicated Well Wizard sampling pumps, you can install an *optional* packer (Purge Mizer) or purge pump (Purge Master) to shorten well purge times in any size well over 2 inches in diameter.

- A Purge Mizer packer inflates to seal off the sampling zone from the remainder of the water column. A *tandem* Purge Mizer combined with a standard Purge Mizer and a sampling pump lets you seal off both *above* and *below* the sampling zone.

- **A Purge Master** purge pump saves purge time in wells that contain a large volume of water to be purged before ground water sampling. This pump operates on a gas-displacement principal that results in high flow rates. However, because drive air contacts the well water, you don't also use this pump for sampling–you use the Well Wizard bladder pump instead.

Portable Components

Portable Well Wizard components include a cycle controller, water-level meter, disposable sample filters, and a flow-through cell.

Cycle Controller

A cycle controller controls operation of the Well Wizard pump by regulating the air flow from a compressed-gas source to the pump. Figure 1-4 shows the control panel from a typical Well Wizard cycle controller. Several controllers are available.

Model 3013 Automatic Controller

When connected to an appropriate compressed-gas source, the Model 3013 Automatic Controller alternately pressurizes then vents the air-supply line to the pump, allowing the pump to discharge, then fill with water. Using two timers, you can separately adjust the duration of the discharge pumping and venting cycles to maximize the pumping rate. The timers have a range of a fraction of 1 second to 2 minutes. A separate control lets you reduce the flow rate for sample collection.

Because this controller is pneumatically operated, it requires no electrical power supply. QED recommends that the compressed-gas sources be of high quality, such as breathing air or air from an oil-less compressor like the one offered in the Well Wizard product line.

WARNING! Do not apply pressure greater than 120 psi to the standard controller. Higher pressures may create hazardous conditions and will void your Well Wizard system warranties. However, higher air-flow-rate and higher pressure versions are available.

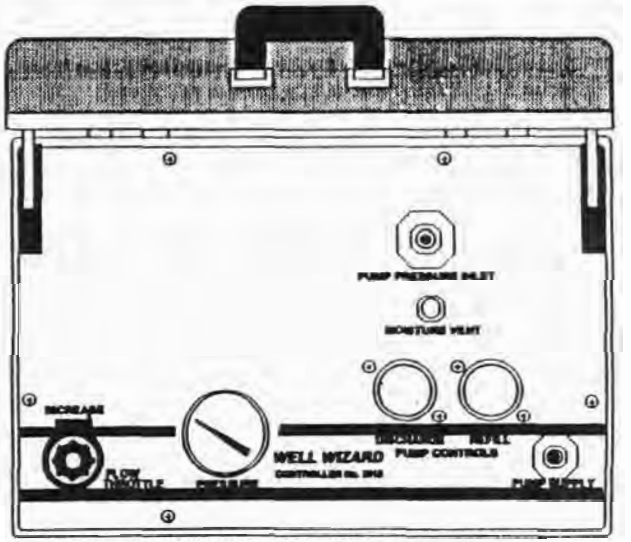


Figure 1-4: Typical Well Wizard Cycle Controller Control Panel

Model 3111 Automatic Controller/Compressor

The Model 3111 Automatic Controller/Compressor is a self-contained, cart-mounted unit that combines a compressor with a 3013 Automatic Controller. Its air-cooled gasoline engine drives a 100 psi oil-less compressor. This is a convenient, easily transportable compressed-air source.

WARNING! Do not apply pressure greater than 120 psi to the controller. Higher pressures may create hazardous conditions and will void your Well Wizard system warranties. However, higher air-flow-rate and higher pressure versions are available.

Model 350 Electronic Controller

Because the Model 350 Electronic Controller is electronic, it's also lightweight. Beyond that, this controller works essentially the same as the 3013 Automatic Controller, except that its timers have a narrower range.

Water-Level Meter

QED offers two approaches to portable static water-level measurement:

- **The pneumatic water-level approach** uses a portable battery-operated meter to measure the submergence of the dedicated probe. You calibrate the meter when you install it, and periodically after that. Batteries and a refillable compressed-gas charge from the pump controller output power the meter.
- **The electronic water-level approach** uses a portable conductivity probe attached to a calibrated tape. A light shines and a buzzer sounds when the probe touches the water surface. You lower this probe into each successive well.

Flow-Through Cell

Purge Saver is QED's *optional* flow-through cell. It simultaneously uses four probes to measure the pH balance, conductivity, temperature, and dissolved oxygen content of purge water. Purge Saver lets you know when it's okay to sample—generally saving you from spending a lot of time and from removing large volumes of water. If you have Purge Saver, for information about how to operate and maintain it, refer to the separate Purge Saver documentation.

QuickFilter

To ensure accurate samples of dissolved metals, you can use an *optional* QED QuickFilter. It removes solids larger than 0.45 micron. Because QuickFilters are disposable—you use one for each sampling event—there's no need to try to clean or decontaminate the filter from well to well.

2

INSTALLING THE COMPONENTS

If you've received a set of preassembled dedicated components, you'll find that unpacking them and installing them is easy when you follow the instructions in this chapter. Because not everyone needs to read the whole chapter, the first section helps you decide which of the other sections you need to read.

If, instead of preassembled components, you've received unassembled components and bulk tubing, read Chapter 5, "Installing a Pump Using Bulk Tubing."

Before You Begin...

How many of the installation procedures in this chapter you need to follow depends entirely on which components you have. But *everyone* needs to refer to these sections:

- "Unpack the Components."
- "Install the Basic Sampling Pump."

To find out which of the other sections to read, take stock of what you have by referring to the stapled sheets titled "Downwell Equipment Build/Specifications Sheet(s)." These sheets–and any other instructions–are inside a box labelled "Instructions Enclosed," which is inside Box 1.

When you know what you have, refer to Table 2-1 to find out which sections of this chapter you need to read to install your specific set of components—and in what order:

Table 2-1: What to Read & In What Order

If you have	Read this	In this sequence
A sampling pump	"Unpack the Components"	First
Inlet screen	"Install the Inlet Screen"	*After* unpacking the components
Packer (Purge Mizer)	"Install an Optional Packer–Purge Mizer"	*Before* installing the basic pump
Purge pump (Purge Master)	"Install an Optional Packer–Purge Pump"	*Before* or *after* installing the basic sampling pump–refer to the "Downwell Equipment Build/Specifications Sheet(s)"
Water-level meter	"Install an Optional Water-Level Meter Probe"	*After* installing the basic pump and any packer or purge pump

Unpack the Components

Here's how to unpack the Well Wizard dedicated components.

1. If you need to install a Well Wizard system in more than one well, decide which well you want to do first. Then find the box of components with the correct well-identification number written on the outside of the box.

2. If you *don't* have a Purge Mizer, skip to Step 3; if you *do* have a Purge Mizer, get the following tools ready:
   - 2 8" adjustable crescent wrenches.
   - 2 12" adjustable crescent wrenches.
   - 1 Tubing cutter (supplied by QED).
3. Carry the box to the well site, then open the box, but don't touch anything yet.
4. *Open the box, then, before unpacking the rest of the box,* put on a pair of the latex gloves you find inside the box.

> **Caution:** Touching well components with your bare hands can contaminate the components and degrade the quality of the samples obtained using the Well Wizard system. Always wear clean latex gloves when unpacking and installing a Well Wizard system, and at any other time when your hands might touch a water-contacting component.

5. Taking care to *not kink the tubing*, gently remove the plastic-wrapped pump and tubing from the box. A label on the package provides the well ID, cap, and tubing length. You may need this information later, so save the label.

> **Note:** The plastic bag also contains the lab-clean certificate on which is recorded the pump batch serial number. Keep this tag *for each pump* you install. It's your proof that the pump is contaminant free–if you need to, you can call QED with the serial number to find out which lab certified the pump.

6. Open the plastic wrapping, then gently slide the pump out of the bag.

Install the Inlet Screen

Well Wizard bladder pumps have a 10-year warranty that is valid *only* if you use the appropriate inlet screen.

There are two types of inlet screen: one that you *thread* onto the pump inlet for 1100 series pumps, and one that you secure with *set screws* for 1200, 1300, and 1500 series pumps. The correct screen for each pump is usually included with the other components for the well–the box label tells you where to find the screen. The following sections describe how to install the two types of inlet screen.

Screens for 1100 Series Pumps

To install a screen on an 1100 series pump, follow these steps:

1. Still wearing the latex gloves, open the plastic wrapping, then remove the screen.
2. Thread the screen onto the male-threaded pump inlet, making sure the screen is firmly tight.

Screens for 1200, 1300, & 1500 Series Pumps

To install a screen on a 1200, 1300, or 1500 series pump, follow these steps:

1. Still wearing the latex gloves, open the plastic wrapping, then remove from the bag both the screen and the small plastic bag that contains spare set screws and a small Allen wrench.
2. Find the groove around the inlet end of the stainless steel pump body (the end opposite the air and water connectors), then slide the screen onto the bottom of the pump assembly, aligning the top rim of the screen with the top groove.

Note: If you have difficulty installing the screen, use the Allen wrench to loosen the set screws a little.

3. Using the Allen wrench, *lightly* tighten each of the set screws, then make sure the screws have engaged the groove.
4. Using the Allen wrench, *firmly* tighten each of the set screws
5. Check to make sure the screen is secure.

Install an Optional Packer–Purge Mizer

If you have a Well Wizard sampling system with Purge Mizer, it was shipped with the Purge Mizer *support cable* and *three tubing connections* loose at the cap, to allow you to adjust the length of the various tubes to exactly fit your well. To finish installing these, complete the steps in the following sections before completing the steps in "Install the Basic Sampling Pump," later in this chapter. As a guideline, at the end of Purge Mizer installation, you want to have the Purge Mizer cable *taut* and the tubing just slightly *slack*–so the cable bears the weight of the pump. Note that there are always several inches of inflation tubing left that must later be trimmed, but still left slack, to avoid kinking.

Note: If you don't understand how to use the compression style fittings described in the following sections, refer to the instructions in "Install or Replace Pump Connectors" in Chapter 6, "Maintaining Your Well Wizard System."

Attach the Purge Mizer Cable to the Well Cap

How you attach the Purge Mizer support cable to the well cap depends on whether you have a standard cap or a 2120A 2-inch cap. The following sections describe both procedures

Standard Cap

If you have a Purge Mizer and a standard cap (with support bar), follow these steps to attach the support cable to the cap.

1 Push the threaded terminal through the cap far enough that the support bar can spin freely on it.
2 Spin the bar down to the bottom threads of the terminal.
3 Lower the bar onto the cap, between the cap fittings.

The result should resemble Figure 2-1.

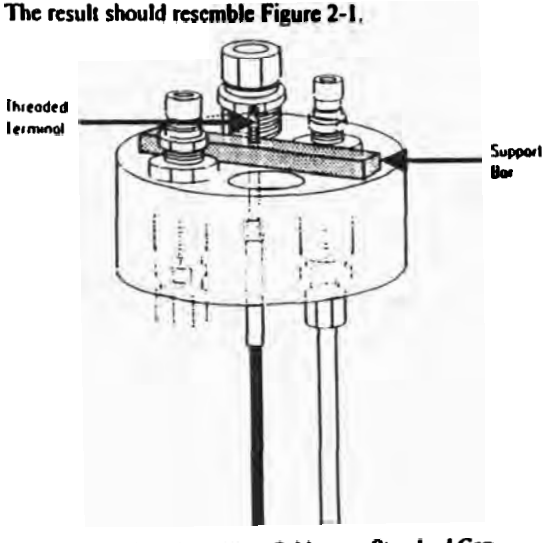


Figure 2-1: Installing Cable on a Standard Cap

2120A 2-Inch Cap

If you have a Purge Mizer and a 2120A 2-inch cap, follow these steps to attach the Purge Mizer support cable to the cap

1 With the support bracket between the sides of the strap fork, slide the clevis pin through the holes
2 Slide the cotter pin through the clevis pin
3. Secure the cotter pin by bending the ends

The result should resemble Figure 2-2

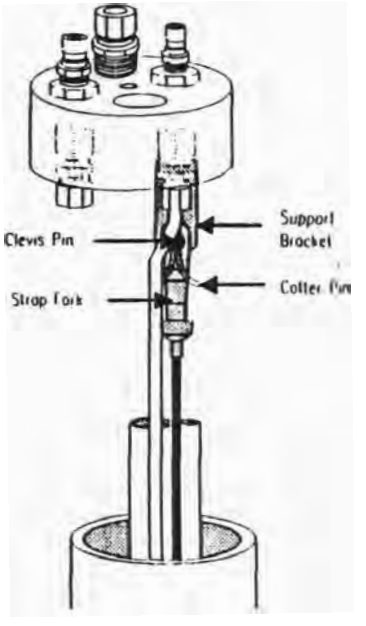


Figure 2-2: Installing Cable on a 2120A 2-Inch Cap

Install the Discharge Tubing

To install the discharge tubing, follow these steps.

1. Pull or push the 1/2-inch discharge tubing through its fitting, adjusting it until it's slightly *less* taut than the Purge Mizer support cable–leaving about *1-1/2 feet* extending above the well cap.

> **Caution:** For now, don't cut off the approximately 1-1/2 feet of excess tubing that extends above the well cap. Wait until Step 3 in "Install the Well Cap," later.

2. With a wrench, hold the base of the through fitting and, with another wrench, tighten the fitting nut until firm.

Install the Inflation Tubing

To install the Purge Mizer inflation tubing, follow these steps.

1. Determine the length of 1/8-inch Purge Mizer inflation tubing needed to extend completely into the compression style fitting on the underside of the cap or cap plate while leaving the tubing *less* taut than the Purge Mizer support cable.

> **Caution:** Measure with care. It's better to leave a little extra tubing prior to cutting than to cut off too much.

2. Use the tubing cutter to cut off the excess tubing.
3. Push the tubing fully into the fitting until it contacts the shoulder inside the fitting.
4. On the top of the cap or cap plate, with a wrench, hold the brass anchor fitting in which the 1/8-inch Purge Mizer inflation tube fitting is installed.
5. Tighten the tubing fitting with the wrench until it's firm.

6. Turn the tubing fitting about three-quarters of a turn past *hand tight*—but don't tighten it enough to crush the Purge Mizer tubing.

Install the Air-Supply Tubing

To install the air-supply tubing, follow these steps.

1. Determine the length of 1/4-inch air-supply tubing needed to extend completely into the brass 1/4-inch compression fitting on the underside of the cap or cap plate while leaving the tubing *less* taut than the Purge Mizer support cable.

> **Caution:** Measure with care. It's better to leave a little extra tubing prior to cutting than to cut off too much.

2. Use the tubing cutter to cut off the excess tubing.
3. Push the tubing into the fitting until it contacts the shoulder inside the fitting.
4. On the top of the cap or cap plate, with a wrench, hold the brass anchor fitting in which the 1/4-inch air-supply tubing is installed.
5. Tighten the tubing fitting with another wrench until it's hand tight.
6. Turn the tubing fitting one and one-quarter turns *past* hand tight.

Install the Basic Sampling Pump

Depending on the length of the tubing and whether your pump includes a Purge Mizer or a Purge Master, it may be easiest for two people to install the pump–but one person often can do it. To install the pump, follow these steps.

Caution: Make sure that you don' bring the tubing or other pump components in contact with the ground or any other surface. It's often helpful to spread out a polypropylene tarp next to the well during installation.

1. Still wearing the latex gloves, if you have a protected well cap, mark any necessary information–such as well ID and depth–on the label inside the well cap.
2. Slowly lower the pump into the well while uncoiling the tubing bundle, until the entire length of tubing is in the well.

   Note: If you don't have a Purge Mizer, skip Step 3.

3. What you do in this step depends on which components you have:
   - **If you have just the basic sampling pump,** either anchor the well cap in position or leave it loosely attached.
   - **If you have a *Purge Mizer*,** lower the cap on the well. Then, leaving 1 inch or a little more, cut off the remaining tubing (about 1-1/2 feet) and attach it to the sample elbow. You can store the elbow and tubing in one of the unused holes in the cap plate.
   - **If you have a *Purge Master that you haven't yet installed*,** proceed with the instructions in "Install an Optional Purge Pump–Purge Master."

Install an Optional Purge Pump–Purge Master

If you have a Well Wizard sampling system with Purge Master, although the tubing is cut to the correct length for your well, you need to install the tubing when you install the pump. Refer to the "Downwell Equipment Build/ Specifications Sheet(s)" to see whether to install your sampling pump or your purge pump first.

The following sections tell you how to install Purge Master

Attach the Tubing Bundle to the Pump

Follow these steps to install the Purge Master tubing bundle.

1. Get the following tools ready:
   - 2 **12"/300 mm adjustable** crescent wrenches
   - 1 Tubing cutter (supplied by QED)
2. Make sure that both the 3/4-inch and the 1/2-inch fitting nuts on the top of the pump are loose.
3. Holding one end of the tubing bundle, press a 1/2-inch and a 3/4-inch tubing insert into the corresponding tubing.
4. Loosening the nuts as necessary, push the tubing into the 3/4-inch and 1/2-inch fittings on the top of the pump, as follows:
   - **Push the larger tubing into the 3/4-inch fitting until it contacts the shoulder inside the fitting.**
   - **Push the smaller tubing into the 1/2-inch fitting until it contacts the shoulder inside the fitting.**
5. With a wrench, tighten the 3/4-inch fitting nut hand tight.
6. With a wrench, hold the fitting base, then turn the 3/4-inch fitting nut one additional turn *past* hand tight.

7. With a wrench, tighten the 1/2-inch fitting nut hand tight.
8. With a wrench, hold the fitting base, then turn the 1/2-inch fitting nut one additional turn *past* hand tight.

Lower Purge Master into the Well

To lower the Purge Master into the well, follow these steps.

1. Lift the cap plate or unprotected cap out of the well and let it hang off to one side.
2. Lower the pump into the well slowly while uncoiling the tubing bundle–until there's about 3 feet of tubing left.

Attach the Discharge Tubing to the Well Cap

To attach the discharge tubing to the well cap, follow these steps.

1. With the large fitting nut on the *top* of the cap plate or unprotected cap loose, push the discharge tubing through its fitting–leaving about 1-1/2 feet extending above the cap.

   Caution: For now, don't cut off the approximately 1-1/2 feet of excess tubing that extends above the fitting. Wait until Step 3 in "Install the Well Cap," later.

2. If you have a cap that has a fitting nut on the underside, with a wrench, tighten the fitting nut on the underside hand tight
3. With a wrench, hold the fitting base.
4. Turn the fitting nut one additional turn *past* hand tight.

Attach the Air-Supply Tubing to the Well Cap

To attach the air-supply tubing to the well cap, follow these steps.

1. Loosen the 1/2-inch fitting nut on the top of the cap or cap plate.
2. Referring to Figure 2-3, estimate where to cut the air-supply tubing so that it contacts the shoulder inside the 1/4-inch air fitting on the underside of the cap or plate—leaving a little bit of slack (the 3/4-inch tubing should provide the main support for the pump).

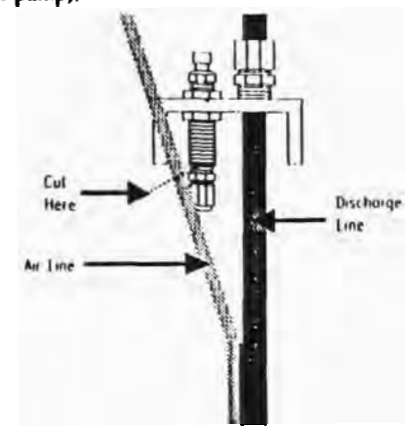


Figure 2-3: Where to Cut the Tubing

3. Cut the air-supply tubing according to your calculation in Step 2.
4. Push the air-supply tubing into the fitting until it contacts the shoulder inside the fitting.
5. With a wrench, tighten the fitting nut hand tight.
6. With a wrench, hold the fitting base.
7. Turn the fitting nut one additional turn *past* hand tight

Install the Well Cap

To install the well cap, follow these steps

1. If you want to prevent debris (such as rust from the protective casing) from getting on the well cap and into the well, fit a plastic bag over the well cap.
2. Lower the cap or cap plate on the well.
3. Making sure that you allow room to install the discharge elbow so that the elbow clears the top edge of any unprotected cap or protective casing, trim off the excess 1-1/2 feet of discharge tubing using the tubing cutter.
4. Store the sample elbow and tubing in the spare hole in the cap, if you want to.

Install the Optional Water-Level Meter Probes

If your Well Wizard system includes the Model 6010E Electronic/Pneumatic Water-Level meter, the following steps describe how to install the probe. Refer to Figure 2-4 as you follow the steps.

Caution: Ensure that the static water level in the well has returned to its natural level after any recent purging or sampling or displacement due to equipment installation. In wells that recover very slowly, water displacement during new-equipment installation may temporarily alter the true static water level of the well.

1. Measure the current static water level in the well (C in Figure 2-4), then record it using your traditional method.

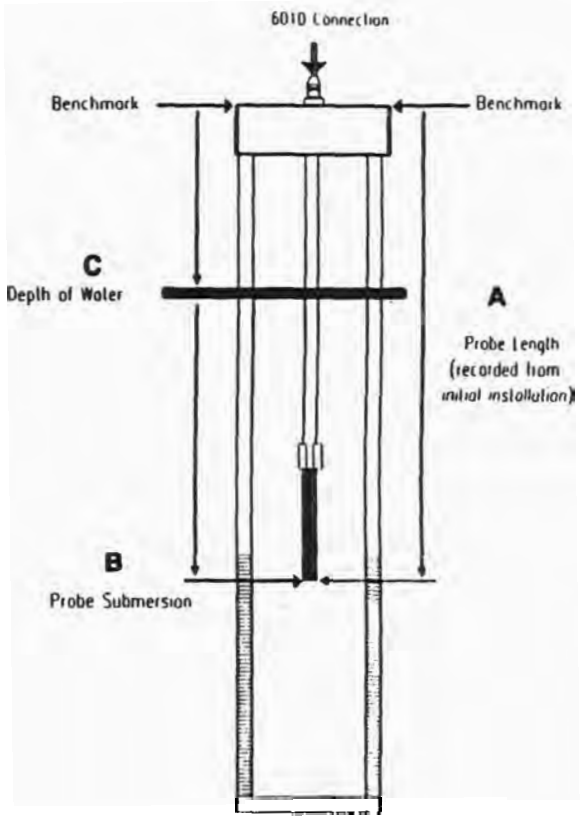


Figure 2-4: Measurements for Probe Installation

2. Review the historic static water-level fluctuations to determine whether the current reading reflects a good starting point for water-level probe location. Ideally, the probe should be submerged about 10 to 12 feet below the *mean static level*.
3. Decide where you want to locate the water-level probe.

> **Caution:** Although 10 to 12 feet below the mean static level is an *ideal* submergence for the probe, you *must* submerge the probe at least 1 foot but not more than 25 feet, because the meter can't display depths outside this range.

4. Measure and cut the 1/4-inch probe tubing to the length you calculated.
5. Attach the tubing to the probe assembly, then, to avoid an air leak and false readings, tighten it carefully using two wrenches.
6. Lift up the cap or plate, then lower the probe and tubing into the well.
7. Attach the probe tubing to the 1/4-inch compression fitting under the cap or plate, then tighten it using two wrenches.
8. Lower the cap or plate back into position on the well casing.
9. Determine the probe submergence. To find out how to do that, refer to Chapter 3, "Purging the Well," and read the section about measuring the water level with a dedicated water-level meter.
10. Add the static water level depth you measured in Step 1 to the submergence reading you determined in Step 9 (A in the drawing), to determine the probe location.
11. Record the probe length (A) and the measured calibration static water level determined in Step 1, for use in all future water-level depth calculations.
12. Apply the new probe submergence readings to the calibration to determine the new static water level.

3

PURGING THE WELL

Before sampling, you need to purge the well according to your approved sampling plan. This chapter tells you how to:

- Measure the water level using either a dedicated or a portable water-level meter.
- Purge the well using:
  - Just the sampling pump.
  - The sampling pump *and* Purge Mizer (packer).
  - Just Purge Master (purge pump).
- Maximize the pumping rate for both a sampling pump and Purge Master.

Measure the Water Level

Before you purge the well, you normally check the static water level. You can do that with either a dedicated or a portable water-level meter, as described in the following sections.

With a Dedicated Water-Level Meter

If you have a Model 6010E Electronic/Pneumatic Water-Level meter, to measure the water level, first you charge the air tank, then you use the water-level meter to measure the water level. The following sections tell you how.

Note: Rapid temperature changes adversely affect water-level meter operation. The best approach is to store the meter at the temperature in which you will use it. If this isn't possible, move the unit to the appropriate temperature at least 45 minutes before you want to use it to allow the temperature to stabilize. Then you can expect the accuracy to be as follows:

- 40 to 120° F ambient air temperatures: +/-0.01 feet.
- -20 to 40° F ambient air temperatures: +/-0.02 feet.

Charge the Tank

1. As shown in Figure 3-1, attach the black driver-controller hose to the controller.
2. As also shown in the figure, attach the red air-supply line from the **PUMP SUPPLY** connector on the controller to the **TANK RECHARGE** fitting, to charge the internal air tank to 100 psi.
3. Set the controller **DISCHARGE** timer for the maximum discharge time (**F** on the Model 3013 and **5 O'CLOCK** on the Model 350).
4. Set the **REFILL** timer for the minimum refill time (**A** on the Model 3013 and about **9 O'CLOCK** for the Model 350).
5. Start the compressed-air source.
6. Let the controller cycle until the 6010E pressure gage reads 80 to 100 psi.

Caution: Do not apply pressure greater than 120 psi to the controller. Higher pressures may create hazardous conditions and will void your Well Wizard system warranties.

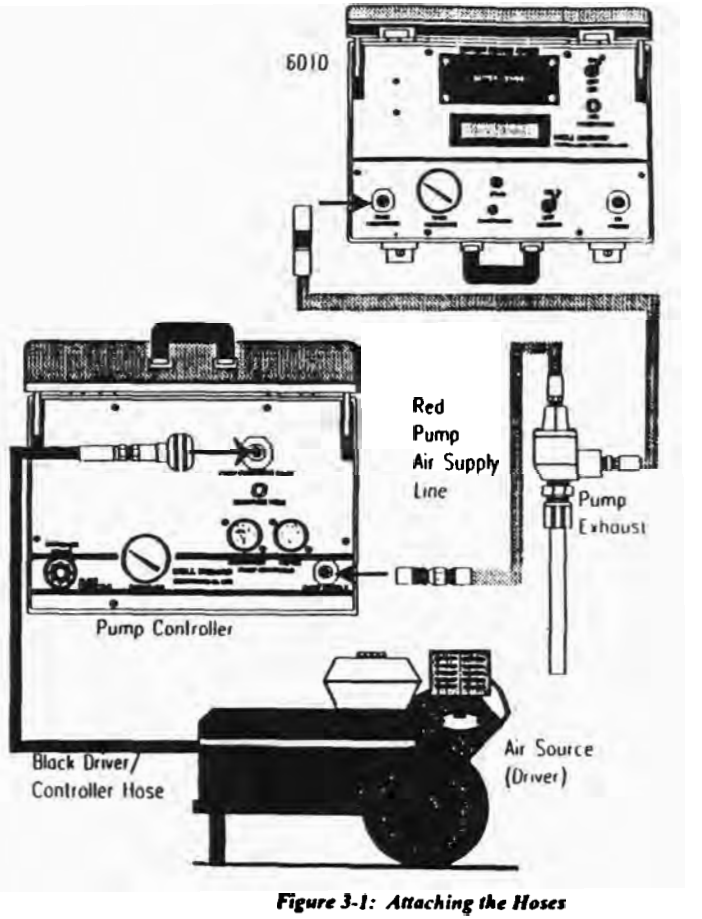


Figure 3-1: Attaching the Hoses

Operate the Meter to Measure Water Levels

1. Set the SENSOR switch to ON.
2. When the message reads **Attach to Well**, attach the clear air tubing from the TO PROBE fitting to the mating well cap connection.
3. Set the AIR switch to ON.
4. Press START once.
5. Press AIR PRE-CHARGE until the display shows the highest reading–you see the numbers increase, then stabilize at the highest reading.
6. Wait for the message to read **Probe Submersion Depth** (this is "B" in the diagram on the face of the meter), then record the reading when the depth stabilizes.
7. Move the AIR and the SENSOR switches to OFF.
8. Subtract the reading for Probe Submersion Depth ("B" in the diagram on the meter) from the known Probe Submergence ("A" in the diagram on the meter), established during probe installation (read about installing an optional water-level meter probe in Chapter 2, "Installing the Components"). The result is the depth of the static water-level probe.

With a Portable Water-Level Meter

If you have a portable water-level meter, follow these steps to measure the water level.

1. Still wearing the latex gloves, remove the black 1/2-inch square-head hole plug from the well cap.

   Note: If you don't see the black square-head screw, the sample tube may be stored in the opening. If so, remove it instead.

2. Insert the probe of the water-level meter through the opening, then unreel the probe tape into the well.

3. When the light shines and the buzzer sounds, the probe has contacted water. Write down or remember the depth to the static water level by reading the length shown on the tape, so you can refer to it when you're purging the well.
4. Remove the probe from the well, then replace the black square-head screw (or the sample tube and elbow).

Purge Using the Sampling Pump

To purge the well using just a Well Wizard sampling pump, you can follow either the general procedure described in the next section, *or* the steps in the more-detailed sections that follow.

Note: If you have a Purge Mizer (packer) as well as a sampling pump, follow the steps in "Purge Using Purge Mizer (packer)," before proceeding with these steps. If you have a Purge Master (purge pump), follow the steps in "Purge Using Purge Master (purge pump);" you don't need the steps in this section.

General Procedure for Purging

Here are the general steps to follow for purging

1. Start the compressor.
2. Hook up the hoses.
3. Set both timers on C for the Model 3013 or about 9 O'CLOCK for the Model 350.
4. Turn the yellow FLOW THROTTLE control knob completely clockwise, to make sure the pressure is as high as it will go.

If Steps 1 through 4 don't give you enough information, you may want to follow the steps in the following section *instead*, because they provide much more detail.

Detailed Procedure for Purging

The following sections provide the detailed steps for purging.

Get Purging Started

1. Considering the depth and size (diameter) of the well, calculate the number of gallons to be purged to comply with your approved sampling plan.
2. Start the compressor engine.

   But don't connect the red air-supply line to the Well Wizard controller yet. Instead, follow Steps 3 and 4 carefully.

3. As shown in Figure 3-2, connect the short end of the red pump air-supply line to the pump connector on the well cap.
4. Connect the long end of the red pump air-supply line to the **PUMP SUPPLY** connector on the Well Wizard controller.
5. Point the pump discharge line away from you.
6. Set both timers on **C** on the Model 3013 or at about **9 O'CLOCK** on the Model 350.
7. Connect the black driver/controller hose to the **PUMP PRESSURE INLET** connector on the Well Wizard controller.

   You'll notice **loud hissing and honking sounds** as air releases through the side of the Well Wizard controller housing and as air releases through the exhaust valve. This is *normal*.

Note: If the controller doesn't sound as though it is alternating between cycles (pressurizing then venting), shorten the cycle times by setting the **REFILL** and **DISCHARGE** timer knobs to **A** on the Model 3013 or at about **9 O'CLOCK** on the Model 350.

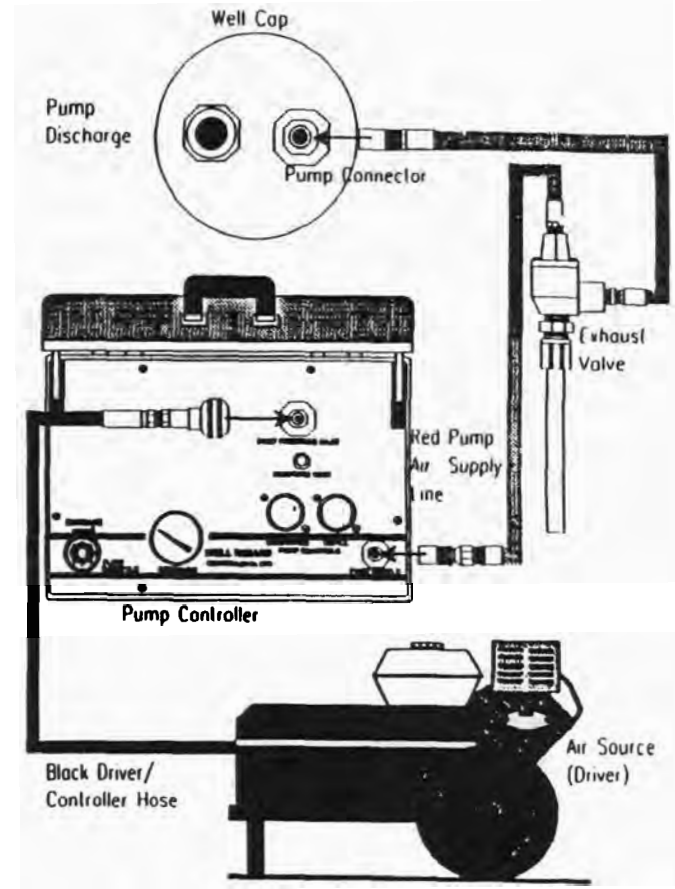


Figure 3-2: Connecting the Red Pump Air-Supply Line

After the venting noises stop, water flows from the pump discharge line as you begin to purge the well. The time required to actually begin discharge of water depends on the depth to the water–it may take several *seconds* or several *minutes*.

8. Check the air pressure on the **PRESSURE** gage on the Well Wizard controller. The pressure–which controls the flow rate–should be between 60 and 120 psi. If necessary, adjust the pressure using the **FLOW THROTTLE** control knob. Pull up on the yellow outer ring to unlock the throttle, adjust the setting, then push down to lock the throttle.

   Turning the **FLOW THROTTLE** knob clockwise increases pressure; turning it counterclockwise decreases pressure.

9. To make well purging as efficient as possible, refer to the steps in "Maximize the Pumping Rate," next.

10. Every 15 minutes, press down (and hold down for 5 seconds) the silver **MOISTURE VENT** button on the Well Wizard controller. This expels accumulated moisture from the side of the controller. It's especially important to vent the moisture during humid conditions and very cold conditions.

Maximize the Pumping Rate

Purging a well can be a time-consuming process. By adjusting the **REFILL** and **DISCHARGE** timers, you can make well purging as efficient as possible–so that as soon as the venting cycle ends, the pump is completely full and the discharge begins, and vice versa.

To do that, as detailed in the following steps, you first make both cycle times *long*, to ensure that the pump will completely fill then completely empty. Then you shorten one time until you see an effect on volume; then you shorten the second time the same way.

1. Lift the yellow outer ring of the **FLOW THROTTLE** control, turn the knob fully clockwise, then push down to lock the control.

2. Turn the **DISCHARGE** and the **REFILL** timer knobs to **D** on the Model 3013 or **12 O'CLOCK** for the Model 350–a *long cycle time*.

3. Using a 1,000 ml graduated cylinder for measuring (1,500 ml for Model 1500 pumps), measure the volume of water discharged in one cycle. This is the maximum pump volume–remember what it is.

   Note: For 1100 Series pumps, discharge volume should be 250 - 350 ml; for 1200 Series pumps it should be 350 - 450 ml. If your discharge volume is less than this, try increasing the refill cycle time. If that doesn't work, try shortening the refill cycle time, especially in deeper wells. (In deeper wells with very little water, if the cycle is too long, the water may actually have time to bleed through the weep hole before it can be discharged.)

4. To achieve as short a refill time as possible *without losing any refill volume*, slightly decrease the **REFILL** timer setting (turn the knob *counter*clockwise about half a setting). Then measure the volume of water discharged in the next three cycles. Repeat this step until you notice a decrease in discharge water volume.

5. Increase the **REFILL** timer setting (turn the knob *clock*wise) enough to regain full discharge volume. Refill is now set for maximum flow.

6. To achieve as short a discharge time as possible *without losing any discharge volume*, slightly decrease the **DISCHARGE** timer setting (turn the knob *counter*clockwise) Then measure the volume of water discharged in the next three cycles. Repeat this step until you notice a decrease in discharge water volume.

7. Increase the **DISCHARGE** timer setting (turn the knob *clock*wise) enough to regain full discharge volume. Discharge is now set for maximum flow.

Now you're purging efficiently.

Purge Using Purge Mizer (packer)

If you have a Purge Mizer, after you measure the water in the well, you inflate Purge Mizer, purge the well, then prepare for sampling.

Warning! ***Never*** **inflate Purge Mizer outside of the well. Inflate Purge Mizer** ***only*** **when positioned at full depth in the well casing. Always deflate Purge Mizer after use.**

To purge using Purge Mizer, follow these steps.

1. Couple the Purge Mizer control unit to the Purge Mizer air tubing fitting on the well cap (see Figure 3-3).
2. Couple the control unit to the short end of the red pump air-supply line connected to the Well Wizard controller.
3. Turn the **PRESSURE REGULATOR** knob fully counterclockwise.
4. Activate the compressed-gas source.

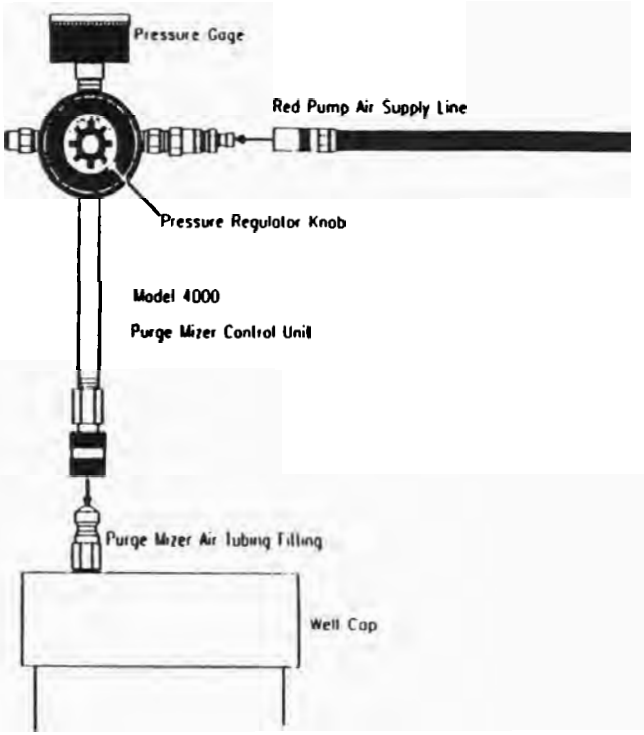


Figure 3-3: Coupling the Purge Mizer Control Unit

5 To fully inflate the Purge Mizer, slowly turn the **PRESSURE REGULATOR** knob on the Purge Mizer control unit clockwise to increase the pressure to the level recommended in Table 3-1.

Table 3-1: Recommended Pressure Levels

Purge Mizer Submergence (feet)	Inflation pressure (psi)
20	50
40	60
60	70
80	80
100	90

Note: The Purge Mizer inflates during the controller discharge cycle. To speed inflation, you can lengthen that cycle.

6. When you reach the correct pressure, disconnect the red air-supply hose. The Purge Mizer control unit check valve maintains the pressure.
7. Purge the well with the sampling pump as described in "Purge Using the Sampling Pump." If the pressure reading on the Purge Mizer control unit pressure gage remains steady, you know that Purge Mizer is operating correctly.

Purge Using Purge Master (purge pump)

If you have a Purge Master (purge pump), follow the steps in the following sections for high-rate purging.

Connect the Discharge Tubing Elbow

1. Connect the discharge tubing elbow to the 3/4-inch tubing protruding from the cap or cap plate.
2. Tighten the fitting nut with a wrench.
3. Direct the end of the tubing on the discharge elbow into the collection vessel.

Connect Purge Master

1. If you have a locking well cap, make sure the cap pin is engaged.
2. To achieve a short discharge cycle to start with, set the **DISCHARGE** timer knob at **A** on the Model 3013 or at about **9 O'CLOCK** on the Model 350.
3. Connect the short end of the red pump air-supply line to the quick-connect nipple on the cap or cap plate nearest to the white high-rate discharge fitting (see Figure 3-4).

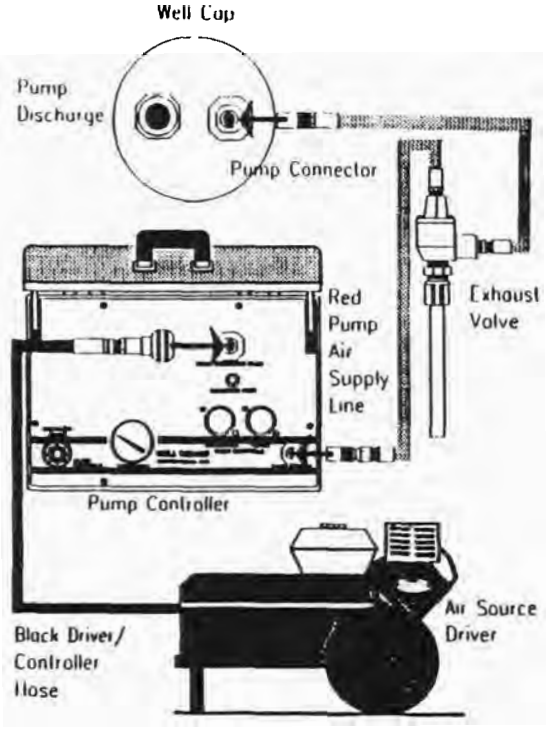


Figure 3-4: Connecting Purge Master

4. Connect the other end of the red pump air-supply line to the **PUMP SUPPLY** connector on the controller.
5. Not exceeding 125 psi, connect the black driver/controller hose to the **PUMP PRESSURE INLET** connector on the controller.

As purging begins, you'll notice loud hissing and honking sounds as air releases through the side of the Well Wizard controller housing and as air releases through the exhaust valve. This is *normal*. After the venting noises stop–from several seconds to several minutes–water flows from the pump discharge line as you begin to purge the well.

Note: If the controller doesn't sound as though it's alternating between cycles (pressurizing then venting), turn the **REFILL** and **DISCHARGE** timer knobs to shorten the cycles.

Set the Cycles

1. Use Tables 3-2 and 3-3 as guides to setting the **REFILL** and **DISCHARGE** timers, depending on the depth and submergence of the Purge Master in the well.

Table 3-2: Recommended Discharge Times

Pump Depth (ft.)	Discharge Time (sec.)
50	2.5
75	3.5
100	4.5

Table 3-3: Recommended Refill Times

Pump Depth (ft.)	Pump Submergence (ft)	Refill Time (sec.)
50	25	5.5
75	25	6.0
100	25	7.5
50	50	5.0
75	50	5.5
100	50	7.0

2. Turn the **FLOW THROTTLE** knob on the controller fully clockwise.

Maximize the Pumping Rate

Even with Purge Master, purging a well can be a time-consuming process. By adjusting the discharge and refill cycles, you can make well purging as efficient as possible.

1. With the pump operating, set the refill time *long* (about **11 O'CLOCK** for Model 350 or **C** for Model 3013 in most cases—a higher setting if the well is shallow).
2. Referring to Table 3-4, set the discharge time *short* (1 second for wells shallower than 50 feet; 3 seconds for wells 50 to 100 feet, and 5 seconds for wells deeper than 100 feet). Water should begin to flow through the discharge line after 5 to 15 pumping cycles, depending on the depth of the well.

Table 3-4: Approximate Settings Versus Times

Model 350 Setting	Seconds	Model 3013 Setting
7 o'clock	1	A
	3	B
8 o'clock	3.5	-
9 o'clock	7	-
	9	C
10 o'clock	13	
11 o'clock	16.5	
12 o'clock	19.5	
	20	D
1 o'clock	22.5	
2 o'clock	26.5	
	31	E
3 o'clock	32	
4 o'clock	35.5	
5 o'clock	37	
	42	F

3. Measure the liquid discharged during one cycle. The volume of the liquid is less than the internal volume capacity of the pump.
4. Increase the discharge time *gradually* (turning the knob less than a full setting), letting the pump go through its cycle three to five times after each adjustment.
5. Repeat Step 4 until you see air bubbles coming through the discharge line.
6. Decrease the discharge time slightly to eliminate the air bubbles. The amount discharged per cycle is now close to the internal volume capacity of the pump—the *discharge* cycle is maximized.

> **Note:** If air and water begin to shoot out *hard*, the discharge cycle time is too long. Set the discharge time short again, then repeat Step 4 using even smaller timer adjustments.

7. Decrease the refill time *gradually*, letting the pump cycle three to five times after each adjustment.
8. Repeat Step 6 until you see air bubbles coming through the discharge line.
9. Increase the refill time slightly to eliminate the bubbles. The amount of water discharged per cycle should still be close to the internal volume capacity of the pump—the *refill* cycle is maximized.

> **Note:** If air and water begin to shoot out *hard*, the refill cycle time is too short. Set the discharge time long again, then repeat Step 4 using very small timer adjustments.

Clear the Discharge Line

During the winter in northern climates, to prevent the discharge tubing of your Purge Master from *freezing*, you need to clear the discharge line of standing water above the static water level.

1. Before disconnecting the air supply from Purge Master, set the discharge cycle time on the controller long enough to cause air to exit from the Purge Master discharge line.
2. Wait until all the water is blown out of the discharge tubing.

4

COLLECTING A SAMPLE

After you've purged the well, you're ready to sample. A slow flow rate is recommended in most sampling protocols. When you *slow* the flow from the pump, you also avoid spurts, sprays, and drips.

The following sections tell you how to adjust the rate of flow for sampling and how to collect the sample.

Adjust the Rate of Flow

When you collect a sample, you want a smooth, non-aerated flow. To get that kind of flow, follow these steps.

1. Turn the **FLOW THROTTLE** knob on the controller *counter-*clockwise to slow the flow.
2. If you want to use a QuickFilter to filter your sample, disconnect the air supply on the controller to stop the pump, attach the QuickFilter to the tubing following the instructions on the box, then re-connect the air-supply on the controller to re-start the pump.

Caution: To avoid housing or membrane failure and sample contamination, make sure the pressure does not exceed 60 psi.

3. If you purged the well using a Purge Master purge pump, reconnect the red pump air-supply line to the sampling pump, then make sure that you purge 1/2 to 1 gallon of water through the sampling pump. This ensures that you sample fresh well water.
4. Turn the **DISCHARGE** timer knob to **D** for the Model 3013 or to **12 o'clock** for the Model 350, to lengthen the cycle (because it will take longer to get the full volume of the pump at the slower flow).
5. Continue adjusting the **FLOW THROTTLE** knob until the flow is completely smooth.

Collect the Sample

To collect the sample, follow these steps.

1. If you're using a QuickFilter, discard the initial volume of filtered sample (500 ml for Model FF8100; 1,000 ml for Model FF8200).
2. Direct the flow into the sample vessel.
3. Turn off the driver engine, then disconnect the hoses from the well cap.
4. If you have a Purge Mizer, turn down the regulator to relieve the pressure, then remove the Purge Mizer control unit. The Purge Mizer deflates automatically.

5
INSTALLING A PUMP USING BULK TUBING

This chapter is for you if you ordered your Well Wizard components and tubing unassembled. The following sections tell you how to assemble the components and tubing.

Get Ready

It's important to not contaminate pump components. Doing so can degrade the quality of the samples obtained using your Well Wizard system. Always wear latex gloves when unpacking and installing Well Wizard components, and at any other time when your hands might touch a water-contacting component.

Cut Tubing to Length

To cut the tubing to the correct lengths, follow these steps.

1. Attach the bulk tubing to the pump.
2. Lower the pump into the well until the pump touches the bottom of the well.
3. Raise the pump up, as follows:
   - 1 foot, for low-recovery wells.
   - To the middle of the screen, for high-recovery wells.

3 With a wrench, hold the anchor nut on the top of the well cap, then tighten the nut one turn past finger tight.

Fittings

To make final adjustments and tighten the tubing in its fittings, follow these steps.

1 Push the discharge and air-supply tubing though the well cap panel slightly–as necessary to provide final, even alignment of the tubing.
2. Tighten the discharge tubing nut one full turn past finger tight.
3. Tighten the air-supply tubing nut one full turn past finger tight.

Install the Optional Components

The following sections provide information to help you as you install optional Well Wizard components.

Inlet Screen

If you want to install an inlet screen on your sampling pump (the Well Wizard 10-year warranty is *void* without it), follow the instructions in Chapter 2, "Installing the Components."

Purge Mizer

If you're installing a Purge Mizer along with your sampling pump, remember that you must install Purge Mizer before you install the pump. You need to position it above the *top of the well screen*, rather than in the screen section of the well. Refer to the installation instructions included with Purge Mizer and, if

necessary, to the instructions in Chapter 2 of this book, "Installing the Components."

Purge Master

Refer to the installation instructions included with Purge Master and, if necessary, to the instructions in Chapter 2 of this book, "Installing the Components."

Install the Pump

To install the assembled pump, follow these steps.

1. If you have a protected well cap, attach the well cap base to the well casing; otherwise, skip to Step 2.
2. Lower the sample pump down the well.
3. If you want to prevent debris (such as rust from the protective casing) from getting on the well cap and into the well, fit a plastic bag over the well cap.
4. Close the well cap.

4. Estimate where to cut the tubing so that the air-supply (smaller) tubing terminates at the proper position below the cap.
5. Cut both tubes at about 1 to 1-1/2 feet longer than the length you estimated in Step 4.
6. Separate the tubing 1 to 2 feet, then cut the air-supply (smaller) tubing at the length you estimated in Step 4.

> **Caution:** Don't pull the tubing apart *sideways*–it may *tear*. Instead, hold the larger tube stationary with one hand. Then, with the smaller tube in the other hand, either push or pull directly toward or away from you.

7. Attach the tubing to the well cap.

Connect the Pump to the Tubing

To connect the pump to the tubing, follow these steps.

1. Separate the discharge (larger) tubing from the air-supply (smaller) tube for 8 to 12 inches from one end.
2. Loosen the nut-and-ferrule assembly as much as possible without actually removing the nut.
3. Push the air-supply tube into the matching fitting on the top end of the pump.
4. Tighten the nut.
5. Cut off a short length from the end of the discharge tubing to compensate for the offset height of the discharge tube fitting.

> **Note:** This is usually 3 to 4 inches. You determine the exact length by checking both fitting nuts for full tube insertion after loose assembly.

6. Make sure that the tube-to-pump fit is correct before proceeding.

7. Tighten both fitting nuts finger tight
8. For each fitting nut, hold the fitting base with *one* wrench and the fitting nut with *another* wrench, then tighten the fitting nut one additional turn.

Connect the Well Cap to the Tubing

The following sections describe how to connect the discharge and air-supply tubing to the well cap.

Discharge Tubing

To connect the well cap to the discharge (larger) tubing, follow these steps.

1. At the free end of the tubing pair, push the discharge tubing up through all casing adapting fittings and well-cap components.
2. Push the discharge tubing up through the bottom of the matching fitting in the well cap until the tubing extends above the fitting by the amount you want to leave for ease of sample collection.
3. Tighten the discharge tube fitting nut finger tight.

Air-Supply Tubing

To connect the well cap to the air-supply (smaller) tubing, follow these steps.

1. Trim the length of the air-supply tubing to allow connection to the matching tubing fitting beneath the well cap panel.
2. Insert the air-supply tubing into the fitting, then check for full engagement.

6
MAINTAINING YOUR WELL WIZARD SYSTEM

This chapter tells you how to:

- Maintain the water-level meter.
- Maintain Purge Master.
- Install or replace well-cap tubing ferrules
- Install or replace pump connectors.

If you'd prefer to *not* do these things yourself, or if you have questions, call QED. If you need to replace an 1100 or 1200 series pump bladder, refer to the instructions included with the field-replaceable bladder kit.

Maintain the Model 6010E Water-Level Meter

The Model 6010E Electronic Pneumatic water-level meter needs little maintenance. However, you need to change the batteries from time to time. You may also want to check the calibration prior to each sampling event. The following sections tell you how.

Change the Batteries

The water-level meter comes with eight size AA alkaline batteries. They're located under the black **BATTERY SERVICE ACCESS** panel. The batteries should provide about 40 hours of continuous operation. When you press the **START** button, if you see the message **Warning! Low Batteries**, you can press the **START** button again to make the batteries last a little longer, but you need to replace them *soon*.

If you see the message **Battery Too Low! Turn System Off**, you can't use the water-level meter until you replace the batteries.

Calibrate the Water-Level Meter

To calibrate the water-level meter, follow these steps.

1. Set up the optional calibration test tube in its stand.
2. Add water to the calibration test tube, to a convenient level on the scale.
3. Attach the red pump air-supply line to the **TANK RECHARGE** fitting.
4. To charge the internal air tank to 100 psi, set the cycle timers for *maximum discharge* time and *minimum refill* time, as follows:
   - **For the Model 3013**, set the **DISCHARGE** timer at **C** and the **REFILL** timer at **A**.
   - **For the Model 350**, set the **DISCHARGE** timer at **9 O'CLOCK** and the **REFILL** timer at **7 O'CLOCK**.
5. Disconnect the red pump air-supply line.
6. Move the **SENSOR** switch to **ON**.
7. Attach the meter air hose from the **TO PROBE** fitting to the mating well cap connection.
8. Move the **AIR** switch to **ON**, then press **START** once.

9. Watch the display until it shows the highest reading–you see the numbers increase, then stabilize at the highest reading.
10. When the message **Probe Submersion Depth...** appears, compare the meter reading to the actual level in the test tube inside the calibration tube.
11. Move the **AIR** switch to **OFF**.
12. If the meter reading and the actual level match, meter calibration is correct and you can skip the following steps; otherwise, remove the **CALIBRATION** panel screw, then use a small screwdriver or other tool to remove the epoxy seal from the internal adjustment screw.
13. Slowly adjust the internal screw until the meter reading matches the actual level.
14. Repeat Steps 6 through 12 to re-check calibration.
15. Apply a dab of paint or epoxy to the lock-calibration screw to lock it in position, then reinstall the **CALIBRATION** panel screw.

Maintain Purge Master

During the winter in northern climates, to prevent the discharge tubing of your Purge Master from *freezing*, you need to clear the discharge line of standing water above the static water level. To do that, before disconnecting the air supply from Purge Master, set the discharge cycle time on the controller long enough to cause air to exit from the Purge Master discharge line—blowing all the water out of the discharge tubing.

Maintain the Model 350 Electronic Controller

The following sections describe how to maintain your Model 350 Electronic Controller.

General Care & Storage

Although the controller is protected from moisture, QED recommends that you protect the unit from direct rain. A dry storage area in the 40 to 100°F temperature range is best. If you plan to store the controller for an extended period, remove the batteries.

Cold-Weather Usage

You can use the controller in sub-freezing temperatures but, if you let the controller sit in a sub-freezing environment without cycling, condensed water in the valve may freeze. If that happens, warm the controller to above freezing to make it resume cycling. Once you have it cycling, you can return it to the freezing conditions for use.

Batteries

The Model 350 Electronic controller is powered by eight size AA batteries (QED recommends alkaline). Battery life depends largely on controller use and the temperature in which you use the controller. Batteries last longer at room temperature than at lower temperatures; intermittent controller use provides longer battery life than continuous use. You can typically obtain 130,000 cycles from a set of batteries–that's about 14 days of continuous 24-hour-per-day use.

Battery Testing

You can press the **BATTERY TEST** button to find out the condition of the batteries.

- A continuous green light indicates fresh batteries.
- A split-second flash of green light–or no light–indicates that you will soon need to replace the batteries.

It isn't unusual to obtain an additional 30,000 cycles (about 4 days of continuous operation) of battery life after the battery test light fails to remain continuous.

Notes:

- If you press the **BATTERY TEST** button often, you'll need to replace the batteries more often.
- If the controller doesn't start spontaneously when you connect the air source, press the **BATTERY TEST** button to start the controller.

Battery Replacement

To replace the eight size AA batteries, follow these steps.

1. Remove the four screws that hold the battery case panel on the controller front panel.
2. Remove the panel to expose the battery holder.
3. To remove the battery holder from the case, *gently* unclasp the transistor-battery-type connector panel.
4. Remove the old batteries, saving them to recycle.
5. Insert the new batteries.
6. Insert the battery holder in the case, then reconnect the transistor-battery-type connector panel.
7. Reinstall the battery case panel, replacing the four set screws.

Install or Replace Well-Cap Tubing Ferrules in a Typical Well Cap

The following sections describe how to replace or install well-cap tubing ferrules. Most people never need to perform either of these procedures. You may need them, however, if you want to re-position the pump or replace kinked tubing.

Unscrew Fitting Caps & Expose Ferrules

Refer to Figure 6-1 as you follow these steps.

1. Using a wrench, loosen the pump discharge fitting cap by turning it counterclockwise.

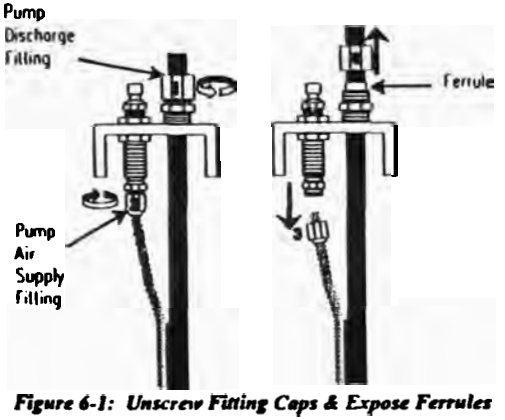


Figure 6-1: Unscrew Fitting Caps & Expose Ferrules

2. Using a wrench, loosen the pump air-supply fitting cap by turning it counterclockwise.
3. Pull the pump air-supply tubing down and out of the fitting.

4. Slide the pump discharge fitting cap up the tube to expose the ferrule.

Discard Tubing & Ferrule, Save Cap for Re-Use

Refer to Figure 6-2 as you follow these steps.

1. Pull the pump discharge tubing up through the cap to allow access to the ferrule.

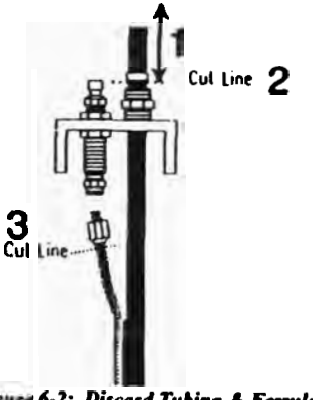


Figure 6-2: Discard Tubing & Ferrule

2. Cut the pump discharge tubing just behind the ferrule.
3. Cut the pump air-supply tubing just behind the fitting cap.
4. Discard the portions you just cut off, saving the fitting caps for re-use.

Re-Attach the Fitting Caps

Refer to Figure 6-3 as you follow these steps

1. Re-attach the pump discharge fitting cap with the new ferrule (smaller end down)—leaving it slightly loose to allow the tube to pass through.
2. Attach a new nut to the pump air-supply tubing—leaving it slightly loose to allow tubing to pass through.

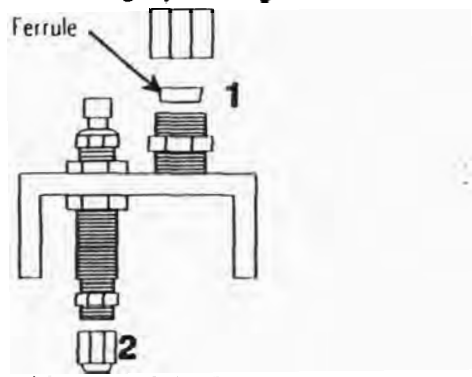


Figure 6-3: Re-Attach the Fitting Caps

Re-Connect the Tubing

Refer to Figure 6-4 as you follow these steps.

1. Separate the tubing for about 6 to 12 inches.

Caution: Don't pull tubing apart *sideways*—it may tear. Instead, hold the larger tube stationary with one hand. Then, with the smaller tube in the other hand, either push or pull directly toward or away from you.

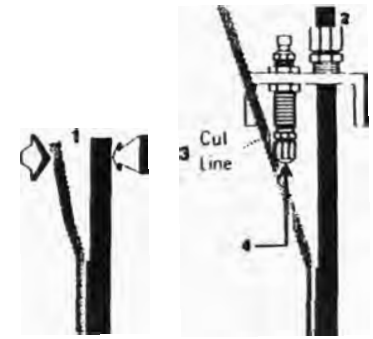


Figure 6-4: Re-Connect the Tubing

2. Push the pump discharge tubing through the pump discharge fitting to the desired length, then tighten the nut.

Note: The length you want depends on the clearance required for any protective casing. You typically need about 1-1/2 feet.

3. Cut the air-supply tubing to size, to allow it to reach *all* the way into the fitting.
4. Push the air-supply tubing all the way into the fitting until it contacts the shoulder inside the fitting, then tighten the nut.

Install or Replace Pump Connectors

The following sections described how to install or replace the three types of connectors that may be included in your Well Wizard system.

Stainless Steel Connectors

Swagelok™ tube fittings, which include four pieces (see Figure 6-5), come to you completely assembled, finger tight.

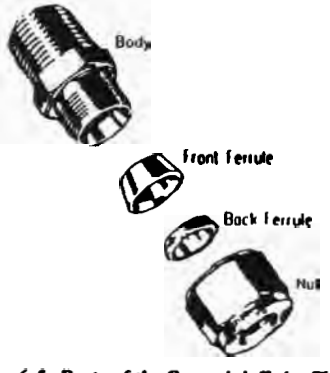


Figure 6-5: Parts of the Swagelok Tube Fitting

Caution: If you disassemble a connector before you use it, dirt or foreign material can get into the fitting and later cause a leak.

To install a stainless steel connector, follow these steps

1. If you're working with a 1/2- or a 3/4-inch connector, wrap the male threads under the nut with Teflon tape.

2. Insert the tubing into the Swagelok tube fitting as follows:
   - **For 1/4-inch tubing**, insert it approximately 5/8 inch
   - **For 3/4-inch tubing**, insert it up to 7/8 inch.

   Make sure that the tubing firmly contacts the shoulder of the fitting and that the nut is finger tight.

   Note: If the tubing is 3/8 inch or larger, you must use a tubing insert. Just push the stainless steel insert into the tubing before inserting the tubing into the tube fitting.

3. Referring to Figure 6-6, scribe or mark the nut at the 6 o'clock position.

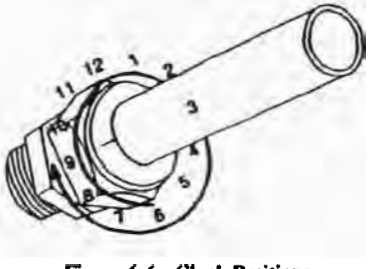


Figure 6-6: Clock Positions

4. While holding the fitting body steady with a backup wrench or vise, tighten the nut as follows, depending on the size of the tube fitting:
   - **For fittings larger than 3/16 inch**, turn the fitting one and one-quarter turns (watch the scribe mark make one complete turn, then continue to 3-o'clock).
   - **For fitting sizes 1/6, 1/8, and 3/16 inch**, turn the fitting three-quarters of a turn (watch the scribe mark turn to 9 o'clock).

   Note: These are guidelines, you may need to further tighten the nut.

Purge Master Barb-and-Clamp Connectors

To install Purge Master barb-and-clamp connectors, follow these steps, referring to Figure 6-7. Have handy the 2-inch purge pump clamp tool (Part Number 35188) that's available from QED.

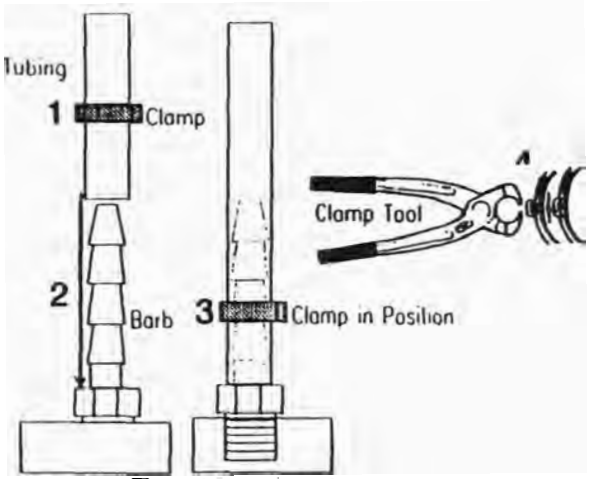


Figure 6-7: Barb & Clamp Connector

1. If you're replacing an old connection, remove the old clamp by cutting through its ear with the clamp tool; otherwise, skip to Step 2.
2. Cut the tubing cleanly and squarely to length.
3. Slide the clamp onto the tubing, then push the tubing onto the barb fitting until the tube contacts the body hex.
4. Position the clamp on the tubing outside of where the barb is positioned in the tube, making sure the hooks on the clamp band are engaged.
5. Squeeze the ear closed with the clamp tool.

Polypropylene Connectors

To install a polypropylene connector, follow these steps.

1. Cut the tubing cleanly and squarely to length.
2. If the tubing is larger than 1/2 inch, push an insert into the tube.
3. Push the tubing into the completely assembled connector until it contacts the shoulder inside the fitting (see the illustration on the left in Figure 6-8).
4. Tighten the nut with a wrench, but be careful to not over tighten it; the nut should not come in contact with the shoulder of the body (see the illustration on the right in Figure 6-8).

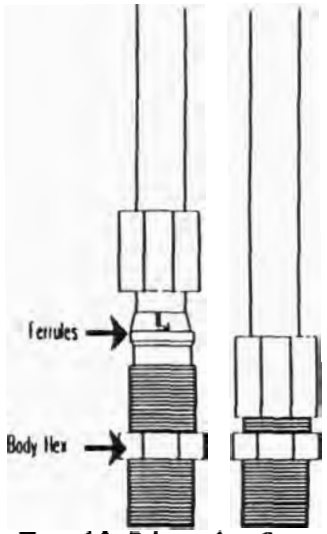


Figure 6-8: Polypropylene Connector

APPENDIX A
SPECIFICATIONS

The following sections provide specifications for Well Wizard controllers and the various Well Wizard sampling system types.

Standard Controller/Compressor

Table A-1 shows compressor performance for the standard controller/compressor cart, Model 3111HR/LR.

Table A-1: Model 3111HR/LR Performance

Air Flow (scfm)	Pressure (psig)
6.0	0
5.5	25
4.7	50
4.3	100

Other specifications are as follows:

- 200 feet maximum lift with *compressor* air source.
- 250 feet maximum lift with *compressed-gas cylinder* air source (regulator set at 125 psi).
- 2.5 hours of operation on a full tank of gasoline.

High-Pressure Controller/Compressor

Table A-2 shows compressor performance for the high-pressure controller/compressor cart, Model 3111HP/LH.

Table A-2: Model 3111HP/LH Performance

Compression (scfm)	Pressure (psig)
2.4	0
2.27	70
2.2	125
2.1	165

Other specifications are as follows:

- 320 feet maximum lift with the supplied *compressor* air source.
- 600 feet maximum lift with *compressed-gas cylinder* air source (regulator set at 300 psi).
- 2.5 hours of operation on a full tank of gasoline.

Well Wizard Equipment Configurations

Well Wizard sampling systems are available in Types A through L, as shown in the following figures. Type A is the basic sampling pump; the other types include options using Purge Mizer and Purge Master in various positions relative to the sampling pump. The diagram letters appear on the "Downwell Equipment Build/Specification Sheet(s)" supplied with your Well Wizard system.

Sampling System Type A

Figure A-1 shows the Type A sampling system, the basic bladder pump.

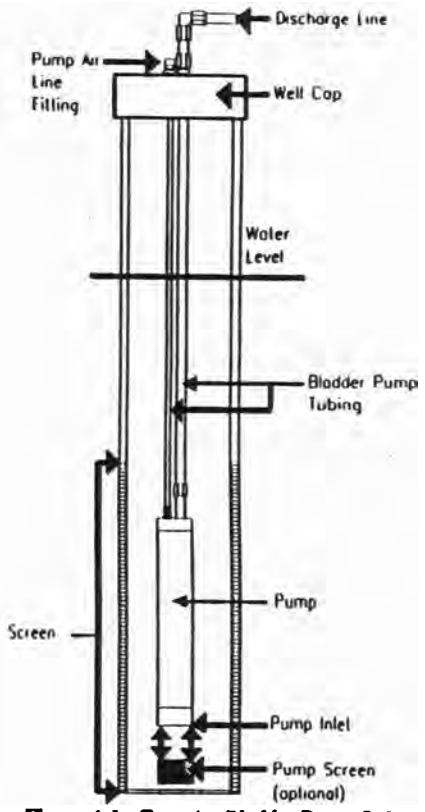


Figure A-1: Type A—Bladder Pump Only

Sampling System Type B

Figure A-2 shows the Type B sampling system, the bladder pump *below* a Purge Master.

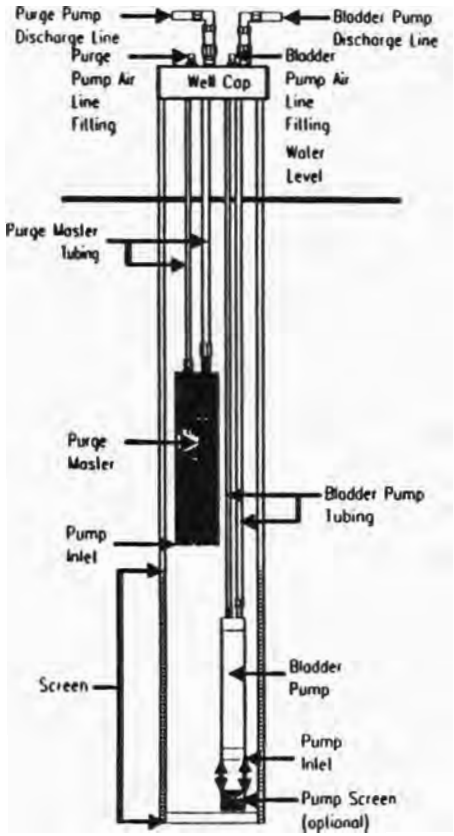


Figure A-2: Type B—Bladder Pump Below a Purge Master

Sampling System Type C

Figure A-3 shows the Type C sampling system, a bladder pump *above* a Purge Master.

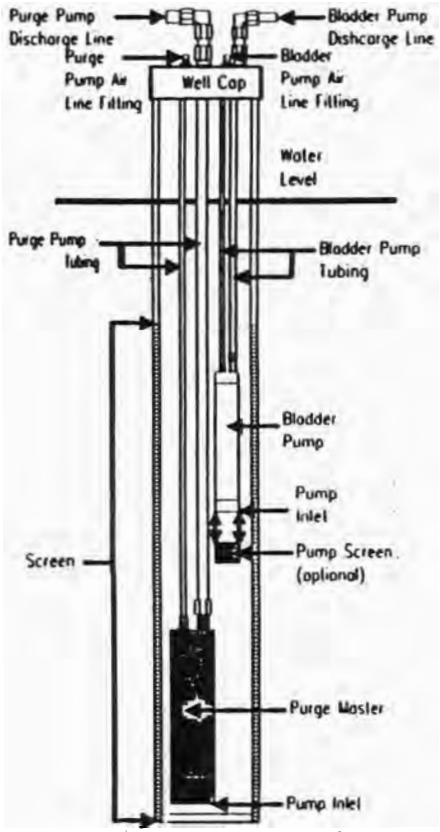


Figure A-3: Type C—Bladder Pump Above a Purge Master

Sampling System Type D

Figure A-4 shows the Type D sampling system, a bladder pump above a Purge Mizer with an inlet extension.

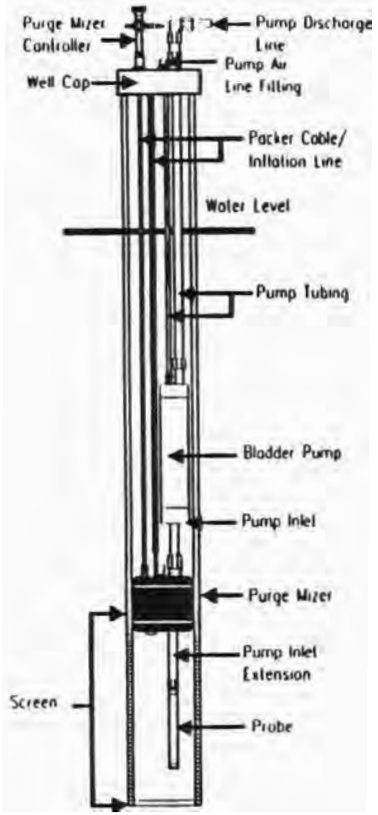


Figure A-4: Type D—Bladder Pump Above Purge Mizer with Extension

Sampling System Type E

Figure A-5 shows the Type E sampling system, a bladder pump *below* a Purge Mizer.

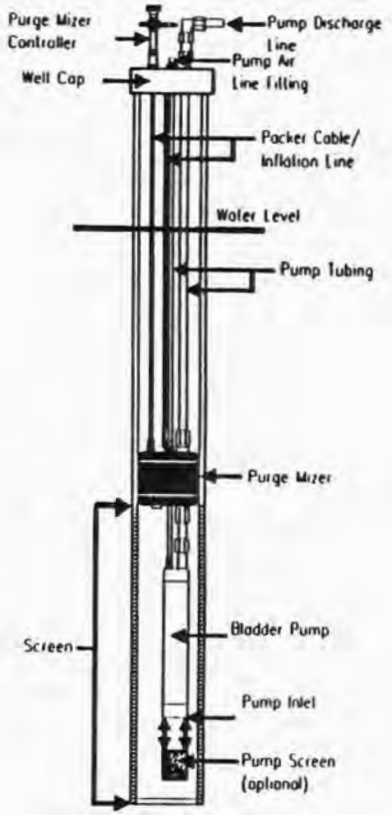


Figure A-5: Type E—Bladder Pump Below a Purge Mizer

Sampling System Type F

Figure A-6 shows the Type F sampling system, a bladder pump with electric submersible *above*.

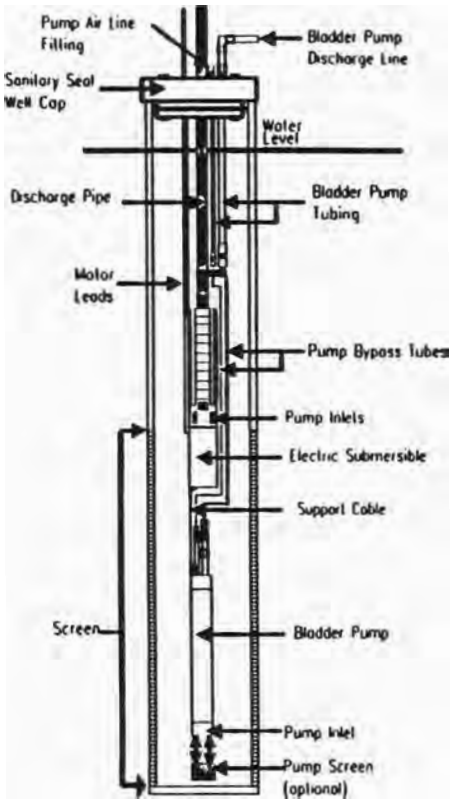


Figure A-6: Type F—Bladder Pump with Electric Submersible Above

Sampling System Type G

Figure A-7 shows the Type G sampling system, a bladder pump with electric submersible *below*.

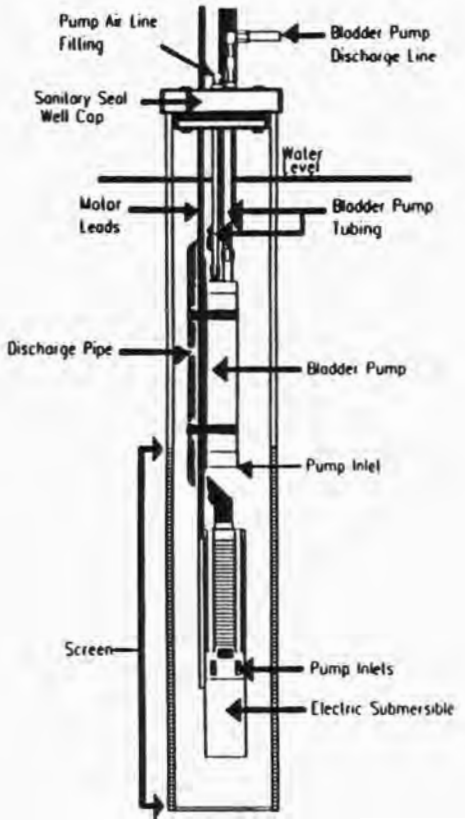


Figure A-7: Type G—Bladder Pump with Electric Submersible Below

Sampling System Type H

Figure A-8 shows the Type H sampling system, a bladder pump with Purge Master and Purge Mizer.

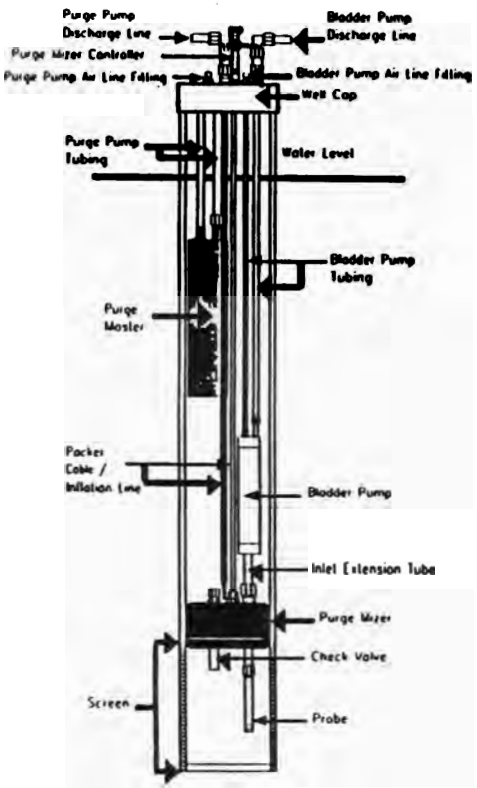


Figure A-8: Type H—Bladder Pump with Purge Master and Purge Mizer

Sampling System Type I

Figure A-9 shows the Type I sampling system, a bladder pump with tandem Purge Mizers.

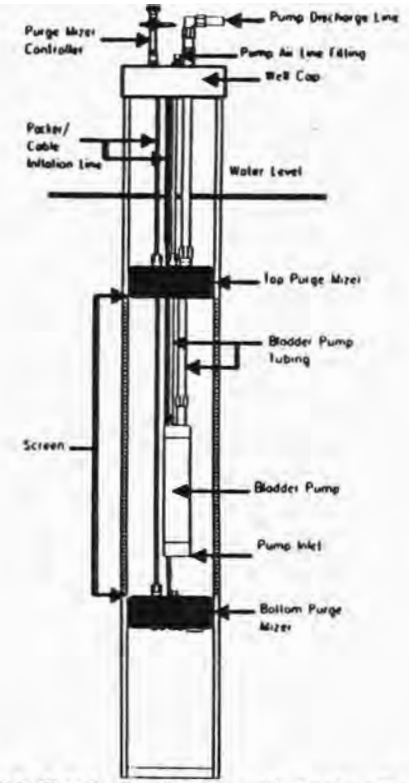


Figure A-9: Type I—Bladder Pump with Tandem Purge Mizers

Sampling System Type J

Figure A-10 shows the Type J sampling system, a bladder pump with Purge Master and Purge Mizer.

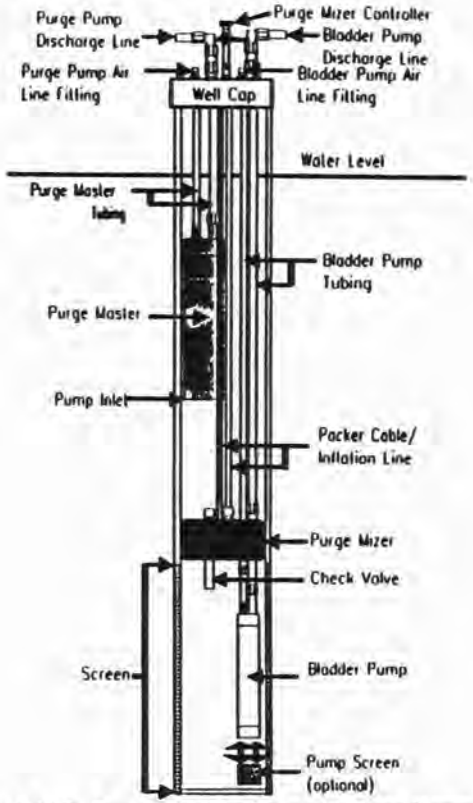


Figure A-10: Type J—Bladder Pump with Purge Master and Purge Mizer

Sampling System Type K

Figure A-11 shows the Type K sampling system, a bladder pump below a Purge Mizer with a vent line.

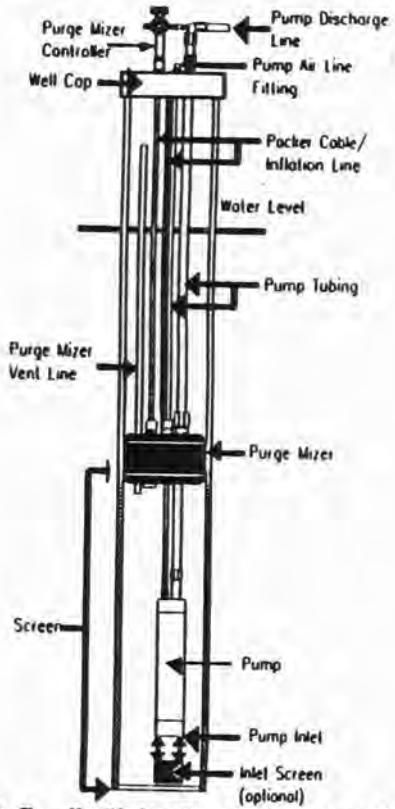


Figure A-11: Type K—Bladder Pump Below a Purge Mizer with a Vent Line

Sampling System Type L

Figure A-12 shows the Type L sampling system, a bladder pump with an inlet extension.

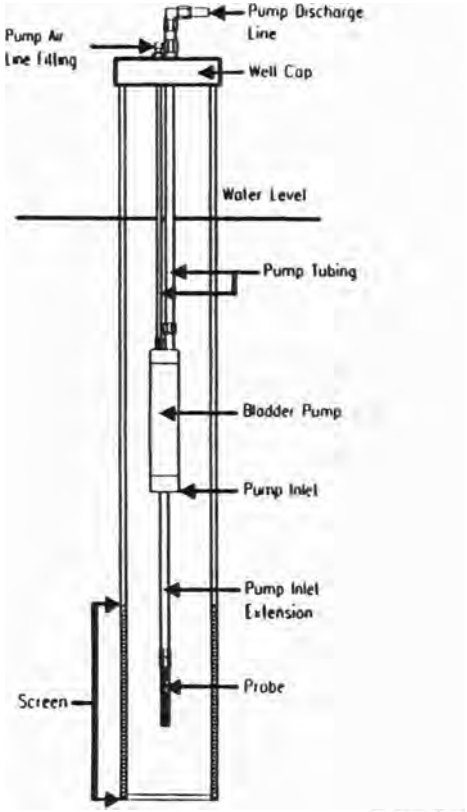


Figure A-12: Type L—Bladder Pump with an Inlet Extension

APPENDIX B
MY WELL WIZARD IS BROKEN: WHAT TO DO

QED sometimes gets calls from customers who say, "My Well Wizard is broken. What should I do?" We *want* to help–and we *will* help–but first we need to know the symptoms. As described in this book, your Well Wizard is a *system* that includes many components. Together we can discover the problem, solve it, and have your system up and running again before long. The following sections provide the trouble-shooting information you need to get a solution started.

Warning! Don't disassemble any component of your Well Wizard system. Doing that could void your warranty coverage.

Perform These Three Checks

If you have a problem, the following three checks will help to either locate the problem or assist in our diagnosis and repair. In case you later have to call QED, write down your findings as you perform these checks–so you can tell us what happened when you performed them.

Note: The components of your Well Wizard system and the correct ways to use them are described earlier in this book. If you're new to Well Wizard, before you decide that you have a problem, please take a few minutes to become familiar with the system and how to operate it.

Check Controller Cycling and Pressure

Make sure the controller is cycling and attaining a pressure of at least 80 psi in 60 seconds. You *may* have to turn the **FLOW THROTTLE** control knob fully clockwise and set the **DISCHARGE** timer knob on **F** for the Model 3013 or **5 O'CLOCK** for the Model 350 to achieve this pressure.

Check Cycle Length Adjustment

Make sure that you can change the cycle length by adjusting the **REFILL** and **DISCHARGE** timer knob positions.

Check for Sufficient Discharge Volume

Make sure that the discharge volume is as high as it should be. To do that, follow these steps.

1. Set the **REFILL** and **DISCHARGE** timer knobs to **F** for the Model 3013 or **5 O'CLOCK** for the Model 350.
2. Measure the volume of one discharge cycle. The volume should be as follows:
   - **For 1100 series pumps,** the volume should be greater than 300 ml.
   - **For 1200 series pumps,** the volume should be greater than 400 ml.
3. If the volume is low, check for the following:
   - Insufficient submergence of the pump.
   - A well-water recovery rate that's too slow.
   - A leaky discharge fitting or leaky tubing.

Call QED, if Necessary

If the three checks didn't reveal a minor problem that you can easily fix–such as a loose fitting–please call our Customer Service department at one of the following numbers for assistance.

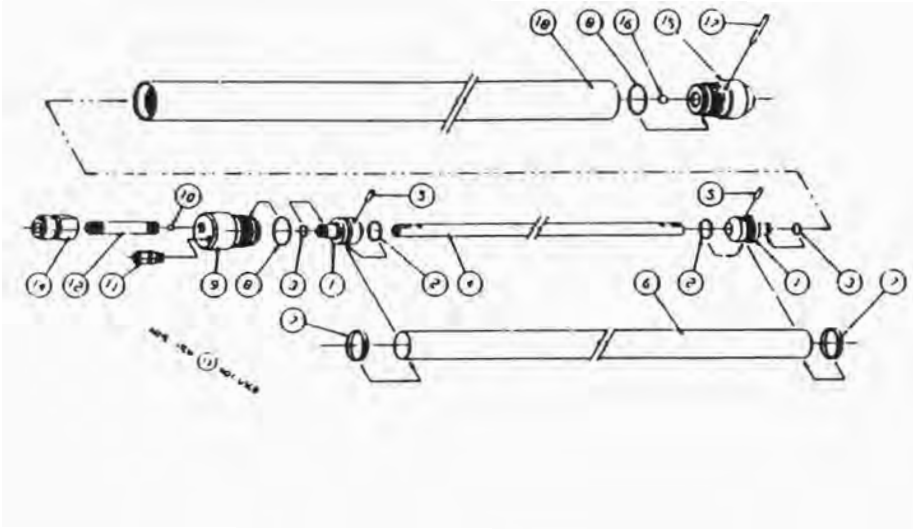
- **Monday through Friday, 8:00 a.m. to 5:00 p.m. EST:** (313) 995-2547.
- **After hours and weekends:** 1-800-272-9559 (*or* 1-313-746-8045 if you're outside the U.S.).

The person you talk to may ask you to look at a schematic drawing or to refer to a parts list. The schematic drawings and parts lists are in Appendix C.

APPENDIX C
DRAWINGS & PARTS LISTS

The following schematic drawings and parts lists for the various Well Wizard components and configurations are here for your reference. For example, they may be helpful to you if you talk to someone in the QED Customer Service department.

P1101H Assembly



ITEM	P/N	DESCRIPTION	QTY
-	REL FOR PROD	ECO-3030 JRV 17JAN92 LH 17JAN92	
18	12030	CASING PVC	1
17	16051	PIN RETAINER TEFLON	1
16	34465	BALL 7/16" TEFLON	1
15	13010	HOUSING INLET PVC	1
14	34640	CONNECTOR 1/2T X 1/4 FPT	1
13			
12	34639EP	NIPPLE DISCHARGE 1/4 NPT POLISHED	1
11	12022	CONNECTOR 1/4 X 1/8 NPT	1
10	34464	BALL 5/16" TEFLON	1
9	11310	HOUSING DISCHARGE PVC	1
8	34471	O-RING HOUSING PVC	2
7	35051	CLAMP SE27.36-.505R 304	2
6	35240	BLADDER,1100 TFE	1
5	16050	PIN 3/16" TEFLON	2
4	14020	ROD CENTER PVC	1
3	34470	O-RING SPOOL PVC	2
2	35049	O-RING 2-211 VITON	2
1	16021	SPOOL PVC	2

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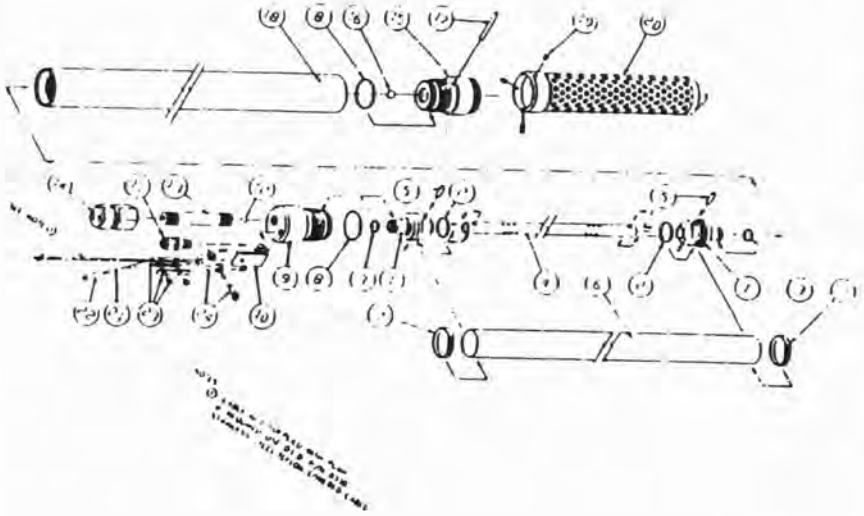
ANN ARBOR MICH

JRV 17JAN92 | DHE 17JAN92 | LH 17JAN92 | P1101H

FILE
PARTS LIST
P1101H ASS'Y

ST1101P Assembly



ITEM	P/N	DESCRIPTION	QTY
-	REL FOR PROD	[illegible]	
24	34877EP	SHACKLE 316 STAINLESS STEEL-EP	1
23	34876EP	CLAMP,CABLE STAINLESS STEEL-EP	2
22	34878	TUBE, SHRINK .131 DIA TEFLON	1
21	34898	ROD, .094 DIA TEFLON	1
20	35192EP	SCREEN,STAINLESS STEEL-EP PUMP	1
19	35190	SCREW, #8-32 X 3/16" SS SOCKET HEAD	3
18	35257EP	CASING 1100 304 STAINLESS STEEL-EP	1
17	16051	PIN RETAINER TEFLON	1
16	34465	BALL 7/16" TEFLON	1
15	35254	INLET, STAINLESS STEEL	1
14	34640	CONNECTOR 1/21 x 1/4 FPT	1
13	34838EP	NIPPLE DISCHARGE 1/4" NPT POLISHED	1
12	34464	BALL 5/16" TEFLON	1
11	12022	CONNECTOR 1/4 x 1/8 NPT	1
10	34700EP	BRACKET P-M 2 304 SS POLISHED	1
9	35256	HOUSING DISCHARGE SS	1
8	12015	O-RING BODY VITON	2
7	35051	CLAMP SE27 36-505R 304	2
6	35240	BLADDER,1100 TFE	1
5	16050	PIN 3/16" TEFLON	2
4	16016LP	ROD SS CENTER EP	1
3	16065	O-RING SPOOL VITON	2
2	35048	O-RING 2-211 VITON	2
1	16012	SPOOL, TEFLON	2

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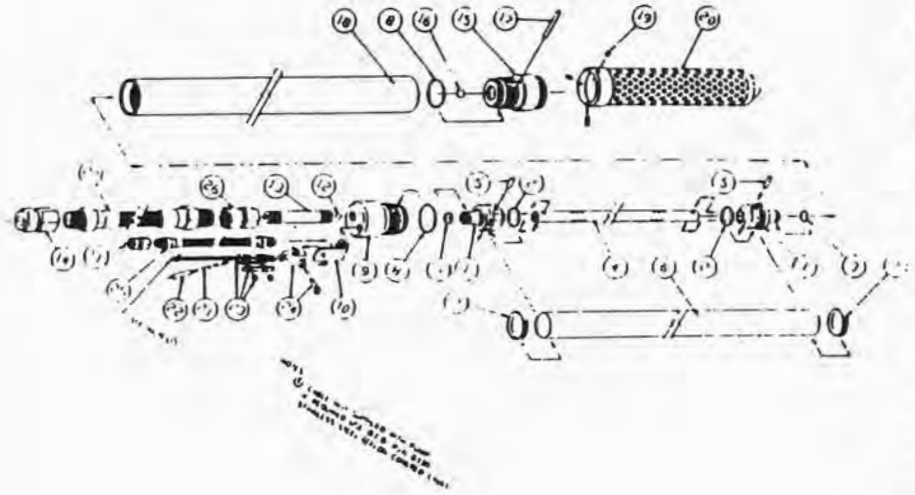
TITLE
PARTS LIST
ST1101P ASS'Y

ST1101PF Assembly



ITEM	P/N	DESCRIPTION	QTY
27	35904	HOSE FLEX STAINLESS STEEL/TEFLON	1
26	35907	COUPLING,REDUCING	1
25	35905	HOSE FLEX STAINLESS STEEL/TEFLON	1
24	34877EP	SHACKLE 316 STAINLESS STEEL-EP	1
23	34876EP	CLAMP,CABLE STAINLESS STEEL-EP	2
22	34878	TUBE SHRINK 131 DIA TEFLON	1
21	34838	ROD .094 DIA TEFLON	1
20	35192EP	SCREEN,STAINLESS STEEL-EP PUMP	1
19	35180	SCREW, 88-32 x 3/16" SS SOCKET HEAD	3
18	35257EP	CASING 1100 304 STAINLESS STEEL-EP	1
17	18051	PIN RETAINER TEFLON	1
16	34485	BALL 7/16" TEFLON	1
15	35254	INLET, STAINLESS STEEL	1
14	34840	CONNECTOR 1/2T x 1/4 FPT	1
13	34839EP	NIPPLE DISCHARGE 1/4" NPT POLISHED	1
12	34484	BALL 5/16" TEFLON	1
11	35906	CONNECTOR 1/4T x 1/8 FPT	1
10	34700EP	BRACKET P-M 2" 304 SS POLISHED	1
9	35256	HOUSING DISCHARGE SS	1
8	12015	O-RING BODY VITON	2
7	35051	CLAMP SC27 36-305R 304	2
6	35240	BLADDER,1100 TFE	1
5	18050	PIN 3/16" TEFLON	2
4	18018EP	ROD SS CENTER EP	1
3	18065	O-RING SPOOL VITON	2
2	35048	O-RING 2-211 VITON	2
1	18012	SPOOL, TEFLON	2

REL FOR PROD	CO-3838	JRV LN	22JAN93

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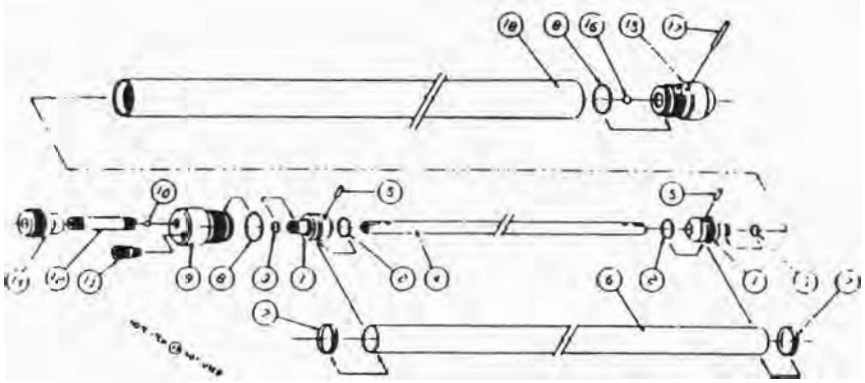
JRV 22JAN93 | DME 22JAN93 | LN 22JAN93

TITLE
PARTS LIST
ST1101PF ASS'Y

DRAWING NUMBER ST1101FB

SHEET 1 of 1

T1100 Assembly



ITEM	P/N	DESCRIPTION	QTY
18	16000	CASING TEFLON	1
17	16051	PIN RETAINER TEFLON	1
16	34465	BALL 7/16" TEFLON	1
15	16035	HOUSING INLET TEFLON	1
14	34431	CONNECTOR 1/2T x 1/4 MPT TEFLON	1
13			
12	34463	NIPPLE 1/4 MPT x 3" TEFLON	1
11	34458	CONNECTOR 1/4T x 1/8 MPT TEFLON	1
10	34464	BALL 5/16" TEFLON	1
9	16030	HOUSING DISCHARGE TEFLON	1
8	16070	O-RING HOUSING VITON	2
7	35051	CLAMP SE27 38-505R 304	2
6	35240	BLADDER 1100 TFE	1
5	16050	PIN 3/16" TEFLON	2
4	16015	ROD CENTER TEFLON	1
3	16065	O-RING SPOOL VITON	2
2	35049	O-RING 2-211 VITON	2
1	16011	SPOOL CARTRIDGE	2

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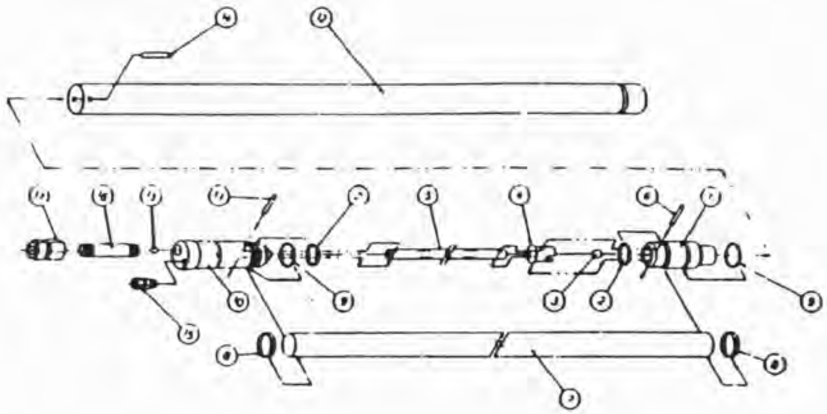
JRV 17JAN92 | DHE 17JAN92 | LH 17JAN92 | 11101

RRE
PARTS LIST
T1100 ASS'Y
T1100B

P1201 Assembly



LTR	DESCRIPTION					
-	REL FOR PROD		JRV	LN	1992	

ITEM	P/N	DESCRIPTION	QTY
17	34446	CONNECTOR 1/2T x 3/8 FPT POLYPROPYLENE	1
16	12020EP	NIPPLE DISCHARGE 316 SS POLISHED	1
15	34452	CONNECTOR 1/4T x 1/8 MPT POLYPROPYLENE	1
14	12013EP	PW BODY POLISHED	1
13	34465	BALL 7/16" TEFLON	1
12	35292EP	CASING EP-SS	1
11	12012EP	PW ROD CENTER POLISHED	1
10	35299	HOUSING DISCHARGE PVC	1
9	12015	O-RING BODY VITON	2
8	35297	CLAMP SE0305-505R SS	2
7	35217	BLADDER 1200 TFE	1
6	35283EP	PW EP INLET CENTER ROD	1
5	35294EP	CENTER ROD EP-SS	1
4	35302	INSERT INLET PVC	1
3	35295	BALL 9/16" DIA TEFLON	1
2	35284	O-RING 2-213 VITON	2
1	35301	HOUSING INLET PVC	1

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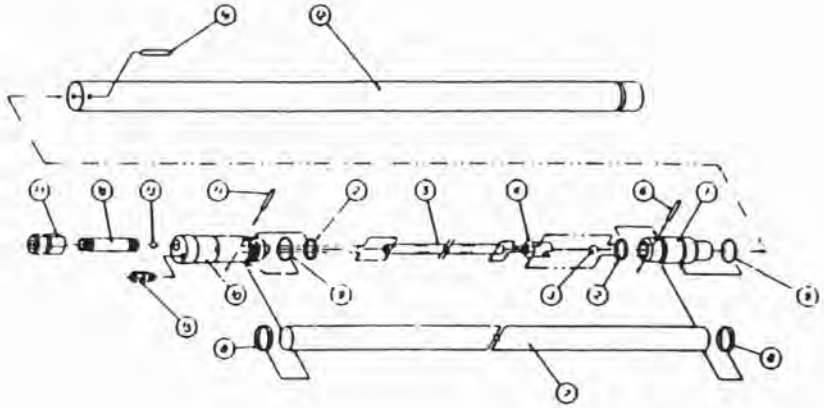
DRAWN BY JRV 9JAN92 — APPROVED BY DHC 9JAN92 — CHECKED BY LN 9JAN92 — P1201

TITLE
PARTS LIST
P1201 ASS'Y
DRAWING NUMBER P1201B — SHEET 1 OF 1

P1201H Assembly



ITEM	P/N	DESCRIPTION	QTY
17	34630	CONNECTOR 1/2T x 3/8 FPT SS	1
16	12020EP	NIPPLE DISCHARGE 316 SS POLISHED	1
15	12022	CONNECTOR 1/4T x 1/8 MPT SS	1
14	12013EP	PIN BODY POLISHED	1
13	34485	BALL 7/16" TEFLON	1
12	35293EP	CASING EP-SS	1
11	12012EP	PIN ROD CENTER POLISHED	1
10	35303	HOUSING DISCHARGE PVC	1
9	12015	O-RING BODY VITON	1
8	35297	CLAMP SE0305-305R SS	2
7	35217	BLADDER 1200 WE	2
6	35283EP	PIN EP INLET CENTER ROD	1
5	35284EP	CENTER ROD EP-SS	1
4	35302	INSERT INLET PVC	1
3	35285	BALL 9/16" DIA TEFLON	1
2	35286	O-RING 2-213 VITON	1
1	35301	HOUSING INLET PVC	2

REL FOR PROD	JRV	LN	1 9 92

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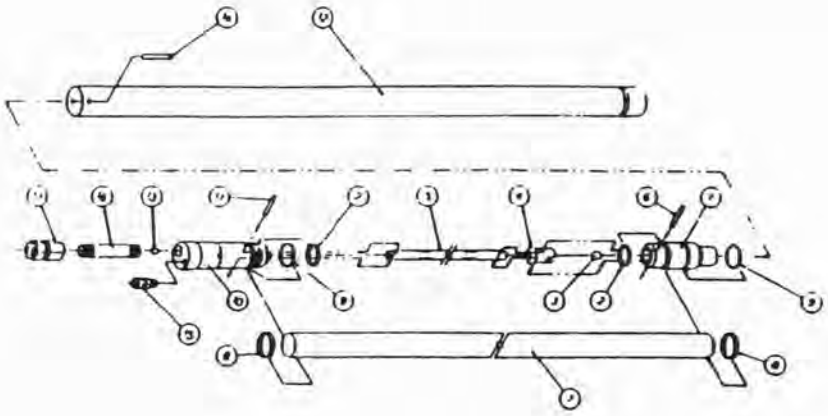
JRV	8JAN92	DHE	8JAN92
LN	8JAN92		
	P1201H		

NRE
PARTS LIST
P1201H ASS'Y

T1200 Assembly



ITEM	P/N	DESCRIPTION	QTY
17	34830	CONNECTOR 1/2T x 3/8 MPT SS	1
16	12020EP	NIPPLE DISCHARGE 316 SS POLISHED	1
15	12022	CONNECTOR 1/4T x 1/8 MPT SS	1
14	12013EP	PIN BUT FOLISHED	1
13	34485	BALL 7/16 TEFLON	1
12	35292EP	CASING EP-SS	1
11	12012EP	PIN ROD CENTER POLISHED	1
10	35290	HOUSING DISCHARGE TEFLON	1
9	12015	O-RING BODY VITON	2
8	35287	CLAMP SE0305-505R SS	2
7	35217	BLADDER 1200 TFE	1
6	35283EP	PIN EP INLET CENTER ROD	1
5	35294EP	CENTER ROD EP-SS	1
4	35293	INSERT TEFLON	1
3	35295	BALL 5/16" DIA TEFLON	1
2	35284	O-RING 2-213 VITON	2
1	35291	INLET TEFLON	1

REL FOR PROD — JRV 9JAN92 — LN 9JAN92 — DME 9JAN92

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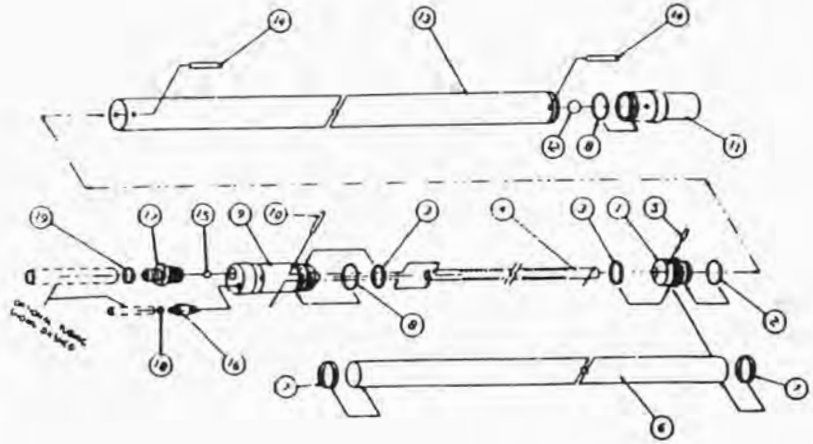
T1200

TITLE
PARTS LIST
T1200 ASS'Y

T12008

P1500 Assembly



ITEM	P/N	DESCRIPTION	QTY
-		REL FOR PROD (ECO 2038) JRV 13JAN92 LN 13JAN92	
19	35211EP	CLAMP, EP-SS 3/4"	1
18	35209EP	CLAMP EP-SS 1/2"	1
17	35213	BARB 5/8"ID x 3/8" MPT	1
16	35215	BARB 3/8"ID x 1/8" MPT	1
15	34465	BALL 7/16" TEFLON	1
14	12013EP	PIN BODY POLISHED	2
13	35804EP	CASING SS EP	1
12	34887	BALL 3/4 TEF	1
11	35818	INLET, PVC	1
10	12012EP	PIN ROD CENTER POLISHED	1
9	35817	DISCHARGE PVC	1
8	12015	O"-RING BODY VITON	2
7	35297	CLAMP SE0305-505A SS	2
6	35806	BLADDER, TFE	1
5	35825EP	PIN 3/16 SS	1
4	35805EP	CENTER ROD SS EP	1
3	35284	"O"-RING 2-213 VITON	2
2	35813	"O"-RING 2-020 VITON	1
1	35819	SPOOL, INLET PVC	1

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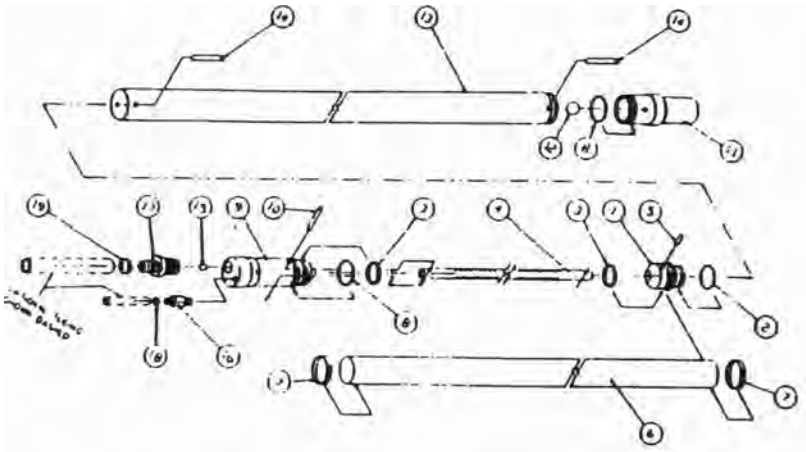
JRV 13JAN92 | DME 13JAN92 | LN 13JAN92 | P1500

TITLE
PARTS LIST
P1500 ASS'Y

P1500B

T1500 Assembly



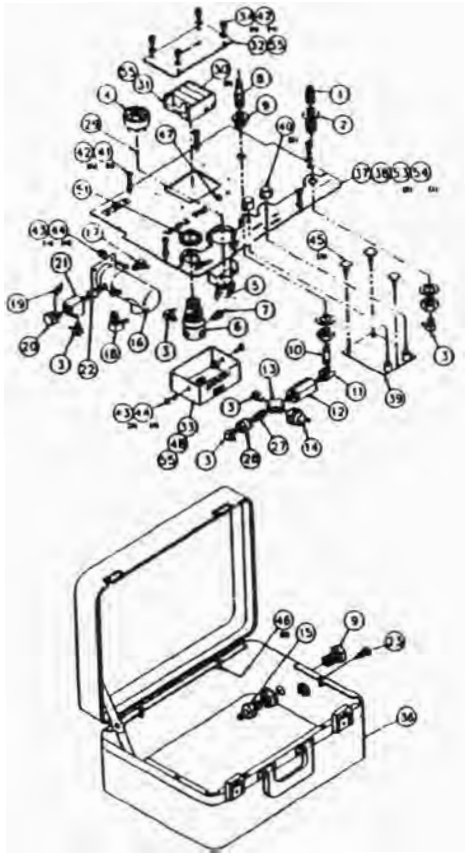
QTY	ITEM	P/N	DESCRIPTION	QTY
-		REL FOR PROD	(OR 3836 JRV 13JAN92)	
	19	35211EP	CLAMP, EP-SS 3/4"	1
	18	35209EP	CLAMP EP-SS 1/2"	1
	17	35213	BARB 3/8"ID x 3/8" MPT	1
	16	35215	BARB 3/8"ID x 1/8" MPT	1
	15	34465	BALL 7/16" TEFLON	1
	14	12013EP	PIN BODY POLISHED	2
	13	35804EP	CASING SS EP	1
	12	34667	BALL 3/4" TEF	1
	11	35802	INLET, TEFLON	1
	10	12012EP	PIN ROD CENTER POLISHED	1
	9	35801	DISCHARGE, TEFLON	1
	8	12015	"O"-RING BODY VITON	2
	7	35297	CLAMP SL0305-505R SS	2
	6	35806	BLADDER, TFE	1
	5	35825EP	PIN 3/16 SS	1
	4	35805EP	CENTER ROD SS EP	1
	3	35284	"O"-RING 2-213 VITON	2
	2	35813	"O"-RING 2-020 VITON	1
	1	35803	SPOOL, INLET TEFLON	1

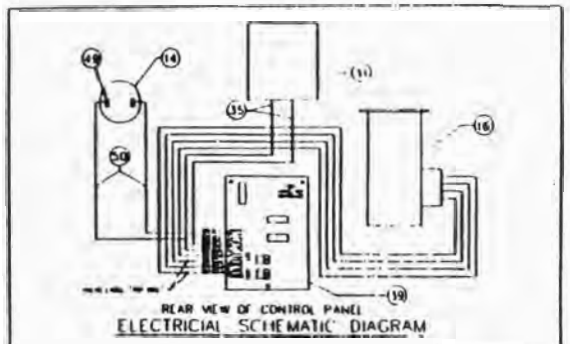
QED
ENVIRONMENTAL SYSTEMS INC
6095 JACKSON RD
ANN ARBOR MICH

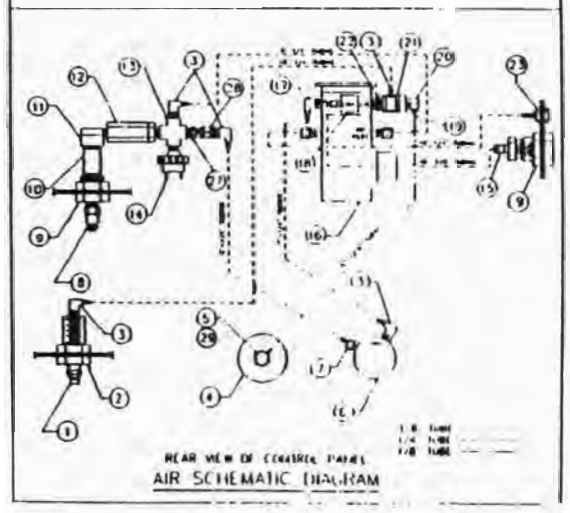
JRV 13JAN92 | DME 13JAN92
L M 13JAN92
T1500

TITLE
PARTS LIST
T1500 ASS'Y
DRAWING NUMBER T1500B

350 Controller







350 Controller (continued)

ITEM	P/N	DESCRIPTION	QTY
31	34577	HOLDER, BATTERY	1
30	34988	BATTERY "AA" ALKALINE	8
29	36338	PLUG, GAUGE THROTTLE	1
28	34606	VALVE, CHECK 1/8" FPT	1
27	35012	NIPPLE, 1/8" MPT HEX	1
26	36082	TUBING, PARALLEX PE 3/8" OD	1.5'
25	35002	TUBING, 1/16" I.D. POLYURETHANE	5'
24	36081	TUBING, PARALLEX PE 1/4" OD	4.5'
23	34131	ANCHOR, BARB, DUAL	1
22	34103	BUSHING, 1/4" X 1/8" BRASS	1
21	34111	TEE, STREET 1/8" MPT BRASS	1
20	34212	CONNECTOR ELBOW DYNAMCO	1
19	35005	CONNECTOR, BARB 1/16" I X #10-32 UNC BRASS	1
18	34586	ELBOW, 1/4" MPT X 3/8" BARB	1
17	34585	ELBOW, 1/4" MPT X 1/4" BARB	1
16	35491	VALVE, HUMPHREY	1
15	35444	CONNECTOR, 1/4" MPT X 3/8" BARB	1
14	34578	SWITCH, PRESSURE	1
13	34812	CROSS 1/8" MPT	1
12	35048	FILTER, 40 MIC INLINE	1
11	34816	ELBOW, STREET 1/4" X 1/8"	1
10	35484	NIPPLE, 1/4" MPT X 1/4" MPT	1
9	34108	ANCHOR, 1/4" FPT	2
8	34110	NIPPLE, COUPLER 1/4" SERIES 30	1
7	34588	CONNECTOR, MALE 1/8" MPT X 1/4" BARB	1
6	34183	REGULATOR, 125 PSI	1
5	34209	CONNECTOR, FEMALE DYNAMCO	1
4	34231	GAUGE, PRESSURE 0-160 PSI	1
3	34584	ELBOW, 1/8" MPT X 1/4" BARB	5
2	34129	ANCHOR, 1/8" FPT	1
1	34132	NIPPLE, COUPLER MOLDMATE 1	1

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ANN ARBOR, MICH

JN 05MAY92 | DME 05MAY92
L.H 05MAY92

TITLE PARTS LIST
350 CONTROLLER
DRAWING NUMBER 350-3 REV.
SHEET 3 OF 4

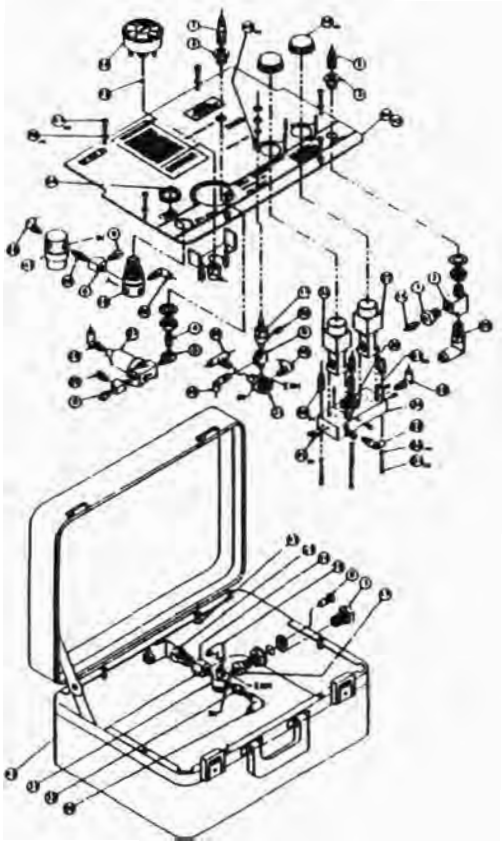
ITEM	P/N	DESCRIPTION	QTY
62	35812	DECAL, INSTRUCTIONS	1
61	33206	DECAL, SERIAL NUMBER	1
60	34988	LABEL, BATTERY COVER	1
59	95016	350 O & T INSTRUCTIONS	1
58	36288	VIDEO, 350 O & M	1
57	34627	HOSE ASSY, 20' X 1/4" MPT	1
56	35041	HOSE ASSY, WITH EXHAUST	1
55	35203	TAPE, 3/4" X 7/16" FOAM	1'
54	36327	TIE, CABLE 8" NARROW	2
53	34741	HOLDER, NYLON CABLE TIE	2
52	34122	COUPLER, SERIES 30 1/4" FPT	1
51	35487	NUT, REG PANEL MTG	1
50	34589	WIRE, #22 AWG, RED, STRANDED	1
49	34583	DISCONNECT, QUICK	2'
48	34895	BUSHING, STRAIN RELIEF	2
47	34883	BOOT, RUBBER SWITCH	1
46	35208	RIVET, BLIND #10-32	1
45	34580	SUPPORT, CIRCUIT BOARD	6
44	34350	LOCKNUT, ELASTIC #10-32	3
43	34385	SCREW, PAN HEAD #10-32 X 1/2" L	6
42	34352	WASHER, NATURAL NYLON	6
41	34361	SCREW, PHILLIPS #10-32 X 3/4" L	10
40	34425	KNOB, PRINTER	6
39	35483	CIRCUIT BOARD	2
38	35482	OVERLAY, 350	1
37	35471	SUBPLATE, 350	1
36	35480	CASE, 350	1
35	34574	LEAD, BATTERY CLIP	1
34	34737	SCREW, #8-32 BRASS FINGER	1
33	34573	BOX, BATTERY	4
32	34735	COVER, BATTERY BOX	1

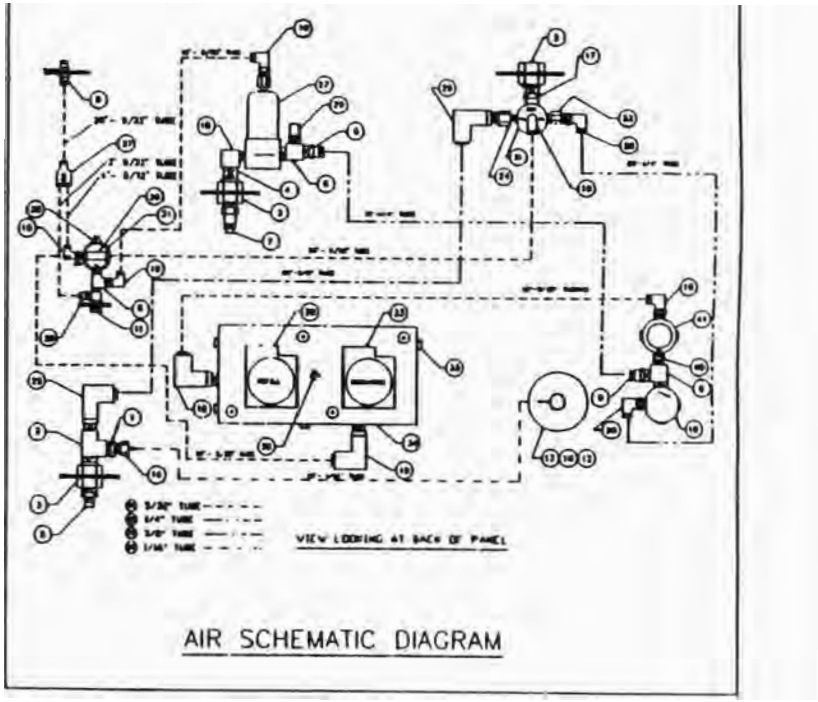
QED
ENVIRONMENTAL SYSTEMS INC
6095 JACKSON RD
ANN ARBOR, MICH

JN 05MAY92 | DME 05MAY92
L.H 05MAY92

TITLE PARTS LIST
350 CONTROLLER
DRAWING NUMBER 350-4 REV.
SHEET 4 OF 4

3013 Controller





AIR SCHEMATIC DIAGRAM

3013 Controller (continued)

ITEM	P/N	DESCRIPTION	QTY
31	35096	VALVE, 3-WAY NC BOOSTER	2
30	35485	CONNECTOR, 5/32" T x #10-32	1
29	36083	VALVE, RELIEF 1/8" MPT, 150 PSI CP	1
28	35002	TUBING, 1/16" I.D. POLYURETHANE	1'
27	35350	FILTER, 5 MIC POLYCAR	1
26	34142	ELBOW, 1/4" T x 1/8" MPT (LEGRIS)	2
25	34831	ELBOW, 3/8" T x 1/4" MPT	2
24	34124	ADAPTOR, 1/8" T x 1/4" FPT	1
23	34845	TUBING, 3/8" O.D. PARAFLEX	15'
22	34844	TUBING, 1/4" O.D. PARAFLEX	25'
21	34843	TUBING, 5/32" O.D. PARAFLEX	65'
20	34835	TIMER, PRT-AID (REFILL)	1
19	34830	ELBOW, 5/32" T x 1/8" MPT	7
18	34818	ELBOW, STREET 1/4" x 1/8"	1
17	34532	NIPPLE, 1/8" MPT x 1/4" MPT HEX	1
16	34230	GAUGE, PRESSURE CONTROL	1
15			
14	35006	CONNECTOR, BARB 1/16" T x 1/8" MPT BRASS	1
13	34208	CONNECTOR, FEMALE DYNAMCO	1
12	36338	PLUG, GAGE THROTTLE	1
11	34185	VALVE, 2-WAY PUSH	1
10	34183	REGULATOR, 125 PSI	1
9	34143	CONNECTOR, 1/4"T x 1/8"MPT (LEGRIS)	2
8	36092	BULKHEAD, 5/32" T x T	1
7	34119	NIPPLE, COUPLER, SCREEN 30, 1/4"MPT	1
6	34111	TEE, STREET 1/8" BRASS	3
5	34110	NIPPLE, COUPLER-MOLDMATE 1/4" MPT	1
4	34109	NIPPLE, 1/4" MPT, BRASS	1
3	34108	ANCHOR, 1/4" FPT	3
2	34104	TEE, STREET 1/4" BRASS	1
1	34103	BUSHING, 1/4" X 1/8" BRASS	1

Q.E.D.
ENVIRONMENTAL SYSTEMS INC
6005 JACKSON RD
ANN ARBOR, MICH

JV 26MAR92 | DHE 26MAR92 | L.N. 26MAR92

TITLE PARTS LIST
3013 CONTROLLER
3013-3 REV -
SHEET 3 OF 4

ITEM	P/N	DESCRIPTION	QTY
60	35915	DECAL, INNER TUBES	1
59	35692	DECAL, INCREASE	1
58	35701	DECAL, INLET PRESSURE	1
57	35142	LABEL, NO PROTECTANT	1
56	35814	DECAL, INSTRUCTIONS	1
55	32206	DECAL, SERIAL NUMBER	1
54	35487	NUT, REG PANEL MOUNT	1
53	35556	EXPANSION PIN 1/8" x 1/4" STAINLESS STEEL	2
52	34841	WASHER, LOCK #8-32	4
51	34848	SCREW, SOCKET HEAD #8-32 x 1 1/2"	4
50	34849	NUT, THREADED SPACER #8-32 HEX	4
49	34836	SCREW, TRUSS STAINLESS STEEL #8-32	4
48	34352	WASHER, NATURAL NYLON	8
47	34381	SCREW, PHILLIPS TRS #10-32 x 3/4"	8
46	35776	CAP, WATER TIGHT	2
45	35265	OVERLAY, 3013C	1
44	35264	SUB-PLATE, 3013C	1
43	35298	RIVET, BLIND #10-32	6
42	35275	CASE, H/P 6.5"	1
41	36094	REGULATOR, 90 PSI PRESET	1
40	35012	NIPPLE, 1/8" MPT HEX	1
39	34829	TEE, 5/32" T x 1/8" MPT	1
38	35557	PLUG, 1/8" MPT HEX	2
37	36091	CONNECTOR, 5/32" T-Y	1
36			
35	35024	PLUG, #10-32, 468-2 BRASS	8
34	35605	MANIFOLD, BASE	1
33	35543	TIMER, PRT C-10 (DISCHARGE)	1
32	35565	ORIFICE #53 GAUGE	1

Q.E.D.
ENVIRONMENTAL SYSTEMS INC
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ANN ARBOR, MICH

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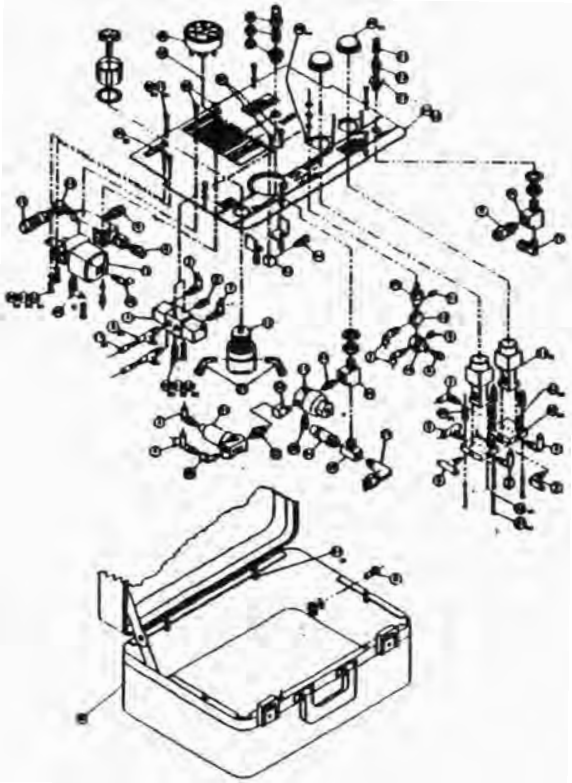
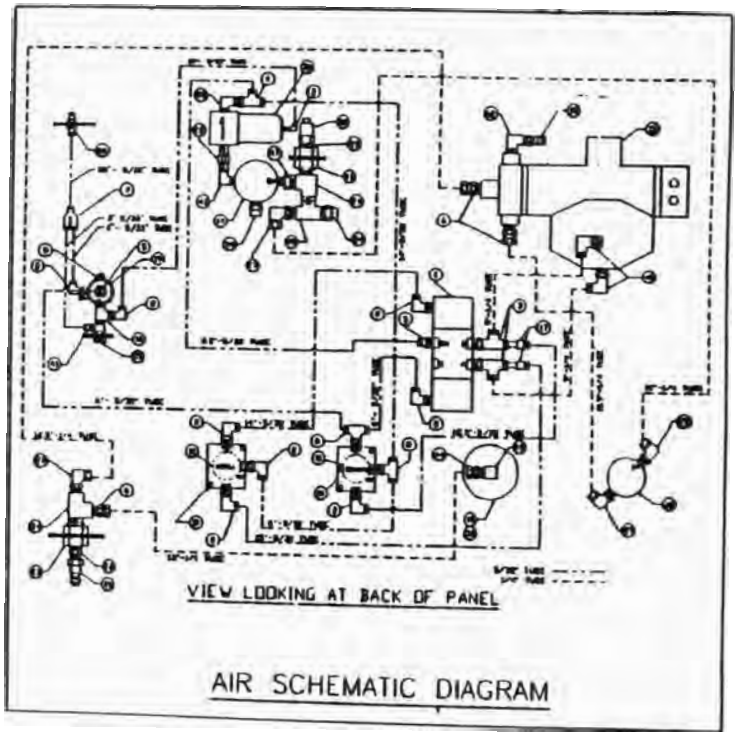
TITLE PARTS LIST
3013 CONTROLLER
3013-4 REV -
SHEET 4 OF 4

3013H Controller





AIR SCHEMATIC DIAGRAM

3013H Controller (continued)

ITEM	P/N	DESCRIPTION	QTY
35	34149	ELBOW STREET 1/8" BRASS	2
34	34158	VALVE RELIEF 300 PSI	1
33	34944	TUBING 1/4"OD PARFLEX	1'
32	34943	TUBING 5/32"OD PARFLEX	95'
31	35350	FILTER, 5 MIC POLYCAR	1
30	34233	GAUGE, PRESSURE CONTROL HP 300 PSI	1
29	34109	NIPPLE, 1/4" NPT, BRASS	1
28	34486	TUBING, 1/4" NYLON NATURAL	4'
27	34545	ELBOW, 1/4"T X 1/4" NPT SWAGELOCK	4
26	36693	BULKHEAD, 5/32" T X T	1
25	34185	VALVE, 2-WAY PUSH	1
24	34104	TEE, STREET 1/4" BRASS	2
23	34108	ANCHOR, 1/4" FPT	2
22	34532	NIPPLE, 1/8" NPT X 1/4" NPT HEX	1
21	34642	NIPPLE, SERIES 810 1/4" NPT BRASS	1
20			
19	35096	VALVE, 3-WAY HC BOOSTER	1
18	36539	PLUG, GAGE THROTTLE	1
17	34928	REDUCER 5/32"T X 1/4"T PUSH-LOCK	2
16	34111	TEE, STREET 1/8" BRASS	1
15	34647	EXHAUST SILENCER	1
14	34946	REGULATOR 0-2	1
13	35277	VALVE/ACTUATOR ASSEMBLY	1
12	35276	REGULATOR "GO" PRIMARY	1
11	34935	TIMER, PRI-810	2
10	34934	SUB-BASE, TIMER	2
9	35557	PLUG, 1/8" NPT HEX	1
8	34929	TEE, 5/32" T X 1/8" NPT	2
7	36891	CONNECTOR, "T"-FEMALE 5/32"	1
6	19485	CONNECTOR, 1/4"T X 1/4" NPT BRASS SWAGELOCK	3
5	34947	CONNECTOR, 5/32"T X 1/8" NPT	2
4	34933	TEE,5/32"T X 1/8"NPT PUSH-LOCK RUN	1
3	34923	TEE,1/4"T X 1/8" NPT PUSH-LOCK RUN	2
2	34930	ELBOW, 5/32" T X 1/8" NPT	9
1	34937	VALVE, MAC	1

Q.E.D.

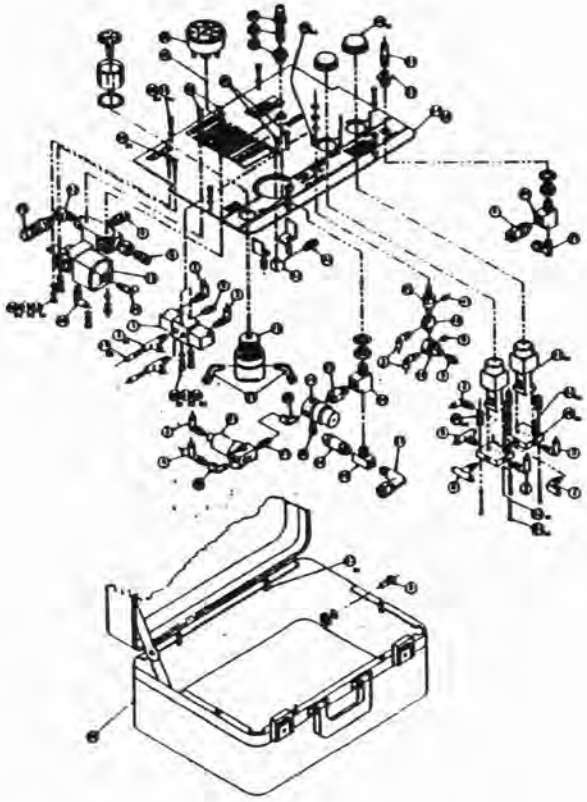
PARTS LIST
3013H CONTROLLER
30134-3

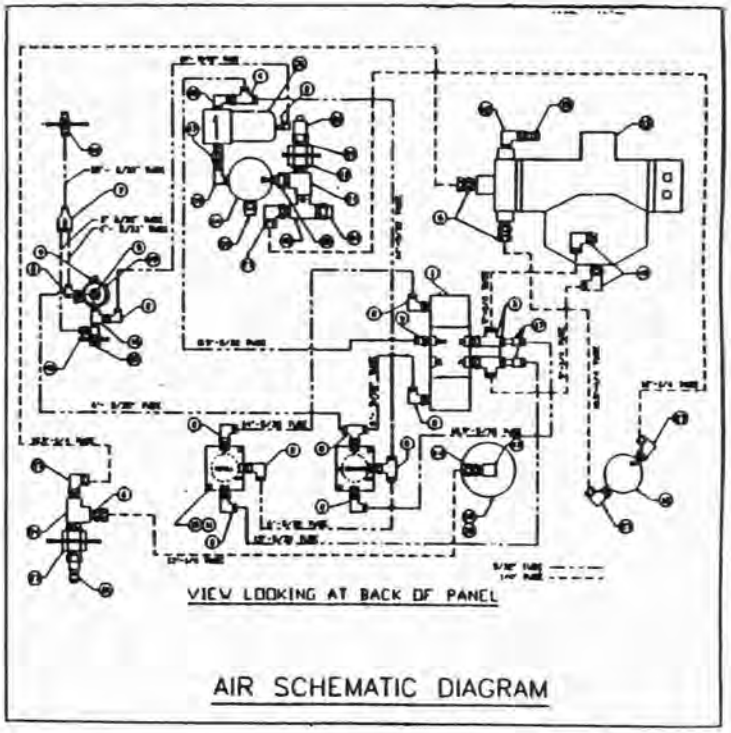
ITEM	P/N	DESCRIPTION	QTY
69	32706	DECAL, SERIAL NUMBER	1
68	35019	LABEL, WARNING -COMPRESSED GAS 300 PSI	1
67	35020	LABEL, CAUTION	1
66	35142	LABEL, NO PROTECTANT	1
65	35002	DECAL, INCREASE	1
64	35015	DECAL, TIMER TIMES	1
63	35014	DECAL, INSTRUCTIONS	1
62	34803	NUT HEX 810-32 STAINLESS STEEL	6
61	35245	WASHER, 810 LOCK STAINLESS STEEL	6
60	35244	WASHER, 810 FLAT STAINLESS STEEL	6
59	35243	SCREW, TRUSS 810-32 X 4" STAINLESS STEEL	2
58	35041	SCREW, TRUSS 810-32 X 62" STAINLESS STEEL	4
57	35298	RIVET, BLIND #10-32	6
56	35275	CASE, H/P 6.5"	1
55	35265	OVERLAY 3013C	1
54	35274	SUB-PLATE 3013HC	1
53	35558	EXPANSION PIN, 1/8" X 1/4" STAINLESS STEEL	2
52	34941	WASHER, LOCK #8-32	4
51	34848	SCREW, SOCKET HEAD #8-32 X 1 1/2"	4
50	34845	NUT, THREADED SPACER #8-32 HEX	4
49	34836	SCREW, TRUSS STAINLESS STEEL #8-32	4
48			
47	35012	NIPPLE, 1/8" NPT HEX	1
46	35778	CAP, WATER TIGHT	2
45	34125	TEE 1/4" NPT	1
44	34644	CONNECTOR,1/4" T X 1/8" NPT BRASS SWAGELOCK	1
43	34648	ELBOW, UNION 1/8" FPT	1
42	34126	ELBOW, STREET 1/4" BRASS	1
41	35465	CONNECTOR, 5/32" T X #10-32	1
40	34142	ELBOW, 1/4" T X 1/8"-NPT (LEGACY)	2
39	34189	VALVE, RELIEF 1/8" NPT 100 PSI	1
38	34625	NIPPLE,COUPLER-SERIES 60 1/4" FPT	1
37	34352	WASHER, NATURAL NYLON #10	6
36	34361	SCREW,PHILLIPS TRUSS HEAD #10-32 X 3/4"	6

Q.E.D.

PARTS LIST
3013H CONTROLLER
30134-4

3013UH Controller





AIR SCHEMATIC DIAGRAM

3013UH Controller (continued)

BY	MAT'L	DESCRIPTION	QTY
35	34148	ELBOW,STREET 1/8" BRASS	1
34	34508	VALVE, RELIEF 500 PSI 1/4" MPT	1
33	34944	TUBING 1/4"OD PARFLEX	1.5'
32	34943	TUBING 5/32"OD PARFLEX	0.5'
31	35350	FILTER, 5 MIC POLYCAR	1
30	34507	GAUGE, 0-800 PSI	1
29	34109	NIPPLE, 1/4" MPT, BRASS	1
28	34486	TUBING, 1/4" NYLON NATURAL	4'
27	34505	ELBOW, 1/4"T X 1/4" MPT SWAGELOCK	4
26	36092	BULKHEAD, 5/32" T X T	1
25	34185	VALVE, 2-WAY PUSH	1
24	34104	TEE, STREET 1/4" BRASS	2
23	34108	ANCHOR, 1/4" FPT	2
22	34532	NIPPLE, 1/8" MPT X 1/4" MPT HEX	2
21	34506	NIPPLE, COUPLER 1/8" FPT SERIES 60	1
20			
19	35096	VALVE, 3-WAY NC BOOSTER	1
18	34200	PLUG GAUGE, THROTTLE	1
17	34828	REDUCER 5/32"T X 1/4"T PUSH-LOCK	2
16	34111	TEE, STREET 1/8" BRASS	1
15	34847	EXHAUST SILENCER	1
14	34742	REGULATOR, 0-300 UH W/OUTLET PORT	1
13	35277	VALVE/ACTUATOR ASSEMBLY	1
12	35276	REGULATOR "GO" PRIMARY	1
11	34935	TIMER, PRE-AID	2
10	34834	SUB-BASE, TIMER	2
9	35557	PLUG, 1/8" MPT HEX	1
8	34828	TEE, 5/32" T X 1/8" MPT	2
7	36081	CONNECTOR, "Y"-FEMALE 5/32"	1
6	90005	CONNECTOR, 1/4"T X 1/4" MPT BRASS SWAGELOCK	3
5	34847	CONNECTOR, 5/32"T X 1/8" MPT	2
4	34833	TEE,5/32"T X 1/8"MPT PUSH-LOCK RUN	1
3	34837	TEE,1/4"T X 1/8" MPT PUSH-LOCK RUN	2
2	34830	ELBOW, 5/32" T X 1/8" MPT	8
1	34837	VALVE, MAC	1
ITEM	P/N	DESCRIPTION	QTY

Q.E.D.
ENVIRONMENTAL SYSTEMS INC
6005 JACKSON RD
ANN ARBOR, MICH

JR	08APR92	DHE	08APR92
L.H.	08APR92		

MKE PARTS LIST
3013UH CONTROLLER
3013UH-3 REV.
SHEET 3 OF 4

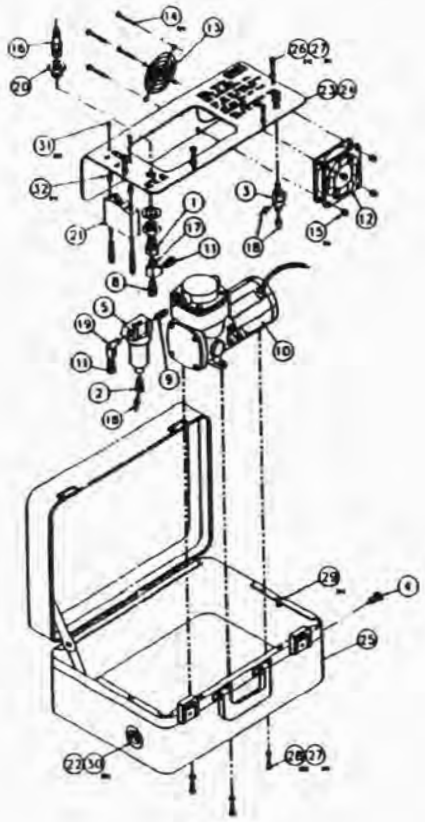
BY	MAT'L	DESCRIPTION	QTY
69	32208	DECAL, SERIAL NUMBER	1
68	35018	LABEL, WARNING -COMPRESSED GAS-500 PSI	1
67	35020	LABEL, CAUTION	1
66	35142	LABEL, NO PROTECTANT	1
65	35682	DECAL, INCREASE	1
64	35815	DECAL, TIMER TIMES	1
63	35814	DECAL, INSTRUCTIONS	1
62	34803	NUT, HEX #10-32 STAINLESS STEEL	6
61	35245	WASHER, #10 LOCK STAINLESS STEEL	8
60	35244	WASHER #10 FLAT STAINLESS STEEL	8
59	35243	SCREW, TRUSS #10-32 X 3" STAINLESS STEEL	2
58	35041	SCREW, TRUSS #10-32 X .62" STAINLESS STEEL	4
57	35298	RIVET, BLIND #10-32	8
56	35275	CASE, H/P 8.5"	1
55	35285	OVERLAY 3013C	1
54	35274	SUB-PLATE 3013UHC	1
53	35556	EXPANSION PIN, 1/8" X 1/4" STAINLESS STEEL	2
52	34841	WASHER, LOCK #8-32	4
51	34848	SCREW, SOCKET HEAD #8-32 X 1 1/2"	4
50	34840	NUT, THREADED SPACER #8-32 HEX	4
49	34838	SCREW, TRUSS STAINLESS STEEL #8-32	4
48			
47	34105	NIPPLE, 1/4" MPT HEX	1
46	35776	CAP, WATER TIGHT	2
45	34125	TEE 1/4" MPT	1
44	34844	CONNECTOR,1/4" T X 1/8" MPT BRASS SWAGELOCK	1
43	34848	ELBOW, UNION 1/8" FPT	1
42	34126	ELBOW STREET 1/4" BRASS	2
41	35485	CONNECTOR, 5/32" T X #10-32	1
40	34142	ELBOW, 1/4" T X 1/8" MPT (LEGRIS)	2
39	34154	VALVE, RELIEF 1/4" MPT 50-150 PSI	1
38	34825	NIPPLE,COUPLER-SERIES 60 1/4" FPT	1
37	34352	WASHER, NATURAL NYLON #10	8
36	34381	SCREW,PHILLIPS TRUSS HEAD #10-32 X 3/4"	8
ITEM	P/N	DESCRIPTION	QTY

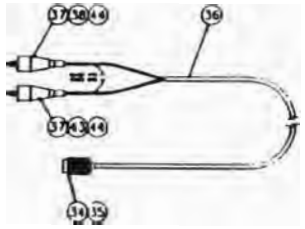
Q.E.D.
ENVIRONMENTAL SYSTEMS INC
6005 JACKSON RD
ANN ARBOR, MICH

JR	08APR92	DHE	08APR92
L.H.	08APR92		

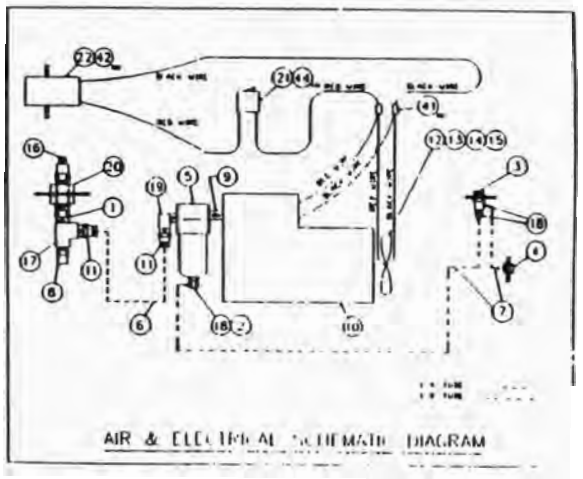
MKE PARTS LIST
3013UH CONTROLLER
3013UH-4 REV.
SHEET 4 OF 4

3020 Compressor





POWER CORD 12V DC ASSEMBLY
SUB-ASS'Y # 36416



3020 Compressor (continued)

QTY	MAT	DESCRIPTION	QTY
31	35493	SCREW, TRUSS #6-32 X 1/2"L	2
30	34542	RIVET 1/8" X 3/8"L ALUMINUM	2
29	35298	RIVET, BLIND #10-32	4
28	34543	SCREW, RD #8-32 X 3/4"L STAINLESS STEEL	3
27	34352	WASHER, NATURAL NYLON	7
26	34361	SCREW; PHILLIPS TRS #10-32 X 3/4"L	4
25	35490	CASE,350	1
24	35758	OVERLAY, 3020	1
23	35758	SUBPLATE, 3020	1
22	34172	CONNECTOR, 2" SOCKET	1
21	34302	BREAKER, CIRCUIT 20 AMP	1
20	34108	ANCHOR 1/4" FPT	1
19	34149	ELBOW, STREET 1/8" BRASS	1
18	35004	CONNECTOR, #10-32 X 1/8"	3
17	34111	TEE, STREET 1/8" BRASS	1
16	34119	NIPPLE COUPLER, SERIES 30 1/4" MPT	1
15	34377	NUT, LOCK #8-32	4
14	35472	SCREW #8-32 X 1 1/2"L	4
13	35424	GUARD, FAN	1
12	35473	FAN, MINI 12VDC	1
11	34143	CONNECT, 1/4"T X 1/8" MPT	2
10	61007	COMPRESSOR, THOMAS	1
9	34135	NIPPLE, 1/8" MPT	1
8	34188	VALVE, RELIEF	1
7	35003	TUBING, 1/8" POLYURETHANE	1.5'
6	34844	TUBING, 1/4" BLACK NYLON	8.5'
5	35350	FILTER, 5 MICRON	1
4	34131	ANCHOR, DUAL BARB	1
3	34185	VALVE, 2-WAY PUSH	1
2	34212	CONNECT, ELBOW	1
1	34103	BUSHING, 1/4" MPT X 1/8" FPT	1
ITEM	P/N	DESCRIPTION	QTY

QED
ENVIRONMENTAL SYSTEMS INC
8005 JACKSON RD
ANN ARBOR, MICH

JR 11MAY92 | DHE 11MAY92 | LN 11MAY92

TITLE PARTS LIST
3020 COMPRESSOR
DRAWING NUMBER 3020-3 REV -
SHEET 3 OF 4

QTY	MAT	DESCRIPTION	QTY
46	95018	3020 O & I INSTRUCTION	1
45	32206	DECAL, SERIAL NUMBER	1
44	35420	TERMINAL, FORK	4
43	34537	INSULATOR, VINYL, RED	1
42	34318	TERMINAL, RING	2
41	34318	SPLICE, BUTT #14	2
40	34317	WIRE, STRANDED, #16AWG, RED	15'
39	34318	WIRE, STRANDED, #16AWG, BLACK	1'
38	34315	INSULATOR, VINYL, BLACK	1
37	34313	CLAMP, BATTERY	2
36	34312	CABLE 14-2 SJ	15'
35	34178	COVER, "SEAL TITE"	1
34	34177	CONNECTOR-2 PLUG	1
33	34122	COUPLER, SERIES 30 1/4" FPT	1
32	34354	WASHER #10 BRASS	4
ITEM	P/N	DESCRIPTION	QTY

QED
ENVIRONMENTAL SYSTEMS INC
8005 JACKSON RD
ANN ARBOR, MICH

JR 11MAY92 | DHE 11MAY92 | LN 11MAY92

TITLE PARTS LIST
3020 COMPRESSOR
DRAWING NUMBER 3020-4 REV -
SHEET 4 OF 4

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APPENDIX D
WELL WIZARD WARRANTY

Q.E.D. Environmental systems, Inc. (QED) warrants to the original purchaser of its products that, subject to the limitations and conditions provided below, the products, materials, and/or workmanship shall reasonably conform to descriptions of the products and shall be free of defects in materials and workmanship. Any failure of the products to conform to this warranty will be remedied by QED in the manner provided herein.

Limits and Conditions

This warranty shall be limited to the duration and the conditions set forth below. All warranty durations are calculated from the original date of purchase.

1. **Dedicated-Use Systems Products**–10-year warranty on dedicated bladder pumps equipped with QED inlet screens, and purge pumps used in periodic, non-continuous ground water sampling (up to 52 sampling events per year). All other components, equipment, and accessories are warranted for 1 year.
2. **Portable-Use Systems**–Controllers and Water-Level Meters are warranted for 1 year. Hose reels, Pumps, and Caps are warranted for 90 days. Tubing and Purge Mizers are covered by a 90-day material and workmanship warranty. There will be no warranty for application on Tubing and Purge Mizers when used as part of a Portable System.

3. **Separately Sold Parts and Spare Parts Kits–Separately sold parts and spare parts kits are warranted for 90 days. Repairs performed by QED are warranted for 90 days from date of repair or for the full term of the original warranty, whichever is longer.**

Remedy

Buyers' exclusive remedy for breach of said warranty shall be as follows: if, and only if, QED is notified in writing within the applicable warranty period of the existence of any such defect in the said products, and QED upon examination of any such defects, shall find the same to be within the term of and covered by the warranty running from QED to Buyer, QED will, at its option, as soon as reasonably possible, replace or repair any such product, without charge to Buyer. If QED for any reason, cannot repair a product covered hereby within 4 weeks after receipt of the original Purchaser's/Buyer's notification of a warranty claim, then QED's sole responsibility shall be, at its option, either to replace the defective product with a comparable new unit at no charge to the Buyer, or to refund the full purchase price. In no event shall such allegedly defective products be returned to QED without its consent, and QED's obligations of repair, replacement, or refund are conditioned upon the Buyer's return of the defective product to QED.

IN NO EVENT SHALL QED ENVIRONMENTAL SYSTEMS, INC. BE LIABLE FOR CONSEQUENTIAL OR INCIDENTAL DAMAGES FOR BREACH OF SAID WARRANTY.

Exclusions

The foregoing warranty does not apply to major sub-assemblies and other equipment, accessories, and parts manufactured by others, and such other parts, accessories, and equipment are subject only to the warranties, if any, supplied by the respective manufacturers. QED makes no warranty concerning products or accessories not manufactured by QED. In the event of failure of any such product accessory, QED will give reasonable assistance to Buyer in obtaining from the respective manufacturer whatever adjustment is reasonable in light of the manufacturer's own warranty.

Applicability

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY (INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE), WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED HEREBY, and of any other obligations or liabilities on the part of QED, and QED neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with the said products, materials, and/or workmanship.

Liability Limits

It is understood and agreed that QED shall in no event be liable for incidental or consequential damages resulting from its breach of any of the terms of this agreement, nor for special damages, nor for improper selection of any product described or referred to for a particular application.

This warranty will be void in the event of unauthorized disassembly of component assemblies. Defects in any equipment that result from abuse, operation in any manner outside the recommended procedures, use and applications other than for intended use, or exposure to chemical or physical environment beyond the designated limits of materials and construction will also void this warranty. QED shall be released from all obligations under all warranties if any product covered hereby is repaired or modified by persons other than QED's service personnel unless such repair by others is made with the written consent of QED.

Defective Product

If any product covered hereby is actually defective within the terms of this warranty, Purchaser must contact QED for determination of warranty coverage. If the return of a component is determined to be necessary, QED will authorize the return of the component, at owner's expense. If the product proves not to be defective within the terms of this warranty, then all costs and expenses in connection with the processing of the Purchaser's claim and all costs for repair, parts, and labor as authorized by owner hereunder shall be borne by the purchaser.

Responsibility of the Purchaser

The original Purchaser's sole responsibility in the instance of a warranty claim shall be to notify QED of the defect, malfunction, or other manner in which the terms of this warranty are believed to be violated. You may secure performance of obligations hereunder by contacting the Customer Service Department of QED and:

1. Identifying the product involved (by model or serial number or other sufficient description that will allow QED to determine which product is defective.)
2. Specifying where, when, and from whom the product was purchased.
3. Describing the nature of the defect or malfunction covered by this warranty.
4. Sending the malfunctioning component, after authorization by QED, to:

   Q.E.D. Environmental Systems, Inc.
   6155 Jackson Road
   Ann Arbor, Michigan 48103
   Attention: Return Authorization Code ____
   (800) 624-2026 (313)995-2547

INDEX

Attachment G

Sample Container and Preservation Procedures

Handling Requirements of Monitoring Parameters

Parameter	Perservation	Holding Time	Bottle Type	Minimum Volume
Total Phenolics	1,2	28 Days	Amber Glass	0.5 L
Sulfate	2	28 Days	Plastic	50 ml*
Total Alkalinity	2	14 Days	Plastic	100 ml*
Fluoride	2	28 Days	Plastic	300 ml*
Chloride	2	28 Days	Plastic	50 ml*
Nitrate/Nitrite	1,2	48 Hrs	Plastic	0.5 L
Arsenic	3,5	6 Mos	Plastic	200 ml**
Cadmium	3,5	6 Mos	Plastic	200 ml**
Calcium	3,5	6 Mos	Plastic	200 ml**
Chromium	3,5	6 Mos	Plastic	200 ml**
Iron	3,5	6 Mos	Plastic	200 ml**
Potassium	3,5	6 Mos	Plastic	200 ml**
Lead	3,5	6 Mos	Plastic	200 ml**
Magnesium	2,3,5	6 Mos	Plastic	200 ml**
Manganese	2,3,5	6 Mos	Plastic	200 ml**
Molybdenum	2,3,5	6 Mos	Plastic	200 ml**
Nickel	2,3,5	6 Mos	Plastic	200 ml**
Sodium	3,5	6 Mos	Plastic	200 ml**
Zinc	3,5	6 Mos	Plastic	200 ml**
Cyanide	2,4	14 Days	Plastic	500 ml
Copper	3,5	6 Mos	Plastic	200 ml**
pH		Immediate	Plastic	25 ml
Bicarbonate	2	14 Days	Plastic	100 ml*
Carbonate	2	14 Days	Plastic	100 ml*
TOC	2,7	28 Days	Glass	100 ml
Specific Conductivity	2	28 Days	Plastic	100 ml
Volatile Organics	2,6	14 Days	Glass	2x40 ml
PCBs	2	7 Days Ext. 40 after Ext.	Amber Glass	1000 ml

1) pH<2 with concentrated Sulfuric Acid
2) Store at 4 degrees Centigrade
3) pH<2 with nitric acid
4) pH>12 with sodium hydroxide
5) Filtered in the field using 0.45 micron membrane filters on the time of collection
6) 4 drops HCL, no headspace
7) pH<2 with hydrochloric acid

* Note: One liter for all of these parameters stored similarily
** Note: One liter for all of these parameters stored similarily

Attachment H

Ground Water Monitoring Parameter List

Ground Water Monitoring Parameter List

A. Primary Parameters

Benzene	1,2 Dichlorobenzene	Xylene
1,2 Dichloroethane	1,2 Dichloroethene	Ethylbenzene
Methylene Chloride	Toluene	Trichloroethene
1,1,1 Trichloroethane	Vinyl Chloride	1,1 Dichloroethane

PCB-1016[1]	**PCB-1221[1]**	**PCB-1231[1]**
PCB-1242[1]	**PCB-1248[1]**	**PCB-1254[1]**
PCB-1260[1]		

B. Secondary Parameters

Potassium	Sodium	Nickel
Chromium(t)	Lead	Molybdenum
Sulfate	Chloride	Bicarbonate
Carbonate	Arsenic	Cyanide[4]
Nitrate	Nitrite	Fluoride
Total Phenolics	Total Organic Carbon	Iron

C. Tertiary Parameters

Calcium[2]	Magnesium[2]	Copper[2]
Manganese[2]	Zinc[2]	Cadmium[2]
Silver	Mercury	Selenium
Barium	2,4-D	Endrin
Silvex	Methoxychlor	Toxaphene

D. Field Monitoring Parameters[3]

Specific Conductance Temperature pH

Notes:

1	PCB's to be analyzed in samples from wells OB-21, OB-23, OB-24, OB-34R and OBN-40R only.
2	Tertiary parameter that will be measured during detection monitoring.
3.	Parameter to be measured in field for all samples collected
4.	Amenable cyanide to be analyzed if cyanide is detected

Attachment I

Analytical Methods and Target Detection Limits

Attachment I - Analytical Methods and Target Detection Limits

VOC Parameter	Detection Limit (mg/l)	Preparation Method	Analytical Method
1,1-Dichloroethane	0.001	---	EPA 8260B
1,2-Dichloroethane	0.001	---	EPA 8260B
1,2-Dichloroethene	0.001	---	EPA 8260B
1,1,1-Trichloroethane	0.001	---	EPA 8260B
Trichloroethene	0.001	---	EPA 8260B
Vinyl Chloride	0.001	---	EPA 8260B
Methylene Chloride	0.005	---	EPA 8260B
1,2-Dichlorobenzene	0.001	---	EPA 8260B
Benzene	0.001	---	EPA 8260B
Toluene	0.001	---	EPA 8260B
Ethylbenzene	0.001	---	EPA 8260B
Xylenes (Total)	0.003	---	EPA 8260B
Indicator Parameter	**Detection Limit (mg/l)**	**Preparation Method**	**Analytical Method**
Alkalinity (Total)	10	---	2320B
Bicarbonate Alkalinity	10	---	2320B
Carbonate Alkalinity	10	---	2320B
Chloride	1	---	SM 4500-Cl E-11
Cyanide (Total)	0.005	EPA 9014	EPA 9014
Fluoride	0.1	---	SM 4500-F C-11
Nitrate/Nitrite	0.01	---	SM 4500-NO3 F-11
pH	N/A	---	SM 4500-H B-11
Phenolics (Total)	0.01	EPA 420.4	EPA 420.4
Specific Conductivity	5(mmhos/cm)	---	SM 2510B-11
Sulfate	2	---	SM 4500-SO4 E-11
TOC	0.5	---	SM 5310C-11
Metals	**Detection Limit (mg/l)**	**Preparation Method**	**Analytical Method**
Arsenic	0.001	EPA 3020A	EPA 6020A
Cadmium	0.0002	EPA 3020A	EPA 6020A
Calcium	1	EPA 3010A	EPA 6010C
Chromium	0.02	EPA 3020A	EPA 6020A
Copper	0.01	EPA 3020A	EPA 6020A
Iron	0.02	EPA 3010A	EPA 6010C
Lead	0.001	EPA 3010A	EPA 6010C
Magnesium	1	EPA 3020A	EPA 6020A
Manganese	0.005	EPA 3020A	EPA 6020A
Molybdenum	0.025	EPA 3020A	EPA 6020A
Nickel	0.025	EPA 3010A	EPA 6010C
Potassium	0.1	EPA 3010A	EPA 6010C
Sodium	1	EPA 3010A	EPA 6010C
Zinc	0.01	EPA 3020A	EPA 6020A
PCB	**Detection Limit (mg/l)**	**Preparation Method**	**Analytical Method**
PCB-1016	0.0001	EPA 3510C	8082A
PCB-1221	0.0001	EPA 3510C	8082A
PCB-1232	0.0001	EPA 3510C	8082A
PCB-1242	0.0001	EPA 3510C	8082A
PCB-1248	0.0001	EPA 3510C	8082A
PCB-1254	0.0001	EPA 3510C	8082A
PCB-1260	0.0001	EPA 3510C	8082A

Attachment J

Field Measurement Equipment and Procedures
Yellow Springs Instrument Co (YSI) Equipments Instructions
(pH, specific conductivity & temperature)

Pro1030

USER MANUAL

English

YSI®

a xylem brand

Item #605182
Rev A, January 2013
For the latest version of this manual,
visit ysi.com

CONTENTS

WARRANTY

The YSI Professional 1030 instrument (Pro1030) is warranted for three (3) years from date of purchase by the end user against defects in materials and workmanship, exclusive of batteries and any damage caused by defective batteries. Pro1030 cable assemblies are warranted for two (2) years from date of purchase by the end user against defects in material and workmanship. Pro1030 pH and ORP sensors are warranted for one (1) year from date of purchase by the end user against defects in material and workmanship. Pro1030 instruments, cables & sensors are warranted for one (1) year from date of purchase by the end user against defects in material and workmanship when purchased by rental agencies for rental purposes. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio at +1 937 767-7241, 800-897-4151 or visit www.YSI.com for a Product Return Form. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

LIMITATION OF WARRANTY

This Warranty does not apply to any YSI product damage or failure caused by:

1. Failure to install, operate or use the product in accordance with YSI's written instructions;
2. Abuse or misuse of the product;
3. Failure to maintain the product in accordance with YSI's written instructions or standard industry procedure;
4. Any improper repairs to the product;
5. Use by you of defective or improper components or parts in servicing or repairing the product;
6. Modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI'S LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

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INTRODUCTION

Thank you for purchasing the YSI Pro1030, an instrument from the YSI *Professional Series* product family. The Pro1030 measures conductivity, temperature and either pH or ORP in water. The Pro1030 features an impact resistant and waterproof (IP-67) case, a rugged MS-8 (military-spec) cable connector, backlit display, user-selectable sensor options, 50 data set memory and a rubber over-mold case.

The Pro1030 provides valuable instructions and prompts near the bottom of the display that will guide you through operation and use; however, reading the entire manual is recommended for a better understanding of the instrument's features.

> ⓘ *The Pro1030 cannot communicate to a PC via a ProComm communications saddle.*

GETTING STARTED

INITIAL INSPECTION

Carefully unpack the instrument and accessories and inspect for damage. Compare received parts with items on the packing list. If any parts or materials are damaged or missing, contact YSI Customer Service at 800-897-4151 (+1 937 767-7241) or the authorized YSI distributor from whom the instrument was purchased.

BATTERY INSTALLATION

The instrument requires 2 alkaline C-cell batteries. Under normal conditions, the average battery life is 425 hours at room temperature without using the back light. A battery symbol  will blink in the lower, left corner of the display to indicate low batteries when approximately 1 hour of battery life remains.

To install or replace the batteries:

1. Turn the instrument off and flip over to view the battery cover on the back.
2. Unscrew the four captive battery cover screws.
3. Remove the battery cover and remove the old batteries if necessary.

4. Install the new batteries, ensuring correct polarity alignment (figure 1).
5. Place the battery cover on the back of the instrument and tighten the four screws. Do not over-tighten.

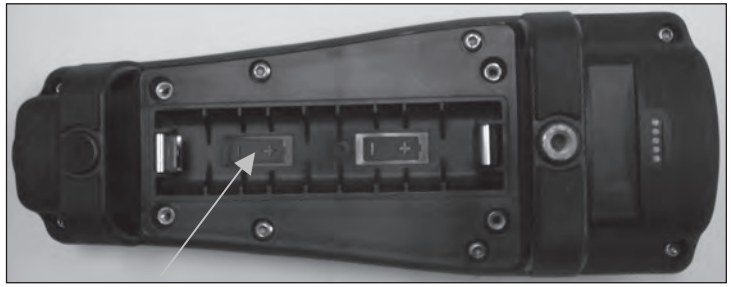

Figure 1. Pro1030 with battery cover removed. Notice battery symbols indicating polarities.

> *The waterproof instrument case is sealed at the factory and is not to be opened, except by factory-authorized service technicians. Do not attempt to separate the two halves of the instrument case as this may damage the instrument, break the waterproof seal, and will void the warranty.*

KEY PAD

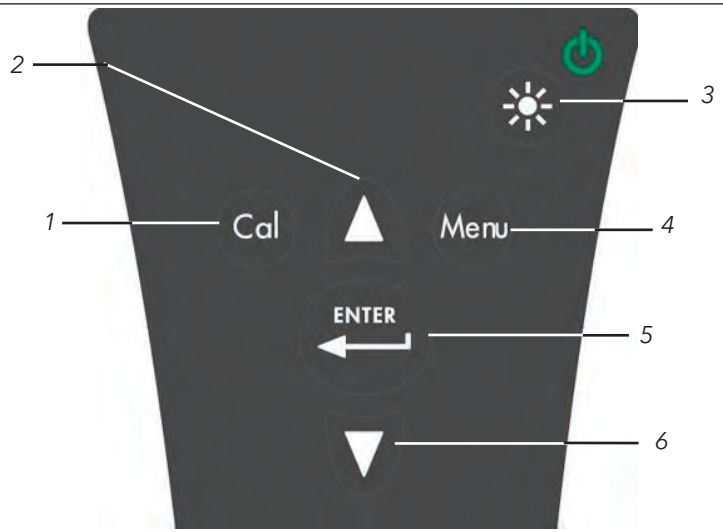

Figure 2, Keypad

Number	*Key*	*Description*
1	Cal	**Calibrate** Press and hold for 3 seconds to calibrate. Opens Calibrate menu from the Run screen.
2	△	**Up Arrow** Use to navigate through menus, to navigate through box options along the bottom of the Run screen and to increase numerical inputs.
3	⏻ ☀	**Power and Backlight** Press once to turn instrument on. Press a second time to turn backlight on. Press a third time to turn backlight off. Press and hold for 3 seconds to turn instrument off.
4	Menu	**Menu** Press to enter the System Setup menu from the Run screen.
5	ENTER	**Enter** Press to confirm entries and selections.
6	▽	**Down Arrow** Use to navigate through menus, to navigate through box options at the bottom of the Run screen and to decrease numerical inputs.

CONNECTING THE SENSOR AND CABLE

"Bulkhead" refers to the single-pin connector at the end of the probe/cable assembly where an ISE sensor, either pH or ORP, is installed (figure 3). The conductivity and temperature sensors are located above and next to the bulkhead and are not replaceable.

When an ISE sensor is not installed in the cable, the bulkhead connector is not water-proof. Do not submerge the cable without a sensor installed. Submerging the cable without a sensor installed may cause permanent damage to the cable that is not covered under warranty.

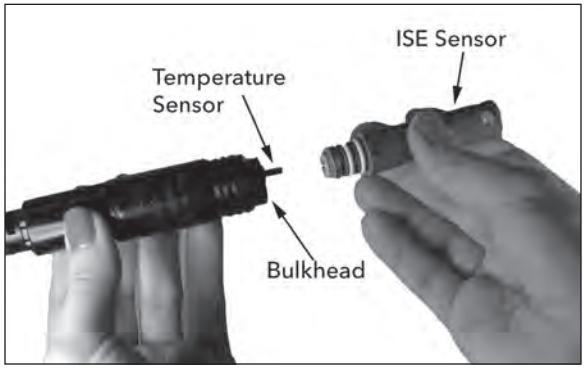

Figure 3

INSTALLING THE ISE SENSOR

The Pro1030 has three compatible ISE sensors: pH (model #1001), pH-amplified (model #1001A) and ORP (model #1002).

1. Remove the plastic plug from the cable's bulkhead port by pulling it straight out of the port. This can be discarded.
2. Remove the red plastic plug from the sensor's connector by pulling it straight off the sensor. This can be discarded.
3. Ensure both the sensor connector and bulkhead connector are clean and dry.
4. Grasp the sensor with one hand and the cable bulkhead in the other.
5. Push the sensor into the connector on the cable until it is firmly seated with only 1 o-ring visible. Failure to properly seat the sensor may result in damage.
6. Twist the sensor clockwise to engage the threads and finger tighten. Do NOT use a tool. This connection is water-tight.

The ISE sensor is shipped with the tip in a storage bottle. To remove, twist the bottle off the lid and remove the bottle from the sensor. Next, remove the o-ring and slide the lid off the sensor.

CONNECTING THE PROBE/CABLE ASSEMBLY TO THE INSTRUMENT

To connect the cable, align the keys on the cable connector to the slots on the instrument connector. Push together firmly and then twist the outer ring until it locks into place (figure 4). This connection is water-proof.

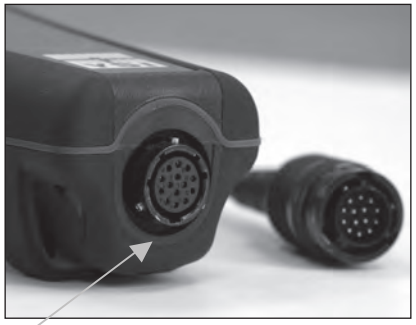

Figure 4, Note the keyed connector.

RUN SCREEN

Press the power/backlight key to turn the instrument on. The instrument will run through a self test and briefly display a splash screen with system information before displaying the main Run screen (figure 5). A language selection menu will display the first time the Pro1030 is powered on. See the First Power On section of this manual for more information.

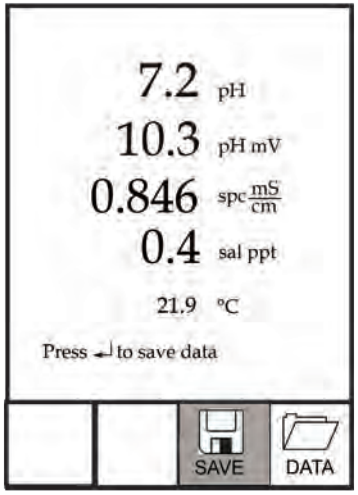

Figure 5, Run screen.

BACKLIGHT

Once the instrument is powered on, pressing the power/backlight key will turn on the display backlight. The backlight will remain on until the key is pressed again or after two minutes of not pressing any key on the keypad.

POWERING OFF

To turn the instrument off, press and hold the power/backlight key for three seconds.

NAVIGATION

The up and down arrow keys allow you to navigate through the functions of the Pro1030.

NAVIGATING THE RUN SCREEN

When in the Run screen, the up and down arrow keys will move the highlighted box along the bottom options. Once a box is highlighted, press enter to access the highlighted option.

Description of Run screen box functions from left to right:

Option	*Description*
 SAVE	Highlight and press enter to save displayed data to memory.
 DATA	Highlight and press enter to view and/or erase saved data.

NAVIGATING THE SYSTEM SETUP MENU

When in the System Setup menu, the up and down arrow keys will move the highlighted bar up and down the system setup options. See the System Setup menu section of this manual for more information about these options.

FIRST POWER ON

The instrument will step through an initial configuration when powered on for the first time. This will set the language. Use the up or down arrow keys to highlight the appropriate language, then press enter to confirm (figure 6).

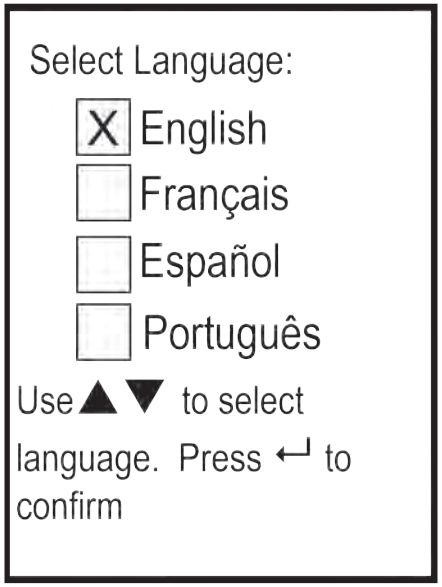

Figure 6, Select language

After selecting a language, the Run screen will be displayed. The next time the instrument is powered up, the Run screen will display immediately after the splash screen.

SYSTEM SETUP MENU

Press the menu key to access the System Setup menu. The System Setup menu contains two screens notated as 'pages'. The current page is indicated near the bottom of the display (figure 7).

Use the up and down arrow keys to scroll through menu options and menu pages.

EXITING THE SYSTEM SETUP MENU

To exit the System Setup menu, press the down arrow key until the ESC - Exit box is highlighted, then press enter to return to the Run screen.

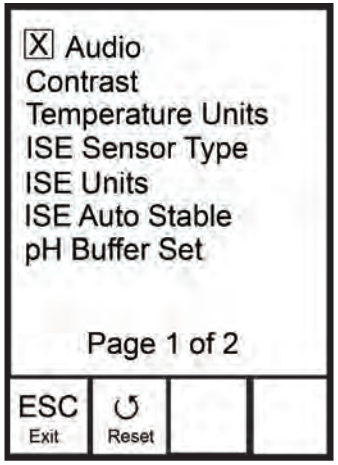

Figure 7, page 1 of System Setup menu.

AUDIO

Audio can be enabled by highlighting Audio and pressing enter. When enabled, there will be an 'X' in the box next to Audio.

When Audio is enabled, the Pro1030 will beep twice to indicate stability when Auto Stable is enabled. The instrument will also beep when a key is pressed. When Audio is disabled, the Pro1030 will not beep.

CONTRAST

To adjust the display Contrast, use the up or down arrow keys to highlight Contrast, then press enter. Next, use the up or down arrow keys to adjust the contrast. The up arrow key will darken the contrast and the down arrow key will lighten the contrast. After adjusting the contrast, press enter to save and exit the Contrast adjustment function.

ALTERNATE CONTRAST ADJUSTMENT OPTION

If necessary, there is an alternate method of adjusting the contrast. To adjust the contrast, press and hold the menu key, then press the up arrow key to darken the contrast or press the down arrow key to lighten the contrast.

TEMPERATURE UNITS

Highlight Temperature Units and press enter to open a submenu that allows you to change the temperature units displayed on the Run screen. Highlight the desired unit (Celsius or Fahrenheit) and press enter to enable. The enabled temperature unit will have an 'X' in the box next to it. Only one unit may be enabled at a time. Highlight the ESC-Exit box and press enter to save any changes and to close the Temperature Units submenu.

ISE SENSOR TYPE

ISE Sensor Type sets the type of ISE sensor being used; either pH (model #1001) or ORP (model #1002).

Use the up or down arrow keys to highlight ISE Sensor Type, then press enter to open a submenu. Highlight the sensor type corresponding to the sensor installed on the cable and press enter to confirm. The enabled sensor type will have an 'X' in the box next to it. Next, use the down arrow key to highlight the ESC – Exit, then press enter to save changes and to close the sensor submenu.

ISE UNITS

Highlight ISE Units and press enter to open a submenu that allows you to select the ISE units to be displayed on the Run screen. Highlight a unit and press enter to enable or disable it. An enabled ISE unit will have an 'X' in the box next to it. Highlight the ESC-Exit box along the bottom of the display and press enter to save any changes and to close the ISE Units submenu.

When pH is enabled in the ISE Sensor Type menu, there are two selectable measurement units: pH and pH mV. pH mV is the sensor's electrical measurement signal before being converting into pH units. pH mVs can help you determine if you are performing a good calibration and the condition of the pH electrode.

When ORP is enabled in the ISE Sensor Type menu, only ORP mVs can be enabled as the ISE unit.

AUTO STABLE

Auto Stable utilizes preset values to indicate when a reading is stable. The preset values are adjustable in the System Setup menu. The user can input a % change in measurement reading over 'x' amount of time in seconds. There are two separate Auto Stable controls, one for ISE readings (ISE Auto Stable) and one for conductivity readings (Cond. Auto Stable). ISE Auto Stable is located on the first page of the System Setup menu. Cond. Auto Stable is located on the second page of the System Setup menu.

When Auto Stable is enabled, an (AS) symbol will display next to the reading on the Run screen and blink during stabilization. When the ISE and/or conductivity reading stabilizes based on the Auto Stable settings, the (AS) symbol will display steadily and the instrument will beep twice if Audio is turned on.

ISE Auto Stable can be set to a % change of 0.0 to 9.9% over 3 to 19 seconds. The auto stable criteria is be applied to the pH measurement or the ORP mV reading depending on which sensor is enabled in the ISE Sensor menu.

Conductivity Auto Stable can be set to a % change of 0.0 to 1.9% over 3 to 19 seconds. The conductivity auto stable criteria is applied to the conductivity reading, but the AS symbol will display next to all enabled conductivity units.

To enable Auto Stable, highlight either ISE Auto Stable or Cond. Auto Stable, then press enter to open the submenu. Next, use the up or down arrow keys to highlight the % change or seconds (secs) input field, then press enter to make the highlighted field adjustable. Use the up or down arrow keys to adjust the selected value, then press enter to confirm changes. Once you have confirmed any changes, highlight the ESC-Exit box along the bottom of the display and press enter to close the Auto Stable submenu. To disable Auto Stable, set the % Change input to 0.0.

pH BUFFER SET

Highlight pH Buffer Set and press enter to open a submenu that allows you to select the Buffer Set used for auto buffer recognition during a pH calibration. There are two buffer set options: USA (4, 7 and 10) and NIST (4.01, 6.86 and 9.18). Highlight the buffer set and press enter to enable. The enabled buffer set will have an 'X' in the box next to it. Highlight the ESC-Exit box and press enter to save any changes and to close the submenu.

CONDUCTIVITY UNITS (COND. UNITS)

Highlight Cond. Units (Conductivity Units) and press enter to open a submenu that allows you to select the conductivity units to be displayed on the Run screen. Highlight a unit and press enter to enable or disable it. An enabled conductivity unit will have an 'X' in the box next to it. Highlight the ESC-Exit box along the bottom of the display and press enter to save any changes and to close the conductivity units submenu.

There are seven options for displaying conductivity. Only two units can be enabled at the same time:

- COND-mS/cm displays conductivity in milliSiemens per centimeter.
- COND-uS/cm displays conductivity in microSiemens per centimeter.
- SPC-mS/cm displays Specific Conductance in milliSiemens per centimeter. Specific Conductance is temperature compensated conductivity.
- SPC-uS/cm displays Specific Conductance in microSiemens per centimeter. Specific Conductance is temperature compensated conductivity.
- Sal ppt displays salinity in parts per thousand. The salinity reading is calculated from the instrument's conductivity and temperature values using algorithms found in *Standard Methods for the Examination of Water and Wastewater*.
- TDS g/L displays Total Dissolved Solids in grams per liter. TDS is calculated from conductivity compensated to 25°C using a user-selectable TDS constant.
- TDS mg/L displays Total Dissolved Solids in milligrams per liter. TDS is calculated from conductivity compensated to 25°C using a user-selectable TDS constant.

Note: 1 S = 1 mho.
1 milliSiemen = 1,000 microSiemens.

SPECIFIC CONDUCTANCE

The conductivity of a sample is highly dependent on temperature, varying as much as 3% for each change of one degree Celsius (temperature coefficient = 3%/°C). In addition, the temperature coefficient itself varies with the nature of the ionic species present in the sample. Therefore, it is useful to compensate for this temperature dependence in order to quickly compare conductivity readings taken at different temperatures.

The Pro1030 can display non-temperature compensated conductivity as well as temperature compensated Specific Conductance. If Specific Conductance is enabled, the Pro1030 uses the temperature and conductivity values associated with each measurement to calculate a specific conductance value that is temperature compensated based on a user-selected temperature coefficient (0 to 4%) and reference temperature (15 to 25°C).

Using the Pro1030's default reference temperature and temperature coefficient (25 °C and 1.91%), the calculation is carried out as follows:

$$\text{Specific Conductance (25°C)} = \frac{\text{Conductivity of sample}}{1 + 0.0191 * (T - 25)}$$

T = Temperature of the sample in °C

SPECIFIC CONDUCTANCE REFERENCE TEMPERATURE (SPC REF. TEMP.)

SPC Ref. Temp. (Specific Conductance Reference Temperature) is the reference temperature used to calculate Specific Conductance. The reference temperature range is 15 and 25°C. The default value is 25°C.

To change the reference temperature, highlight SPC Ref. Temp. and press enter to open the submenu. With the reference temperature highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. Press enter to save the new reference temperature. Next, highlight the ESC-Exit box and press enter to close the submenu.

SPECIFIC CONDUCTANCE TEMPERATURE COEFFICIENT (SPC %/°C)

SPC %/°C (Specific Conductance Temperature Coefficient) is the temperature coefficient used to calculate Specific Conductance. The coefficient range is 0.00 to 4.00. The default value is 1.91% which is based on KCl standards.

To change the temperature coefficient, highlight SPC %/°C and press enter to open the submenu. With the temperature coefficient highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. Press enter to save the new coefficient. Next, highlight the ESC-Exit box and press enter to close the submenu.

TDS CONSTANT

TDS Constant is a multiplier used to calculate an estimated TDS (Total Dissolved Solids) value from conductivity. The multiplier is used to convert Specific Conductance in mS/cm to TDS in g/L. The Pro1030's default value is 0.65. This multiplier is highly dependent on the nature of the ionic species present in the water sample. To be assured of moderate accuracy for the conversion, you must determine a multiplier

for the water at your sampling site. Use the following procedure to determine the multiplier for a specific sample:

1. Determine the specific conductance of a water sample from the site;
2. Filter a sample of water from the site;
3. Completely evaporate the water from a carefully measured volume of the filtered sample to yield a dry solid;
4. Accurately weigh the remaining solid;
5. Divide the weight of the solid (in grams) by the volume of water used (in liters) to yield the TDS value in g/L for this site;
6. Divide the TDS value in g/L by the specific conductance of the water in mS/cm to yield the conversion multiplier. Be certain to use the correct units.

If the nature of the ionic species at the site changes between sampling studies, the TDS values will be in error. TDS cannot be calculated accurately from specific conductance unless the make-up of the chemical species in the water remains constant.

To change the TDS Constant in the Pro1030, highlight TDS Constant and press enter to open the submenu. With the TDS Constant highlighted, press enter to make the field adjustable. Next, use the up or down arrow key to increase or decrease the value. The input range is 0.30 to 1.00. Press enter to save the new TDS Constant. Next, highlight the ESC-Exit box and press enter to close the submenu.

LANGUAGE

Highlight Language and press enter to open a submenu that allows you to change the language. Highlight the desired language (English, Spanish, Portuguese, or French) and press enter to enable. The enabled language will have an 'X' in the box next to it. Highlight ESC-Exit box and press enter to save any changes and to close the Language submenu.

The text in the boxes along the bottom of the Run screen will always be displayed in English regardless of the language enabled in the System Setup menu.

AUTO SHUTOFF

Auto Shutoff allows you to set the instrument to turn off automatically after a period of time. In the setup menu, use the up or down arrow keys to highlight Auto Shutoff, then press enter to open the submenu. Press enter while the minute field is highlighted to make it adjustable.

Next, use the up or down arrow keys to adjust the shut off time from 0 to 60 minutes. Press enter to save the new shutoff time. Next, highlight the ESC-Exit box and press enter to close the submenu.

To disable Auto Shutoff, set the Time in Minutes to 0 (zero).

CELL CONSTANT

The Cell Constant displays the cell constant of the conductivity cell. The cell constant is calculated and updated each time a conductivity calibration is performed. The cell constant range is 4.0 to 6.0. Resetting the System Menu resets the cell constant to 5.0.

RESETTING THE SYSTEM SETUP MENU AND CELL CONSTANT TO FACTORY DEFAULT

To reset the Pro1030 settings and conductivity cell constant back to factory default, press the down arrow key while in the System Setup menu until the Reset - ↺ box is highlighted, then press enter. The instrument will prompt you to confirm the reset. Highlight Yes and press enter to continue with the reset or highlight No and press enter to cancel the reset. A Factory Reset will not affect data saved in the instrument's memory.

The following will be set in the Pro1030 after performing a reset:

Parameter	*Reset Defaults*
Audio	On
Contrast	Set to mid range
Temperature Units	°C
ISE Sensor Type	pH
ISE Units	pH
ISE Auto Stable	Off (0.0 % Change and 10 seconds)
pH Buffer Set	USA
Conductivity Units	*cond mS/cm and spc mS/cm*
Conductivity Auto Stable	Off (0.0 % Change and 10 seconds)
SPC Reference Temperature	*25°C*
SPC Temperature Coefficient	*1.91%/°C*
TDS Constant	*0.65*
Language	English
Auto Shutoff	30 minutes
Conductivity Cell Constant	5.0
pH Calibration	Factory default

CALIBRATION

TEMPERATURE

All Pro1030 cables have built-in temperature sensors. Temperature calibration is not required nor is it available.

pH CALIBRATION

The Pro1030 pH sensor can be calibrated by performing a 1, 2 or 3-point calibration. At least one of the calibration points must be done with pH buffer 7 or 6.86. For auto buffer recognition to work properly with an older or dirty sensor, calibrate in buffer 7 or 6.86 first. For highest accuracy, use fresh, traceable pH buffers and ensure the sensor and calibration vessel are clean.

1-POINT CALIBRATION

1. Place the sensor in pH buffer 7 or 6.86 and allow the temperature and pH readings to stabilize.
2. Press and hold Cal (Cal) for three seconds.
3. Highlight pH and press enter. If pH is not listed as an option, check the System Setup menu to ensure pH is enabled in the ISE Sensor Type menu.
4. Highlight 1 point and press enter.
5. If necessary, use the up and down arrow keys to adjust the pH buffer value. Note the pH mV reading which ideally should be between -50 and +50 in buffer 7.
6. Press enter to complete the calibration or press Cal (Cal) to cancel.

7. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
8. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting guide for possible solutions.

2-POINT CALIBRATION

1. Place the sensor in pH buffer 7 or 6.86 and allow the temperature and pH readings to stabilize.
2. Press and hold Cal for three seconds.
3. Highlight pH and press enter. If pH is not listed as an option, check the System Setup menu to ensure pH is enabled in the ISE Sensor Type menu.
4. Highlight 2 point and press enter.
5. If necessary, use the up and down arrow keys to adjust the pH buffer value. Note the pH mV reading which ideally should be between -50 and +50 in buffer 7.
6. Press enter to continue to second point.
7. Rinse the sensor and place it in the second pH buffer (4/4.01 or 10/9.18).
8. If necessary, use the up and down arrow keys to adjust the pH buffer value.
9. Wait approximately 30 to 60 seconds for the pH sensor to stabilize and for the temperature reading to stabilize. Note the pH mV reading. pH mVs in buffer 4 should be +159 to 180 mV from the previous buffer 7 pH mV value. pH mVs in buffer 10 should be -159 to 180 mV from the previous buffer 7 pH mV value.
10. Press enter to complete the calibration or press Cal to cancel.
11. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
12. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting section of this manual for possible solutions.

3-POINT CALIBRATION

1. Place the sensor in pH buffer 7 or 6.86 and allow the temperature and pH readings to stabilize.
2. Press and hold Cal for three seconds.

3. Highlight pH and press enter. If pH is not listed as an option, check the System Setup menu to ensure pH is enabled in the ISE Sensor Type menu.
4. Highlight 3 point and press enter.
5. If necessary, use the up and down arrow keys to adjust the pH buffer value. Note the pH mV reading which should be between -50 and +50 in buffer 7.
6. Press enter to continue to second point.
7. Rinse the sensor and place it in the second pH buffer (4/4.01 or 10/9.18). If necessary, use the up and down arrow keys to adjust the pH buffer value.
8. Wait approximately 30 to 60 seconds for the pH sensor to stabilize and for the temperature reading to stabilize. Note the pH mV reading. pH mVs in buffer 4 should be +159 to 180 mV from the previous buffer 7 pH mV value. pH mVs in buffer 10 should be -159 to 180 mV from the previous buffer 7 pH mV value.
9. Rinse the sensor and place it in the third pH buffer (4/4.01 or 10/9.18). If necessary, use the up and down arrow keys to adjust the pH buffer value.
10. Wait approximately 30 to 60 seconds for the pH sensor to stabilize and for the temperature reading to stabilize. Note the pH mV reading. pH mVs in buffer 4 should be +159 to 180 mV from the previous buffer 7 pH mV value. pH mVs in buffer 10 should be -159 to 180 mV from the previous buffer 7 pH mV value.
11. Press enter to complete the calibration or press Cal to cancel.
12. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
13. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting section of this manual for possible solutions.

ORP CALIBRATION

1. Place the clean sensor in ORP calibration solution. Wait for the ORP and temperature readings to stabilize.
2. Press and hold Cal for three seconds.
3. Highlight ORP and press enter. If ORP is not listed as an option, check the System Setup menu to ensure ORP is enabled in the ISE Sensor Type menu.
4. Use the up and down arrow keys to adjust the ORP calibration solution value.

5. Wait for the temperature reading to stabilize, then press enter to complete the calibration or press Cal (Cal) to cancel.
6. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
7. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting section of this manual for possible solutions.

CONDUCTIVITY CALIBRATION

Ensure the conductivity sensor is clean and dry before performing a conductivity, specific conductance or salinity calibration.

It is not necessary to calibrate conductivity, specific conductance and salinity. Calibrating one of these parameters will simultaneously calibrate the others. YSI recommends calibrating specific conductance for greatest ease.

Always calibrate with fresh, traceable calibration solution with a value of 1000 uS or more.

Note: 1 mS = 1000 uS

CALIBRATING SPECIFIC CONDUCTANCE (SPC) OR CONDUCTIVITY

Note: When calibrating Specific Conductance, the Pro1030 uses the factory default values for the Specific Conductance Reference Temperature and the Specific Conductance Temperature Coefficient regardless of what is configured in the System Setup Menu. The default value for the Reference Temperature is 25°C and the default value for the Temperature Coefficient is 1.91%/°C. It is important to note that the Temperature Coefficient of a calibration solution is dependent on the contents of the solution. Therefore, for highest accuracy, YSI recommends using a traceable calibration solution made of KCl (potassium chloride) when calibrating Specific Conductance since these solutions typically have a Temperature Coefficient of 1.91%/°C. Additionally, be sure to enter the value of the solution as it is listed for 25°C when calibrating Specific Conductance.

1. Place the sensor into the solution. The solution must cover the holes of the conductivity sensor that are closest to the cable

(figure 8). Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately half the expected value. Gently move the probe up and down to remove any air bubbles from the conductivity sensor.

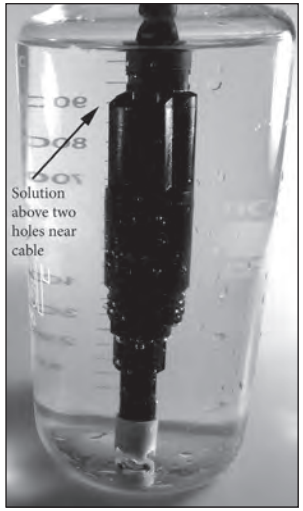

Figure 8, solution above two holes near cable.

2. Turn the instrument on and allow the conductivity and temperature readings to stabilize. Press and hold the Cal key for 3 seconds. Highlight Conductivity and press enter. Next, highlight the desired calibration method, Sp. Conductance or Conductivity, and press enter.
3. Highlight the units you wish to calibrate, either uS/cm or mS/cm, and press enter. 1 mS = 1,000 uS.
4. Use the up or down arrow key to adjust the value on the display to match the value of the conductivity calibration solution. Most conductivity solutions are labeled with a value at 25°C. If calibrating specific conductance, enter the value listed for 25°C. If calibrating conductivity, look up the value of the solution at the solution's current temperature and enter that value into the Pro1030. Press and holding either the up or down arrow key for 5 seconds will move the changing digit one place to the left. The Pro1030 will remember the entered calibration value and display it the next time a conductivity calibration is performed.
5. Press enter to complete the calibration or press Cal to cancel.
6. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.

7. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting section of this manual for possible solutions.

CALIBRATING IN SALINITY

1. Place the sensor into the solution. The solution must cover the holes of the conductivity sensor that are closest to the cable (figure 8). Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately half the expected value. Gently move the probe up and down to remove any air bubbles from the conductivity sensor.
2. Turn the instrument on and allow the conductivity and temperature readings to stabilize. Press and hold the Cal key for 3 seconds. Highlight Conductivity and press enter. Next, highlight Salinity and press enter.
3. Use the up or down arrow key to adjust the value on the display to match the value of the salinity solution. Press and holding either the up or down arrow key for 5 seconds will move the changing digit one place to the left. The Pro1030 will remember the entered calibration value and display it the next time a salinity calibration is performed.
4. Press enter to complete the calibration. Or, press Cal to cancel the calibration and return to the Run screen.
5. 'Calibration Successful' will display for a few seconds to indicate a successful calibration and then the instrument will return to the Run screen.
6. If the calibration is unsuccessful, an error message will display on the screen. Press the Cal key to exit the calibration error message and return to the Run screen. See the Troubleshooting section of this manual for possible solutions.

TAKING MEASUREMENTS

Before taking measurements, be sure the instrument has been calibrated to ensure the most accurate readings. Install the sensor guard to protect the pH or ORP sensor. Place the probe in the sample to be measured and give the probe a quick shake to release any air bubbles.

CONDUCTIVITY

The conductivity sensor will provide quick readings as long as the entire sensor is submerged and no air bubbles are trapped in the sensor area. Immerse the probe into the sample so the sensors are completely submerged and then shake the probe to release any air bubbles. Occasional cleaning of the sensor may be necessary to maintain accuracy and increase the responsiveness. To clean the sensor, use the soft bristle cleaning brush provided with the instrument and a mild detergent.

pH/ORP

pH and ORP readings are typically quick and accurate. However, it may take the sensors a little longer to stabilize if they become coated or fouled. To improve the response time of a sensor, follow the cleaning steps in the Maintenance section of this manual.

SAVING AND VIEWING DATA

The Pro1030 can store 50 data sets in non-volatile memory for later viewing. A data set includes the values currently on the display, i.e. temperature, dissolved oxygen and two conductivity parameters. Each data point is referenced with a data set number, 01 through 50.

SAVING DATA

From the Run screen, use the up or down arrow keys to highlight the Save box and press enter to save the current readings. The instrument will indicate the data set is saved and display the saved data set's number (figure 9).

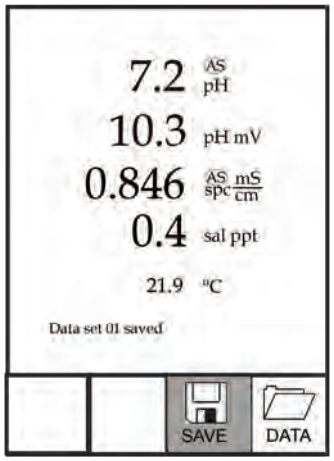

Figure 9, data set saved.

The instrument will display 'Memory Full' if all 50 data sets have been saved and you attempt to save another data set.

VIEWING AND ERASING SAVED DATA

Data mode allows you to view and erase saved data. From the Run screen, use the up or down arrow keys to highlight Data and press enter to access Data mode. Note that the function boxes at the bottom of the display are different in Data mode (figure 10).

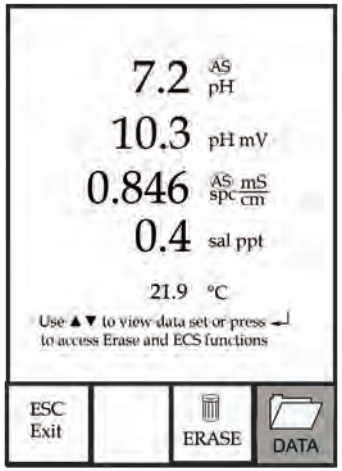

Figure 10, Data mode.

VIEWING DATA

Once in Data mode, use the up and down arrow keys to view saved data sets in sequential order or press enter to access the bottom functions. After accessing the bottom functions, highlight the Data box and press enter to regain access to viewing data. The data set displayed is indicated by the data set number, 01 through 50.

ERASING DATA

While viewing saved data, press the enter key to access the function boxes at the bottom of the display. Next, use the up or down arrow keys to highlight Erase, then press enter. The instrument will give you the option to erase one data set or all data sets (figure 11).

Figure 11, Erase data mode.

Use the up or down arrow key to select Erase Data Set, Erase All Sets or the ESC-Exit function box, then press enter to confirm.

Select ESC-Exit and press enter to exit Erase mode without erasing any data.

Select Erase Data Set and press enter to erase the data set that was displayed before entering Erase mode. For example, if data set 12 was displayed before entering erase mode, and Erase Data Set is selected, Data Set 12 will be erased from memory and the data sets AFTER that number will move up to keep them sequential. For example, if there are 15 records and number 12 is erased then 13 becomes 12, 14 becomes

13, and 15 becomes 14. The instrument will return to Data mode after erasing one data set.

Select Erase All Data Sets and press enter to clear the Pro1030 memory and return to Data mode.

EXITING DATA MODE

While in Data mode, press enter to access the bottom functions. Next, highlight the ESC-Exit box and press enter to return to the Run screen.

CARE, MAINTENANCE AND STORAGE

This section describes the proper procedures for care, maintenance and storage of the sensors. The goal is to maximize their lifetime and minimize down-time associated with improper sensor usage.

GENERAL MAINTENANCE

GENERAL MAINTENANCE - GASKET AND O-RINGS

The instrument utilizes a gasket and o-rings as seals to prevent water from entering the battery compartment and the sensor port. Following the recommended procedures will help keep the instrument functioning properly.

If the gasket, o-rings and sealing surfaces are not maintained properly, it is possible that water can enter the battery compartment and/or sensor port of the instrument. If water enters these areas, it can damage the battery terminals or sensor port causing loss of battery power, false readings and corrosion to the sensors or battery terminals. Therefore, when the battery compartment lid is removed, the gasket that provides the seal should be carefully inspected for contamination (i.e. debris, grit, etc.) and cleaned with water and mild detergent if necessary.

The same inspection should be made of the o-rings associated with the ISE sensor connector when replacing the ISE sensor. The o-rings should be free of dirt or debris before installing the sensor onto the cable.

GENERAL MAINTENANCE - ISE SENSOR PORT

It is important that the entire sensor connector end be dry when installing, removing or replacing the sensor. This will prevent water

from entering the port. Once the ISE sensor is removed, examine the connector inside the port. If any moisture is present, use compressed air to completely dry the connector or let it air dry. If the connector is corroded, contact YSI Technical Support or the YSI authorized dealer where you purchased the instrument.

SENSOR MAINTENANCE

> ⓘ *Typical working life for pH and ORP sensors is approximately 12-24 months depending on usage, storage and maintenance. Proper storage and maintenance generally extends the sensor's working life.*

SENSOR MAINTENANCE - TEMPERATURE

You must keep the temperature sensor free of build up. No additional maintenance is required. A toothbrush can be used to scrub the temperature sensor if needed.

SENSOR MAINTENANCE - CONDUCTIVITY

The openings that allow sample access to the conductivity electrodes should be cleaned regularly. The small cleaning brush included in the Maintenance Kit is intended for this purpose. Dip the brush in clean water and insert it into each hole 10 to 12 times. In the event that deposits have formed on the electrodes, it may be necessary to use a mild detergent (laboratory grade soap or bathroom foaming tile cleaner) with the brush. Rinse thoroughly with clean water, then check the response and accuracy of the conductivity cell with a calibration solution.

SENSOR MAINTENANCE - pH AND ORP

Cleaning is required whenever deposits or contaminants appear on the glass and/or platinum sensor surfaces or when the sensor's response slows. The cleaning can be chemical and/or mechanical.

Removing the sensor from the cable may make cleaning easier. Initially, use clean water and a soft clean cloth, lens cleaning tissue, or cotton swab to remove all foreign material from the glass bulb and/or platinum button. Then use a moistened cotton swab to carefully remove any material that may be blocking the reference electrode junction of the sensor.
If good pH and/or ORP response is not restored, perform the following additional procedure:

1. Soak the sensor for 10-15 minutes in clean water containing a few drops of commercial dish washing liquid.
2. GENTLY clean the glass bulb and platinum button by rubbing with a cotton swab soaked in the cleaning solution.
3. Rinse the sensor in clean water, wipe with a cotton swab saturated with clean water, and then rerinse with clean water.

If good pH and/or ORP response is still not restored, perform the following additional procedure:

1. Soak the sensor for 30-60 minutes in one molar (1 M) hydrochloric acid (HCl). This reagent can be purchased from most lab supply distributors. Be sure to follow the safety instructions included with the acid.
2. Rinse the sensor in clean water, wipe with a cotton swab saturated with clean water (not DI water), and then rerinse with clean water. To be certain that all traces of the acid are removed from the sensor crevices, soak the sensor in clean water for about an hour with occasional stirring.

If biological contamination of the reference junction is suspected or if good response is not restored by the above procedures, perform the following additional cleaning step:

1. Soak the sensor for approximately 1 hour in a 1:1 dilution of commercially-available chlorine bleach.
2. Rinse the sensor with clean water and then soak for at least 1 hour in clean water with occasional stirring to remove residual bleach from the junction. (If possible, soak the sensor for a period of time longer than 1 hour in order to be certain that all traces of chlorine bleach are removed.) Then rerinse the sensor with clean water and retest.

ⓘ **CAUTION**: *When using a cotton swab, be careful NOT to wedge the swab between the guard and the glass sensor. If necessary, remove cotton from the swab tip, so that the cotton can reach all parts of the sensor tip without stress. You can also use a pipe cleaner for this operation if more convenient.*

ⓘ *Dry the port and sensor connector with compressed air and apply a very thin coat of o-ring lubricant to all o-rings before reinstallation.*

If this procedure is unsuccessful, as indicated by improper sensor performance, contact YSI Technical Support or the YSI authorized dealer where you purchased the instrument.

SENSOR STORAGE

SHORT TERM STORAGE

The instrument is supplied with a grey storage sleeve that slides over the probe guard. The sleeve is used for short-term storage (less than 2 weeks). Be sure to keep a small amount of moisture (clean tap water) on the sponge in the sleeve during storage. The moistened sponge in the sleeve provides a 100% water saturated air environment which is ideal for short-term sensor storage.

LONG TERM STORAGE

The conductivity sensor should be stored long term in a dry state while the ISE sensor should be stored in solution. When storing for more then 30 days, place the ISE sensor in the storage bottle that was originally included with the sensor. This can be filled with buffer 4 solution. If you no longer have the storage bottle, simply place the sensor in a buffer 4 solution. Ensure the conductivity sensor is clean and dry.

Long Term Storage Temperature: -5 to 70°C (23 to 158°F) without pH
0 to 30°C (32 to 86°F) with pH*

*Operating temperature range for pH sensor is -5 to 60°C (23 to 140°C).

TROUBLESHOOTING

Symptom	*Possible Solution*
Instrument will not turn on, a battery symbol appears, or "Critical Shutdown" displays on the screen.	1. Low battery voltage, replace batteries. 2. Batteries installed incorrectly, check battery polarity. 3. Return system for service.
Temperature values display Over or Undr on Run screen.	1. Sample temperature is less than -5° C or more than +55°C. Increase or decrease the sample temperature to bring within the allowable range. 2. Contact YSI Tech Support.

Symptom	*Possible Solution*
Instrument will not calibrate pH or ORP; instrument displays "Calibration Over", "Calibration Under", or "Unstable Reading" during calibration.	1. Verify correct sensor type selection in the System Setup menu. 2. Verify the calibration solution is accurate. 3. If calibrating pH, make sure you are calibrating buffer 7 first. 4. Clean the pH or ORP sensor. 5. Contact YSI Tech Support.
pH or ORP readings are inaccurate.	1. Verify correct sensor type selection in the System Setup menu. 2. Verify temperature readings are accurate. 3. Recalibrate the pH or ORP sensor. 4. Clean the pH or ORP sensor. 5. Contact YSI Tech Support.
pH values display Over or Undr on Run screen.	1. Verify correct sensor type selection in the System Setup menu. 2. Sample pH value is outside the measurement range of 0 to 14. 3. Verify temperature readings are accurate. 4. Recalibrate the pH sensor. 5. Clean the pH sensor and recalibrate. 6. Contact YSI Tech Support.
ORP values display Over or Undr on Run screen.	1. Verify correct sensor type selection in the System Setup menu. 2. Sample ORP value is outside the measurement range of -1500 to 1500 mV. 3. Verify temperature readings are accurate. 4. Recalibrate the ORP sensor. 5. Clean the ORP sensor and recalibrate. 6. Contact YSI Tech Support.

Symptom	*Possible Solution*
Instrument will not calibrate the Conductivity sensor; instrument displays "Calibration Over", "Calibration Under", or "Unstable Reading" during calibration.	1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual. 2. Verify the calibration solution is above the two holes near the cable, see figure 8. 3. Verify the calibration solution is not expired or contaminated. Try a new bottle of solution. 4. Ensure you are entering in the correct value for the solution according to the measurement units. 1 mS = 1,000 uS. 5. Allow sufficient stabilization time for conductivity and temperature AND wait at least 3 seconds before confirming a calibration. 6. Contact YSI Tech Support.
Conductivity readings are inaccurate.	1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual. 2. Verify the sample is above the two holes near the cable, see figure 8. 3. Verify calibration. 4. Verify temperature readings are accurate. 5. Verify the correct units are setup in the System Setup menu, i.e. uS vs mS and Conductivity vs. Specific Conductance. 6. Contact YSI Tech Support.
Conductivity values display Over or Undr on Run screen.	1. Ensure the conductivity sensor is clean. Follow the cleaning procedures in the Care, Maintenance and Storage section of this manual. 2. Verify the sample is above the two holes near the cable, see figure 8 3. Verify calibration. 4. Verify temperature readings are accurate. 5. Sample conductivity is outside the measurement range of the instrument, i.e. 0-200 mS. 6. Contact YSI Tech Support.

SPECIFICATIONS

These specifications represent typical performance and are subject to change without notice. For the latest product specification information, please visit YSI's website at ysi.com or contact YSI Tech Support.

Parameter	*Range*	*Resolution*	*Accuracy*
Temperature	-5 to 55°C	0.1°C	± 0.2°C
pH	0 to 14 pH units	0.01	Instrument with cable and sensor: +/- 0.2
ORP	-1500 to 1500 mV	1 mV	Instrument with cable and sensor: +/-20 mV
Conductivity	0-500 uS/cm 0-5 mS/cm 0-50 mS/cm 0-200 mS/cm (auto ranging)	0.0001 to 0.1 mS/cm; 0.1 to 0 uS/cm (range dependent)	Instrument only: ± 0.5% of the reading or 1 uS/cm, whichever is greater. Instrument with 1 or 4 meter cables: ± 1.0% of the reading or 1 uS/cm, whichever is greater. Instrument with 10, 20, or 30 meter cables: ± 2.0% of the reading or 1 uS/cm, whichever is greater.
Salinity	0 to 70 ppt	0.1 ppt	± 1.0% of the reading or ± 0.1 ppt, whichever is greater.
Total Dissolved Solids (TDS)	0 to 100 g/L. TDS Constant range: 0.3 to 1.00 (0.65 default)	0.0001 to 0.1 g/L (range dependent)	Dependent on accuracy of temperature, conductivity and TDS Constant.

ACCESSORIES / PART NUMBERS

Part Number	*Description*
6051030	Pro1030 Instrument
6261030-1, -4, -10, -20, or -30	1, 4, 10, 20, 30-meter cable assembly* (3.2, 13, 32.8, 65.6, 98.4-feet)
605101	pH Sensor
605102	ORP Sensor
603077	Flow cell
603056	Flow cell mounting spike
603075	Carrying case, soft-sided
603074	Carrying case, hard-sided
603069	Belt clip for clipping instrument onto belt
063517	Ultra clamp for instrument for clamping instrument to lab counter or other surface
063507	Tripod for instrument
603062	Cable management kit, included with all cables longer than 1 meter
605978	Cable weight, 4.9 oz, stackable
603070	Shoulder strap
038213	Soft bristle brush for cleaning conductivity cell
003821	pH 4 Buffer, box of 6 pints
003822	pH 7 Buffer, box of 6 pints
003823	pH 10 Buffer, box of 6 pints
603824	pH Buffer, assorted case, 2 pints each of buffer 4, 7 and 10
060907	Conductivity Calibration Solution, 1,000 µS/cm. 1 box of 8 pints.
060911	Conductivity Calibration Solution, 10,000 µS/cm. 1 box of 8 pints.
060660	Conductivity Calibration Solution, 50,000 µS/cm. 1 box of 8 pints.
065274	Conductivity Calibration Solution, 100,000 µS/cm. 1 box of 8 pints.

*All cables include a temperature and conductivity sensor. The pH or ORP sensor is sold separately.

DECLARATION OF CONFORMITY

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for the listed European Council Directive(s) and carries the CE mark accordingly.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Product Name:	Pro1030 Water Quality Instrument
Model Numbers	
Instrument/ Accessory:	Pro1030 (6051030)
Probe/Cable Assemblies:	6051030-1, -4, -10, -20, and -30
Conforms to the following:	
Directives:	EMC 2004/108/EC RoHS 2011/65/EU WEEE 2002/96/EC
Harmonized Standards:	• EN61326-1:2006 (IEC 61326-1:2005) • IEC 61000-3-2:2005 • IEC 61000-3-3:2005
Supplementary Information:	All performance met the operation criteria as follows: 1. ESD, IEC 61000-4-2:2001 2. Radiated Immunity, IEC 61000-4-3:2006 3. Electrical Fast Transient (EFT), IEC 61000-4-4:2004, +Corr. 1:2006 + Corr. 2:2007 4. Radio Frequency, Continuous Conducted Immunity, IEC61000-4-6:2006 5. IEC 6100-4-8:2001
Authorized EU Representative	Xylem Analytics UK Ltd Unit 2 Focal Point, Lacerta Court, Works Road Letchworth, Hertfordshire, SG6 1FJ UK

Signed: Lisa M. Abel Date: 31 Jan 2013
Title: Director of Quality

RECYCLING

YSI is committed to reducing the environmental footprint in the course of doing business. Even though materials reduction is the ultimate goal, we know there must be a concerted effort to responsibly deal with materials after they've served a long, productive life-cycle. YSI's recycling program ensures that old equipment is processed in an environmentally friendly way, reducing the amount of materials going to landfills.

- Printed Circuit Boards are sent to facilities that process and reclaim as much material for recycling as possible.
- Plastics enter a material recycling process and are not incinerated or sent to landfills.
- Batteries are removed and sent to battery recyclers for dedicated metals.

When the time comes for you to recycle, follow the easy steps outlined at www.ysi.com.

BATTERY DISPOSAL

The Pro1030 is powered by alkaline batteries which the user must remove and dispose of when the batteries no longer power the instrument. Disposal requirements vary by country and region, and users are expected to understand and follow the battery disposal requirements for their specific locale.

CONTACT INFORMATION

ORDERING AND TECHNICAL SUPPORT

Telephone: 800 897 4151 (USA)
+1 937 767 7241 (Globally)
Monday through Friday, 8:00 AM to 5:00 ET
Fax: +1 937 767 9353 (orders)
+1 937 767 1058 (technical support)
Email: environmental@ysi.com
Mail: YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387 USA
Internet: ysi.com

When placing an order please have the following available:
1.) YSI account number (if available)
2.) Name and phone number
3.) Purchase Order or Credit Card number
4.) Model Number or brief description
5.) Billing and shipping addresses
6.) Quantity

SERVICE INFORMATION

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit ysi.com and click 'Support' or contact YSI Technical Support directly at 800-897-4151 (+1 937-767-7241).

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for a YSI Service Center to accept the instrument for service. The form may be downloaded from ysi.com by clicking on the 'Support".

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